WATER TECHNOLOGY
WATER, COASTAL & ENVIRONMENTAL CONSULTANTS

Princess Royal Harbour CHRMAP

Implementation and Monitoring

City of Albany

28 March 2024

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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. We respectfully acknowledge the past and present Traditional Custodians of this land on which the project focusses, the Menang People of Menang Noongar Country.

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 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 present study aims 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 km^2 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 will adhere to the WAPC (2019) guidelines with scope and deliverables to be consistent with their objectives and SPP2.6. In addition, the project will identify the strategic direction for coastal adaptation scenarios from the present to 2122 (100-year management time frame) and determine 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 (100 years).

As per the CHRMAP Guidelines this Chapter Report presents the Stage 6 Implementation Plan and Stage 7 Monitor and Review aspects of the project., The Implementation Plan outlines planning and coastal management actions (i.e., Options) recommended to address erosion and inundation vulnerabilities. The Monitoring and Review section address the need to collect, analyse and review new data and information. The red bubble displayed in Figure 1-2 outlines Stages 6 and 7 in the context of the full CHRMAP methodology. Recommendations have required the use of various assumptions, and several require confirmation by additional investigations before options can be confirmed and physical works would/could proceed.

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1 INTRODUCTION

It is internationally recognised that the mean sea level has been rising globally since the nineteenth century and is projected 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 or permanent), 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 this process (WAPC, 2019).

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

The study area for this CHRMAP is the entire shoreline within Princess Royal Harbour, Albany, within the City of Albany local government area (refer Figure 1-1). It consists of various shoreline types and many coastal assets, involving multiple stakeholders:

- Port and breakwaters protected by physical controls,
- Roads,
- Shallow sandy foreshore backed by vegetation and fronted by seagrass meadows,
- River mouths and channels through the sandbars,
- Sailing club, boat ramp and other coastal infrastructure, and
- Presence of rock features.

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 will adhere to the WAPC (2019) guidelines with scope and deliverables to be consistent with their objectives and SPP2.6 and follows the risk management hierarchy of 'Avoid', 'Retreat', 'Accommodate' and 'Protect'. 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 will occur over 8 stages (as summarised in Figure 1-2), each representing a key hold point. The staged approach is developed according to the PRH's scope and is in line with the CHRMAP Guidelines (WAPC, 2019). This report presents Stage 7: Implementation and monitoring. The red bubble in Figure 1-2, indicates where this component sits in the CHRMAP methodology.

The previous project stage was the Cost Benefit Analysis which concluded beach nourishment for MU1, MU2, MU3 and MU5 and planned / managed retreat for MU4 as the recommended option against erosion. For inundation a levee ('Protect') is the recommended option for all MU's except MU1, where 'Avoid' and 'Accommodate' practices will form the management approach.

Figure 1-1 Princess Royal Harbour Study Area

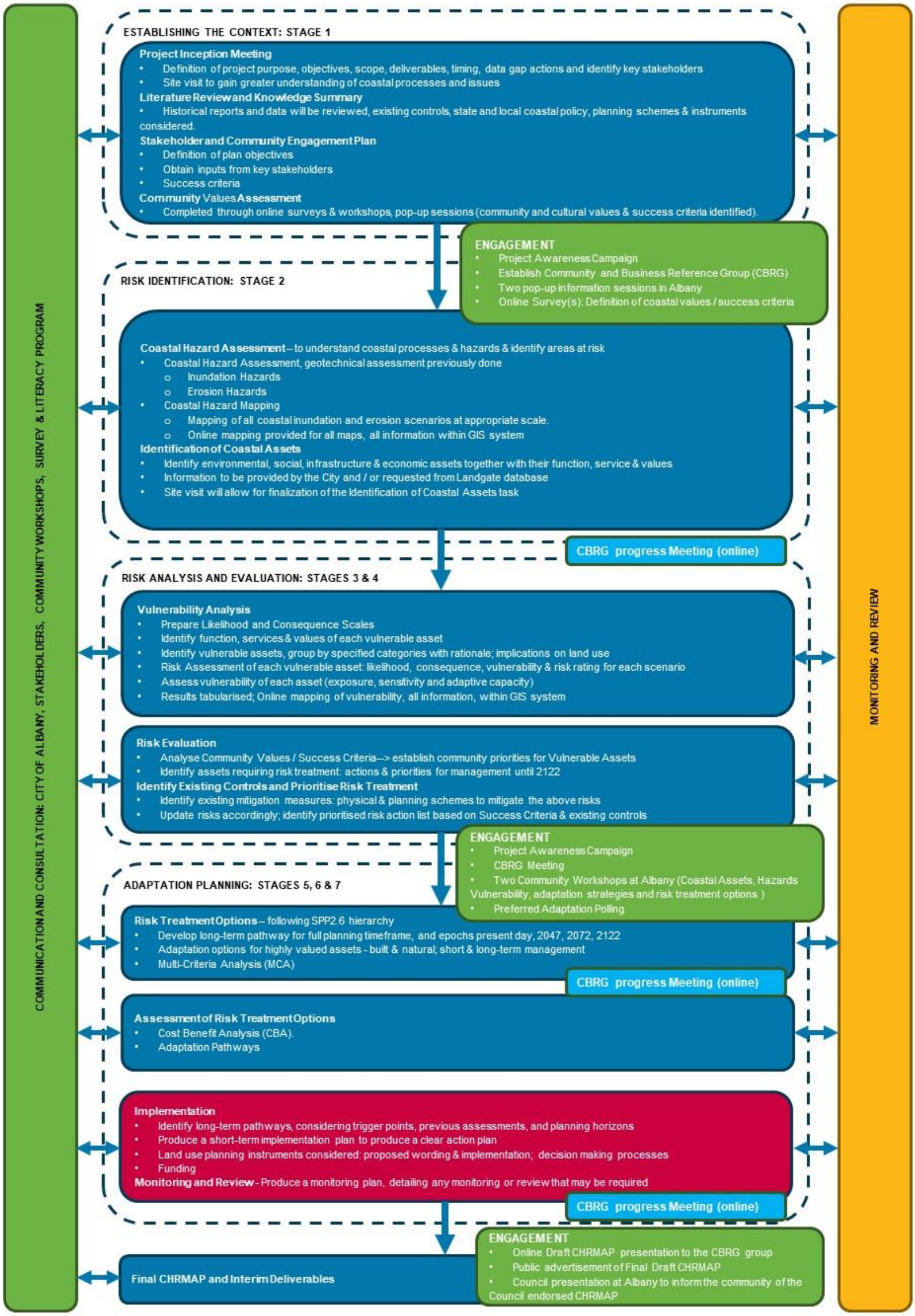

Figure 1-2 Methodology

2 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 2-1.

Table 2-1 CHRMAP implementation strategy.

Milestone	Adaptation Actions	Adaptation Hierarchy
Present	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	Assess development against the amended planning framework which supports the adaptation hierarchy under the CHRMAP Guidelines, specifically: • Prohibit subdivision or rezoning of land which has been identified as being subject to erosion over the 100-year planning timeframe; • Prohibit development within the S1 distance of the HSD; • 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 (HSD plus S1 erosion) . Accommodate development prone to inundation provided certain design requirements can be achieved, in accordance with the PRL Coastal Hazard Local Planning Policy.	Avoid; Planned/ Managed Retreat; Accommodate
Protection Measures Constructed	Accommodate subdivision / 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.	Accommodate; Protect

3 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.

3.1 Statutory Planning Mechanisms

Review of the existing planning controls (Water Technology, 2022a) concluded that a local planning scheme amendment to introduce a Special Control Area (SCA) was considered the most appropriate statutory planning mechanism 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 which provides guidance on planning risk treatment options across the risk management and adaptation hierarchy.

3.1.1 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 appropriately zoned under LPS 2. In these instances, alternative adaptation options will need to be considered.

3.1.2 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 3-2 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 landowners 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.

3.1.3 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 PRH Coastal Hazard Local Planning Policy which provides specific design requirements for development in vulnerable areas.

3.1.4 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 landowners to undertake protection measures as part of the decision-making process. However, should landowners propose protection works on private land as a means of accommodating assets, the City will need to ensure the protection structures proposed as part of any future development do not cause undue impact on nearby properties and the locality.

3.2 Recommended Planning Controls

3.2.1 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.

3.2.2 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 16 – Princess Royal Harbour Inundation Area under Schedule 8 of LPS 2 to Special Control Area 16 – Princess Royal Harbour Coastal Hazard Area. The recommended provisions for SCA 16 have been outlined in Table 3-1.
- Update SCA 16 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.

3.2.3 Special Control Area

The introduction of a Special Control Area (SCA) for all land affected by coastal hazards over the 100-year planning period will provide the most effective response to the identified risks. The SCA will stipulate provisions to respond to the hazards identified in this CHRMAP.

Schedule 8 of LPS 2 already contains SCA 16 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 16 is modified rather than include a new SCA to holistically respond to the coastal hazards identified in this CHRMAP. The recommended updates to SCA 16 have been summarised in Table 3-1.

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 3-1 Recommended updates to SCA16 in 2022 draft of LPS 2.

Name of Area	Purpose	Additional Provisions
Special Control Area 16 – Princess Royal Harbour Coastal Hazard Area (SCA 16)	(1) To provide guidance for land use and development within areas subject to erosion and inundation. (a) To identify land within Princess Royal Harbour at risk of coastal erosion and inundation by 2122. (b) To ensure land in the coastal zone is continuously available for coastal foreshore management, public access, recreation and conservation purposes. (c) To ensure public health and safety and reduce risk associated with coastal erosion and inundation. (d) To avoid inappropriate land use and development of land at risk of coastal erosion and inundation. (e) To ensure land use and development does not accelerate coastal processes; or have a detrimental impact on the functions of public reserves. To ensure coastal process considerations are taken into account in preparing strategic planning proposals and in assessing subdivision and development applications.	(1) Notwithstanding any other provision of the Scheme, all proposed development within SCA 16 requires the approval of the local government. (2) In considering any application for development approval, or its advice in relation to a proposed structure plan, or application for subdivision for land within SCA16, the local government is to have particular regard to: (a) The Princess Royal Harbour Coastal Hazard and Risk Management Adaptation Plan. (b) State Planning Policy 2.6 – State Coastal Planning Policy. (c) The PRH Coastal Hazard Local Planning Policy. (3) In considering an application for development approval within SCA 16, the local government may refer the application to any statutory, public or planning authority for advice and recommendations prior to determination. (4) 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: (a) That the lot is located in an area likely to be subject to coastal erosion or inundation over the next 100 years. (b) Any limited term of a development approval. (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 the PRH Coastal Hazard Local Planning Policy. (5) Where subdivision applications are received within SCA 16, 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.

3.2.4 PRH Coastal Hazard Local Planning Policy

Following the introduction of SCA 16 into LPS 2, the City shall prepare and adopt a PRH 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 PRH Coastal Hazard Local Planning Policy includes provisions identified in Table 3-2 which may be subject to further refinement by the City following the completion of this CHRMAP.

Table 3-2 PRH Coastal Hazard Local Planning Policy

PRH Coastal Hazard Local Planning Policy
Policy Application
This policy applies to all land with Special Control Area 16 - Princess Royal Harbour Coastal Hazard Area (SCA 16), which is that land identified as being subject to coastal hazards. The extent of SCA 16 is shown on the plan in Appendix 1. The policy applies to all strategic planning, subdivision and development proposals for land within SCA 16.
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 landowner 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.

PRH Coastal Hazard Local Planning Policy
SCA 16 means Special Control Area 16 – 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.
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 16, 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 16, 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 50m^2 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.

PRH Coastal Hazard Local Planning Policy

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.
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 landowner, 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 landowner 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.

PRH Coastal Hazard Local Planning Policy

Inundation

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.

PRH Coastal Hazard Local Planning Policy

Appendix 1 – Coastal Hazard Policy Area Map

3.3 Management Requirements

3.3.1 Model Conditions List

The City shall include the following conditions and advice notes to the model conditions list which can then be applied to development applications within SCA 16, 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 erosion) 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 landowners 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 erosion) 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.'

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.

3.3.2 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.

3.3.3 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.

3.3.4 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.

4 FUNDING OPTIONS

The Stage 5 Risk Treatment Report presents a summary of financial and economic implications to inform the local governments of the potential cost of coastal hazards over the planning timeframe and the cost to implement the recommended treatment 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.

4.1 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.

4.2 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.

4.3 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.

4.4 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.

4.5 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 has committed $33.5 million of funding over five years from 2021-26. 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:

- Royalties for Regions,
- 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 hotpots 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.

Royalties for Regions is 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.wa.gov.au/organisation/department-of-primary-industries-and-regional-development/royalties-regions

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 landowners or users.

Because coastal hazards and coastal land management will continue to evolve and are unlikely to be resolved by 2026 (beyond the term of the CoastWA Grants), long-term sustainable funding is likely to be required from the State.

4.6 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 landowners or users.

4.6.1 Disaster Ready Fund

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 Two opening date is Monday, 22 January 2024. For more information visit Disaster Ready Fund - Round Two | National Emergency Management Agency (nema.gov.au)

4.7 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 user 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.

The benefit distribution analysis that is to be conducted as part of the next stage of this CHRMAP project will provide recommendations on options for methods and proportions by which the City could fund coastal works from direct beneficiaries. This information will be provided in the CHRMAP summary report.

5 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.

5.1 Review of Existing Coastal Monitoring

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

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

5.2 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 5-1.

Table 5-1 Recommended coastal monitoring activities.

Monitoring Activity	Overview	Location	Timing
Beach and foreshore topographic survey.	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). 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.	MU's 2, 3, 4 & 5.	2024-2027.
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.	2025-2027.
Bathymetric survey.	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. Specifically bathymetric survey of shallow waters of MU1 to identify any changes in sand and seagrass banks, approximately every 5 years.	All MU's. Focus on MU1 sand and seagrass banks.	2025
Coastal protection structure audit.	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. 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.	MU's 1, 2, 3 & 5.	2026

Monitoring Activity	Overview	Location	Timing
Geotechnical investigations.	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. 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.	All MU's.	2027 / 2028 / 2029.

5.3 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".

5.4 CHRMAP Review

This CHRMAP should be updated every 5 to 10 years to maintain currency and should be considered a “living document”. An earlier review should be considered when the following event occurs:

- 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
  - 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.

6 IMPLEMENTATION

6.1 Overview

Detailed implementation plans for each MU are presented in Table 6-2. to Table 6-6.

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.

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.

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.

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 for 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. 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 6.2.2

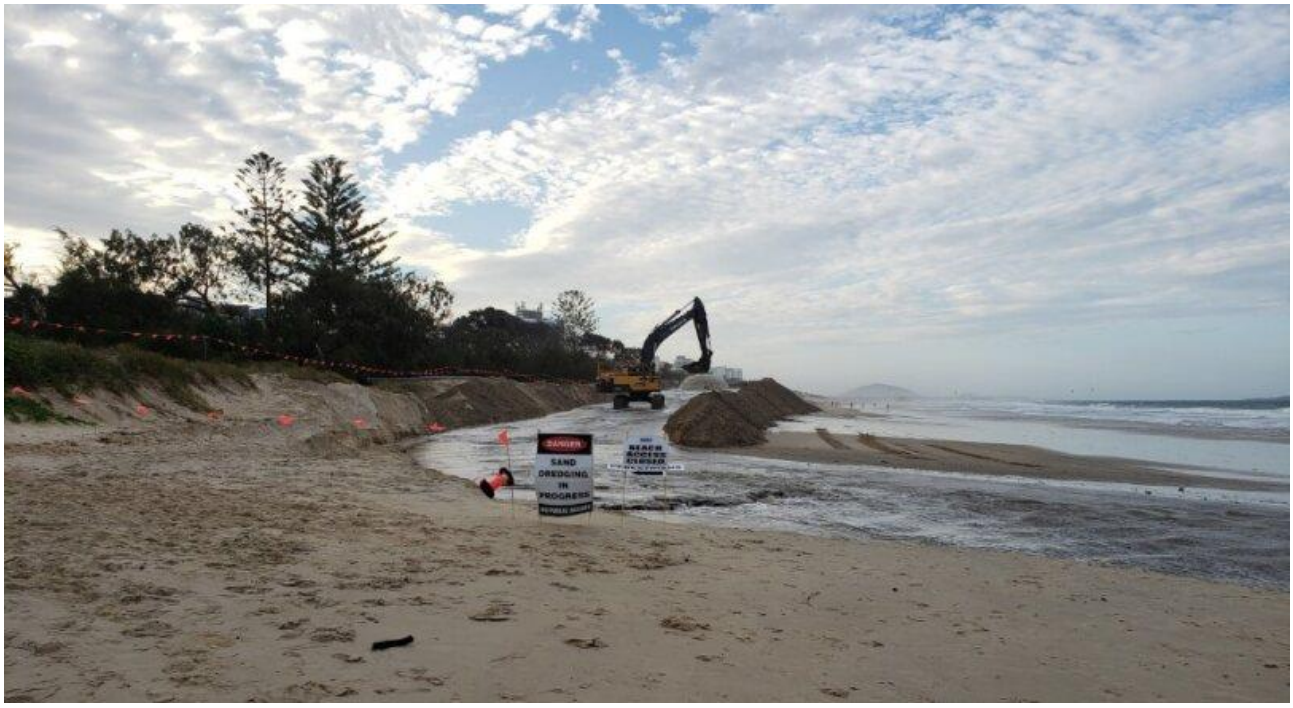

Figure 6-1 Beach nourishment underway at Sunshine Coast, QLD

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 6-2**Error! Reference source not found.** and Figure 6-3**Error! Reference source not found.** 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 6-2 Typical earth levee design, (SES 2022)

Figure 6-3 Earth levee example from the Netherlands (California Water Blog, 2015)

6.2 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.

6.2.1 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.

6.2.2 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 5. 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 6-1.

Table 6-1 Recommended coastal investigations.

Coastal Investigation	Overview	Location	Timing
Foreshore asset audit.	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. 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: 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. 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.	All MU's.	2025.
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.	2025.
Sand source feasibility study.	The City should prepare an RFQ and engage a consultant to investigate potential sand sources to use for coastal protection works. 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.	All MU's.	2025.

Coastal Investigation	Overview	Location	Timing
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. 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.	All MU's.	2026.
Update Foreshore Management Plans.	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. Updated (FMPs) may increase the protective capacity of the natural dune system, and should address: ▪ The requirements of SPP2.6 and its supporting documentation. ▪ 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.	All MU's.	2026.

Coastal Investigation	Overview	Location	Timing
Internal prioritisation of Management Units	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 CHRMAP as the cost benefit analysis has considered these boundary extents and quantities. It is anticipated the current MU' 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 hazard . 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.		

6.3 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.

6.4 Detailed Implementation Plans

Detailed implementation plans for each MU are presented in Table 6-2 to Table 6-6. 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 6-4 below for reference. Individual maps depicting each hazard and the extent of proposed treatment options for each MU are provided in Appendix A.


LOCKYER
YAKAMIA
KALGAN
GLEDHOW
MIRA MAR
Melville Point
ALBANY
ROBINSON
PORT ALBANY
Point King
MU 1
MU 2
Uredale Point
MU 5
Princess Royal Harbour
TORNDIRRUP
Geake Point
Rushy Point
LITTLE GROVE
MU 3
MU 4
BIG GROVE
Limekilns Point
LEGEND
Shoreline
Points of interest
Management Units (MU)
Locality / Suburb
Km
0 0.5 1 2 3 4
Landgate / SLIP
Landgate / SLIP
Data sources:
Contains:SIP Satellite Imagary, SIP LGA Boundary

Figure 6-4 Princess Royal Harbour Study Area

Table 6-2 MU1 – Point King to Melville point recommendations in priority order.

Recommendation	Notes	Responsibility	Trigger	Cost	Funding	2024-2025	2025-2035	2035-2050	2050-2120
INVESTIGATION 1 Update Foreshore Management Plans (FMPs)	■ 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	■ LGA	■ Completed CHRMAP	■ $30,000 ■ Assumes only undertaken for this MU in isolation, but synergies should be investigated.	■ Operational ■ Grants (e.g. CMPAP)	x	x	x	x
Locating assets in areas that will not be vulnerable to coastal hazards (AV)	■ Item cost for investigations and management plans	■ LGA ■ Southern Ports	■ Completed CHRMAP	■ $50,000	■ Operational	x	x		
Monitoring (NR1)	■ Bathymetric survey to monitor seagrass banks, approximately every 5 years ■ Occasional survey to track inundation extent and levels	■ LGA ■ Can seek support and assistance from Southern Ports, DoT	■ Completed CHRMAP ■ Severe storm event(s)	■ $10,000 annually	■ Operational ■ Grants (e.g. CAP)	x	x	x	x
Notification on title (NR3)	■ Item cost for investigations and implementation plans	■ LGA ■ Can seek support and assistance from DPLH, WALGA	■ Completed CHRMAP	■ $50,000 ■ (Plus 1% annual maintenance of $500)	■ Operational ■ Grants (e.g. CMPAP)	x	x		
Protection Structure Audit (NR2)	■ 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	■ LGA, ■ Southern Ports	■ Completed CHRMAP	■ $150,000 ■ (Plus 2% annual maintenance of $3,000)	■ Operational ■ Grants (e.g. CAP)		x	x	
Emergency evacuation plans (NR4)	■ Item cost for investigations and evacuation plans	■ LGA ■ Southern Ports	■ Completed CHRMAP	■ $100,000 ■ (Plus 1% annual maintenance of $1,000)	■ Operational ■ Grants (e.g. DRF)	x	x		
Prevention of further development / prohibit expansion of existing use rights (PMR3)	■ 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 ■ Southern Ports	■ Completed CHRMAP	■ $30,000 ■ (Plus 1% annual maintenance of $300)	■ Operational ■ Grants (e.g. CMPAP)	x	x		
Design assets to withstand impacts (AC1)	■ Item cost for investigations and management plans – primarily any case-by-case work needed for public assets	■ LGA ■ Southern Ports	■ Completed CHRMAP	■ $100,000 ■ (Plus 1% annual maintenance of $1,000)	■ Operational ■ Grants	x	x		

Recommendation	Notes	Responsibility	Trigger	Cost	Funding	2024-2025	2025-2035	2035-2050	2050-2120
INVESTIGATION 2 Sand Source Feasibility Study	■ 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	■ LGA ■ Can seek support from Southern Ports and state departments	■ Completed CHRMAP	■ $150,000 ■ Assumes undertaken for all MUs.	■ Operational ■ Grants (e.g. CAP)			x	
Recommended Short-Term Option to address Erosion Protection with existing Seawalls (PR3)	■ Protection is currently provided by various structures which while maintained are likely to continue to provide adequate protection.	■ LGA ■ DoT ■ Southern Ports	■ Coastal Protection Structure Audit (NR2) will identify maintenance required.	■ 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)	■ 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	■ Monitoring ■ Updated CHRMAP	■ 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)	■ 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	■ LGA	■ Monitoring ■ Updated CHRMAP	■ 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)	■ **See AC1** ■ Future consideration of erosion protections options should consider their influence on, and capacity to provide protection from, inundation.	■ LGA	■ Monitoring ■ Updated CHRMAP	■ **See AC1** ■	■ Operational ■ Grants ■ Direct beneficiaries				x

Table 6-3 MU2 – Melville Point to Rushy Point recommendations in priority order.

Recommendation	Notes	Responsibility	Trigger	Cost	Funding	2024-2025	2025-2035	2035-2050	2050-2120
INVESTIGATION 1 Sand Source Feasibility Study	■ 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.	■ LGA ■ Can seek support from state departments	■ Completed CHRMAP	■ $150,000 ■ Assumes undertaken for all MUs	■ Operational ■ Grants (e.g. CAP)	x	x		
INVESTIGATION 2 Update Foreshore Management Plans (FMPs)	■ 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	■ LGA	■ Completed CHRMAP	■ $30,000 ■ Assumes only undertaken for this MU in isolation, but synergies should be investigated.	■ Operational ■ Grants (e.g. CMPAP)	x	x	x	x
Locating assets in areas that will not be vulnerable to coastal hazards (AV)	■ Item cost for investigations and management plans	■ LGA	■ Completed CHRMAP	■ $50,000	■ Operational	x	x		
Monitoring (NR1)	■ Beach survey for storm behaviour and to track HSD and inundation levels ■ Routine beach profiles every six months	■ LGA ■ Can seek support and assistance from DoT	■ Completed CHRMAP ■ Severe storm event(s)	■ $15,000 annually	■ Operational ■ Grants (e.g. CAP)	x	x	x	x
Notification on title (NR3)	■ Item cost for investigations and implementation plans	■ LGA ■ Can seek support and assistance from DPLH, WALGA	■ Completed CHRMAP	■ $50,000 ■ (Plus 1% annual maintenance of $500)	■ Operational ■ Grants (e.g. CMPAP)	x	x		

Recommendation	Notes	Responsibility	Trigger	Cost	Funding	2024-2025	2025-2035	2035-2050	2050-2120
Protection Structure Audit (NR2)	■ 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.	■ LGA	■ Completed CHRMAP	■ $50,000 ■ (Plus 2% annual maintenance of $1,000)	■ Operational ■ Grants (e.g. CAP)		x	x	
Emergency evacuation plans (NR4)	■ Item cost for investigations and evacuation plans	■ LGA	■ Completed CHRMAP	■ $100,000 ■ (Plus 1% annual maintenance of $1,000)	■ Operational ■ Grants (e.g. DRF)	x	x		
Demolition / removal / relocation of asset from inside hazard area (PMR2)	■ Preparation of Asset Management Plan ■ To 2047 for public-built assets ■ Maintenance assumes ongoing allowance for foreshore reserve ■ Removal / Relocation of assets as required	■ LGA	■ Audit of assets within 2047 erosion and inundation hazard zone and identification of assets where damage would be unacceptable	■ $1,600,000 ■ (Plus 1% annual maintenance of $16,000)	■ Operational ■ Grants	x	x	x	
Prevention of further development / prohibit expansion of existing use rights (PMR3)	■ 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	■ $30,000 ■ (Plus 1% annual maintenance of $300)	■ Operational ■ Grants (e.g. CMPAP)	x	x		
Design assets to withstand impacts (AC1)	■ Item cost for investigations and management plans – primarily any case-by-case work needed for public assets	■ LGA	■ Completed CHRMAP	■ $100,000 ■ (Plus 1% annual maintenance of $1,000)	■ Operational ■ Grants	x	x		

Recommendation	Notes	Responsibility	Trigger	Cost	Funding	2024-2025	2025-2035	2035-2050	2050-2120
Recommended Short-Term Option to address Erosion is to investigate and prepare for Protection with Beach Nourishment (PR1)	■ 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: ■ 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 6.2.2.	■ LGA	■ Completed CHRMAP ■ Monitoring ■ Confirmation of design, costs and funding	■ $21.9M at NPV 4% for a 100-year timeframe	■ Operational ■ Grants (e.g. CAP) ■ Direct beneficiaries	x	x	x	
Recommended Short-Term Option to address Inundation is a Levee (PR6)	■ 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	■ LGA	■ Completed CHRMAP ■ Monitoring ■ Confirmation of design, costs and funding ■ Confirmation of SLR in accordance with projections to 2047	■ $18.8M at NPV 4% for a 100-year timeframe ■ Detailed design and costings estimated at $200,000	■ Operational ■ Grants (e.g. DRF) ■ Direct beneficiaries	x	x	x	

Recommendation	Notes	Responsibility	Trigger	Cost	Funding	2024-2025	2025-2035	2035-2050	2050-2120
Leaving assets unprotected (PMR1)	■ 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	■ LGA	■ Storm damage ■ Audit of assets within 2047 erosion and inundation hazard zone and identification of assets where damage would be unacceptable	■ $711,000 ■ (Plus 3% annual maintenance of $21,330)	■ Operational	x	x	x	
Recommended Medium and Long-term pathway to address Erosion is Protection with Beach Nourishment (PR1)	■ Monitoring will determine the need for additional works beyond those recommended in the short-term	■ LGA	■ Monitoring ■ Updated CHRMAP	■ $21.9M at NPV 4% for a 100-year timeframe ■ Annual maintenance estimate of approximately $0.5M	■ Operational ■ Grants (e.g. CAP) ■ Direct beneficiaries				x
Recommended Medium and Long-term pathway to address Inundation is a Levee (PR6)	■ 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	■ LGA	■ Monitoring ■ Updated CHRMAP	■ $18.8M at NPV 4% for a 100-year timeframe ■ Annual maintenance estimate of approximately $0.27M	■ Operational ■ Grants (e.g. DRF) ■ Direct beneficiaries				x

Table 6-4 MU3 - Rushy Point to Limekilns Point recommendations in priority order.

Recommendation	Notes	Responsibility	Trigger	Cost	Funding	2024-2025	2025-2035	2035-2050	2050-2120
INVESTIGATION 1 Sand Source Feasibility Study	■ 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	■ LGA ■ Can seek support from state departments	■ Completed CHRMAP	■ $150,000 ■ Assumes undertaken for all MUs	■ Operational ■ Grants (e.g. CAP)	x	x		
INVESTIGATION 2 Update Foreshore Management Plans (FMPs)	■ 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	■ LGA	■ Completed CHRMAP	■ $30,000 ■ Assumes only undertaken for this MU in isolation, but synergies should be investigated.	■ Operational ■ Grants (e.g. CMPAP)	x	x	x	x
Locating assets in areas that will not be vulnerable to coastal hazards (AV)	■ Item cost for investigations and management plans	■ LGA	■ Completed CHRMAP	■ $50,000	■ Operational	x	x		
Monitoring (NR1)	■ Beach survey for storm behaviour and to track HSD and inundation levels ■ Routine beach profiles every six months	■ LGA ■ Can seek support and assistance from DoT	■ Completed CHRMAP ■ Severe storm event(s)	■ $15,000 annually	■ Operational ■ Grants (e.g. CAP)	x	x	x	x
Notification on title (NR3)	■ Item cost for investigations and implementation plans	■ LGA ■ Can seek support and assistance from DPLH, WALGA	■ Completed CHRMAP	■ $50,000 ■ (Plus 1% annual maintenance of $500)	■ Operational ■ Grants (e.g. CMPAP)	x	x		
Protection Structure Audit (NR2)	■ 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	■ LGA ■ Princess Royal Sailing Club	■ Completed CHRMAP	■ $30,000 ■ (Plus 2% annual maintenance of $600)	■ Operational ■ Grants (e.g. CAP)		x	x	
Emergency evacuation plans (NR4)	■ Item cost for investigations and evacuation plans	■ LGA	■ Completed CHRMAP	■ $100,000 ■ (Plus 1% annual maintenance of $1,000)	■ Operational ■ Grants (e.g. DRF)	x	x		

Recommendation	Notes	Responsibility	Trigger	Cost	Funding	2024-2025	2025-2035	2035-2050	2050-2120
Demolition / removal / relocation of asset from inside hazard area (PMR2)	■ Preparation of Asset Management Plan ■ To 2047 for public-built assets ■ Maintenance assumes ongoing allowance for foreshore reserve ■ Removal / Relocation of assets as required	■ LGA	■ Audit of assets within 2047 erosion and inundation hazard zone and identification of assets where damage would be unacceptable	■ $1,095,000 ■ (Plus 1% annual maintenance of $10,950)	■ Operational ■ Grants	x	x	x	
Prevention of further development / prohibit expansion of existing use rights (PMR3)	■ 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	■ $30,000 ■ (Plus 1% annual maintenance of $300)	■ Operational ■ Grants (e.g. CMPAP)	x	x		
Design assets to withstand impacts (AC1)	■ Item cost for investigations and management plans – primarily any case-by-case work needed for public assets	■ LGA	■ Completed CHRMAP	■ $100,000 ■ (Plus 1% annual maintenance of $1,000)	■ Operational ■ Grants	x	x		
Recommended Short-Term Option to address Erosion is to investigate and prepare for Protection with Beach Nourishment (PR1)	■ 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 6.2.2	■ LGA	■ Completed CHRMAP ■ Monitoring ■ Confirmation of design, costs and funding	■ $8.7M at NPV 4% for a 100-year timeframe ■ Detailed design and costings estimated at $200,000	■ Operational ■ Grants (e.g. CAP) ■ Direct beneficiaries	x	x	x	

Recommendation	Notes	Responsibility	Trigger	Cost	Funding	2024-2025	2025-2035	2035-2050	2050-2120
Leaving assets unprotected (PMR1)	■ 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	■ LGA	■ Storm damage ■ Audit of assets within 2047 erosion and inundation hazard zone and identification of assets where damage would be unacceptable	■ $498,000 ■ (Plus 3% annual maintenance of $14,940)	■ Operational	x	x	x	
Recommended Short-Term Option to address Inundation is Monitoring (NR1), Accommodate (AC1) and Emergency Evacuation Plans (NR4)	■ 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	■ Monitoring ■ Updated CHRMAP	■ 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)	■ Monitoring will determine the need for additional works beyond those recommended in the short-term	■ LGA	■ Monitoring ■ Updated CHRMAP	■ $8.7M at NPV 4% for a 100-year timeframe ■ Annual maintenance estimate of approximately $0.4M	■ Operational ■ Grants (e.g. CAP) ■ Direct beneficiaries				x
Recommended Medium and Long-term pathway to address Inundation is a Levee (PR6)	■ 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	■ LGA	■ Monitoring ■ Updated CHRMAP	■ $1.1M at NPV 4% for a 100-year timeframe ■ Annual maintenance estimate of approximately $0.13M	■ Operational ■ Grants (e.g. DRF) ■ Direct beneficiaries				x

Table 6-5 MU4 – Limekilns Point to Geake Point recommendations in priority order.

Recommendation	Notes	Responsibility	Trigger	Cost	Funding	2024-2025	2025-2035	2035-2050	2050-2120
INVESTIGATION 1 Update Foreshore Management Plans (FMPs)	■ 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	■ LGA	■ Completed CHRMAP	■ $30,000 ■ Assumes only undertaken for this MU in isolation, but synergies should be investigated.	■ Operational ■ Grants (e.g. CMPAP)	x	x	x	x
Locating assets in areas that will not be vulnerable to coastal hazards (AV)	■ Item cost for investigations and management plans	■ LGA	■ Completed CHRMAP	■ $50,000	■ Operational	x	x		
Monitoring (NR1)	■ Beach survey for storm behaviour and to track HSD and inundation levels ■ Routine beach profiles every six months	■ LGA ■ Can seek support and assistance from DoT	■ Completed CHRMAP ■ Severe storm event(s)	■ $7,500 annually	■ Operational ■ Grants (e.g. CAP)	x	x	x	x
Notification on title (NR3)	■ Item cost for investigations and implementation plans	■ LGA ■ Can seek support and assistance from DPLH, WALGA	■ Completed CHRMAP	■ $50,000 ■ (Plus 1% annual maintenance of $500)	■ Operational ■ Grants (e.g. CMPAP)	x	x		
Emergency evacuation plans (NR4)	■ Item cost for investigations and evacuation plans	■ LGA	■ Completed CHRMAP	■ $20,000 ■ (Plus 1% annual maintenance of $200)	■ Operational ■ Grants (e.g. DRF)	x	x		
INVESTIGATION 2 Sand Source Feasibility Study	■ 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.	■ LGA ■ Can seek support from state departments	■ Completed CHRMAP	■ $150,000 ■ Assumes undertaken for all MUs	■ Operational ■ Grants (e.g. CAP)	x	x		
Demolition / removal / relocation of asset from inside hazard area (PMR2)	■ Preparation of Asset Management Plan ■ To 2047 for public-built assets ■ Maintenance assumes ongoing allowance for foreshore reserve ■ Removal / Relocation of assets as required	■ LGA	■ Audit of assets within 2047 erosion and inundation hazard zone and identification of assets where damage would be unacceptable	■ $143,000 ■ (Plus 1% annual maintenance of $1,430)	■ Operational ■ Grants	x	x	x	
Prevention of further development / prohibit expansion of existing use rights (PMR3)	■ 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	■ $30,000 ■ (Plus 1% annual maintenance of $300)	■ Operational ■ Grants (e.g. CMPAP)	x	x		

Recommendation	Notes	Responsibility	Trigger	Cost	Funding	2024-2025	2025-2035	2035-2050	2050-2120
Design assets to withstand impacts (AC1)	■ Item cost for investigations and management plans – primarily any case-by-case work needed for public assets	■ LGA	■ Completed CHRMAP	■ $50,000 ■ (Plus 1% annual maintenance of $500)	■ Operational ■ Grants	x	x		
Recommended Short-Term Option to address Erosion is to investigate and prepare for Planned / Managed Retreat by Voluntary Acquisition (PMR4)	■ 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	■ LGA	■ Completed CHRMAP	■ $38.4M at NPV 4% for whole 100-year timeframe	■ Operational ■ Grants (e.g. DRF) ■ Specified Area Rate ■ Levies	x	x	x	
Recommended Short-Term Option to address Inundation is a Levee (PR6)	■ Assumes one 1250m section of levee required along coast near Lake Vancouver ■ Assumes 2047 implementation	■ LGA	■ Completed CHRMAP ■ Monitoring ■ Confirmation of design, costs and funding ■ Confirmation of SLR in accordance with projections to 2047	■ $2.5M at NPV 4% ■ Detailed design and costings estimated at $150,000	■ Operational ■ Grants (e.g. DRF) ■ Direct beneficiaries	x	x	x	
Leaving assets unprotected (PMR1)	■ 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	■ LGA	■ Storm damage ■ Audit of assets within 2047 erosion and inundation hazard zone and identification of assets where damage would be unacceptable	■ $65,000 ■ (Plus 3% annual maintenance of $1,950)	■ Operational	x	x	x	
Recommended Medium and Long-term pathway to address Erosion is Planned / Managed Retreat by Voluntary Acquisition (PMR4)	■ Implement when triggers are met ■ See explanation in Land Use Planning Section of this report	■ LGA	■ HSD within specified distance of property boundary	■ $38.4M at NPV 4% for whole 100-year timeframe	■ Operational ■ Grants (e.g. DRF) ■ Specified Area Rate ■ Levies				x
Recommended Medium and Long-term pathway to address Inundation is a Levee (PR6)	■ 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	■ LGA	■ Monitoring ■ Updated CHRMAP	■ $2.5M at NPV 4% ■ Annual maintenance estimate of approximately $0.1M	■ Operational ■ Grants (e.g. DRF) ■ Direct beneficiaries				x

Table 6-6 MU5 - Geake Point to Possession/Uredale Point recommendations in priority order.

Recommendation	Notes	Responsibility	Trigger	Cost	Funding	2024-2025	2025-2035	2035-2050	2050-2120
INVESTIGATION 1 Sand Source Feasibility Study	■ 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.	■ LGA ■ Can seek support from state departments	■ Completed CHRMAP	■ $150,000 ■ Assumes undertaken for all MUs	■ Operational ■ Grants (e.g. CAP)	x	x		
INVESTIGATION 2 Update Foreshore Management Plans (FMPs)	■ 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	■ LGA	■ Completed CHRMAP	■ $30,000 ■ Assumes only undertaken for this MU in isolation, but synergies should be investigated.	■ Operational ■ Grants (e.g. CMPAP)	x	x	x	x
Locating assets in areas that will not be vulnerable to coastal hazards (AV)	■ Item cost for investigations and management plans	■ LGA	■ Completed CHRMAP	■ $30,000	■ Operational	x	x		
Monitoring (NR1)	■ Beach survey for storm behaviour and to track HSD and inundation levels ■ Routine beach profiles every six months	■ LGA ■ Can seek support and assistance from DoT	■ Completed CHRMAP ■ Severe storm event(s)	■ $7,500 annually	■ Operational ■ Grants (e.g. CAP)	x	x	x	x
Notification on title (NR3)	■ Item cost for investigations and implementation plans	■ LGA ■ Can seek support and assistance from DPLH, WALGA	■ Completed CHRMAP	■ $50,000 ■ (Plus 1% annual maintenance of $500)	■ Operational ■ Grants (e.g. CMPAP)	x	x		
Protection Structure Audit (NR2)	■ Item cost to inspect coastal asset condition, influence on sediment transport and inundation and remaining design life on all coastal management structures ■ Includes Camp Quaranup revetment	■ LGA	■ Completed CHRMAP	■ $15,000 ■ (Plus 2% annual maintenance of $150)	■ Operational ■ Grants (e.g. CAP)		x	x	
Emergency evacuation plans (NR4)	■ Item cost for investigations and evacuation plans	■ LGA	■ Completed CHRMAP	■ $10,000 ■ (Plus 1% annual maintenance of $100)	■ Operational ■ Grants (e.g. DRF)	x	x		
Demolition / removal / relocation of asset from inside hazard area (PMR2)	■ Allows for removal / relocation of shed at Camp Quaranup ■ Maintenance assumes ongoing allowance for foreshore reserve ■ No other built public assets at risk	■ LGA	■ Monitoring	■ $82,000 ■ (Plus 1% annual maintenance of $820)	■ Operational ■ Grants	x	x	x	

Recommendation	Notes	Responsibility	Trigger	Cost	Funding	2024-2025	2025-2035	2035-2050	2050-2120
Prevention of further development / prohibit expansion of existing use rights (PMR3)	■ 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	■ $20,000 ■ (Plus 1% annual maintenance of $200)	■ Operational ■ Grants (e.g. CMPAP)	x	x		
Design assets to withstand impacts (AC1)	■ Item cost for investigations and management plans – primarily any case-by-case work needed for public assets	■ LGA	■ Completed CHRMAP	■ $30,000 ■ (Plus 1% annual maintenance of $300)	■ Operational ■ Grants	x	x		
Recommended Short-Term Option to address Erosion is to investigate and prepare for Protection with Beach Nourishment (PR1)	■ 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: ■ Protection of Camp Quaranup 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 Quaranup shoreline with 2047 implementation ■ Assumes suitable sand source available (grain size, volume, cleanliness, proximity)	■ LGA	■ Completed CHRMAP ■ Monitoring ■ Confirmation of design, costs and funding	■ $2.0M at NPV 4% for a 100-year timeframe ■ Detailed design and costings estimated at $200,000	■ 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)	■ 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	■ Monitoring ■ Updated CHRMAP	■ 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)	■ Monitoring will determine the need for additional works beyond those recommended in the short-term	■ LGA	■ Monitoring ■ Updated CHRMAP	■ $2.0M at NPV 4% for a 100-year timeframe ■ Annual maintenance estimate of approximately $0.15M	■ Operational ■ Grants (e.g. CAP) ■ Direct beneficiaries				x
Recommended Medium and Long-term pathway to address Inundation is a Levee (PR6)	■ Assumes 300m of levee required around Camp Quaranup and 50m for depression in Isthmus ■ Assumes 2072 implementation, so there are no priority actions in short-term	■ LGA	■ Monitoring ■ Updated CHRMAP	■ $0.2M at NPV 4% ■ Annual maintenance estimate of approximately $27,000	■ Operational ■ Grants (e.g. DRF) ■ Direct beneficiaries				x

7 SUMMARY AND NEXT STEPS

In this report, 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.

As outlined throughout the report, further monitoring, investigations and considerations are required to confirm the recommended options. Once those data gaps are filled, or after other triggers occur it is recommended the CHRMAP be updated. Specifically, preceding the CHRMAP review an optimisation of MU boundaries should be considered so that targeted treatments can be recommended depending on the nature of the foreshore and assets identified as vulnerable. Also, simultaneous treatment could be considered for both erosion and inundation.

The next stage for the project is to complete the CHRMAP summary report which will incorporate the findings of all the previous chapter reports including this one.

8 REFERENCES

California Water Blog (2015). Dutch lessons on levee design and prioritization for California. Available at: https://californiawaterblog.com/ Accessed 9/1/2024.

Cardno (2017). *Coastal Hazard Risk Management and Adaption Plan: CHRMAP For the Onslow Coast*, Report No 59916801 R06 Rev0, prepared for the Shire of Ashburton

Cardno (2022). *Princess Royal Harbour Coastal Hazard Risk Management and Adaption Plan: Risk Identification*, Report No CW1200123 R001 Rev0, prepared for the City of Albany

City of Albany (2019) *Local Planning Strategy: development in flood prone areas*, prepared for the City of Albany.

IPCC, (2021). Summary for Policymakers. In: *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [Masson-Delmotte, V., P. Zhai, A. Pirani, S. L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M. I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T. K. Maycock, T. Waterfield, O. Yelekçi, R. Yu and B. Zhou (eds.)]. Cambridge University Press. In Press. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

SES (2024). *Do you live behind a levee?,* NSW SES, Available at: https://www.ses.nsw.gov.au/ . Accessed 9/1/2024.

Water Technology (2019). *Denham Townsite CHRMAP Chapter Report: Adaptation Options Assessment*, Report No 5652-01 R07v03, prepared for Shire of Shark Bay

Water Technology (2022a). *Princess Royal Harbour CHRMAP Chapter Report: Establish the Context*, report 22040008_PRH_CHRMAP_R01 V02, report prepared for City of Albany

Water Technology (2022b). *Princess Royal Harbour CHRMAP Chapter Report: Vulnerability Scales Analysis*, report 22040008_PRH_CHRMAP_R03 V02, report prepared for City of Albany

Water Technology (2023). *Princess Royal Harbour CHRMAP Chapter Report: Risk Evaluation and Treatment*, report 22040008_PRH_CHRMAP_R04 V02, report prepared for City of Albany

Western Australian Planning Commission (WAPC, 2013). State Planning Policy No. 2.6 – State Coastal Planning Policy, prepared under the Planning and Development Act 2005.

Western Australian Planning Commission (WAPC, 2017). WA Coastal Zone Strategy, Department of Planning, Lands and Heritage.

Western Australian Planning Commission (WAPC, 2019). Coastal Hazard Risk Management and Adaptation Planning Guidelines

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APPENDIX A
EROSION AND INUNDATION MAPS


Albany
Middleton Beach
Melville Point
Point King
Port Albany
Protection by PR3 Seawall - existing structures
Protection by PR3 Seawall - existing structures
MU 1
Cockburn Sound
Albany
Beach
Melville Point
Port Albany
MU1
Point King
Possession Point
Geake Point
Vancouver Peninsula
Rushy Point
Little Grove
Limekilns Point
Goode
Coolinda Park Playground
Grey Street W
Foundation Park
Collie Street
Peels Street
Spencer Street
Frederick Street
Hill Street
Stirling Terrace
Princess Royal Drive
Anzac Peace Park
Innes Street
Bungyle Road
Balston Gardens
Apex Drive
Mt Clarence Parklands
Marine Drive
Spencer Lawley Park
Princess Royal Drive
Marine Drive
Ferris Road
Eyre Park
Wylie Crescent
Hare Street
LEGEND
Shoreline
2022 Erosion
2047 Erosion
2072 Erosion
2122 Erosion
0
0.25
0.5
Kilometers
1:11,000 at A3
Princess Royal Harbour CHRMAP
Erosion - Controlled (MU1)


Melville Point
Protection by PR1 Beach Nourishment
MU 2
Protection by PR1 Beach Nourishment
Rushy Point
Torndirrup
Robinson
Mount Melville
Foundation Park
Anzac Peace Park
Princess Royal Drive
Frenchman Bay Road
Bay View Drive
Hill Street
Frederick Street
Stirling Terrace
Port
Albany
Beach
Port Albany
Point King
Possession Point
MU2
Geake Point
Vancouver Peninsula
Little Grove
Limekilns Point
Goode
Rushy Point
LEGEND
Shoreline
2022 Erosion
2047 Erosion
2072 Erosion
2122 Erosion
Option for Erosion
0 0.25 0.5 Kilometers
1:17,500 at A3
Princess Royal Harbour CHRMAP
Erosion - Controlled (MU2)


Rushy Point
Protection by PR1 Beach Nourishment
Protection by PR3 Seawall - existing structures
MU 3
Protection by PR1 Beach Nourishment
Limekilns Point
Albany
Beach
Melville Point
Port Albany
Point King
Possession Point
Geake Point
Vancouver Peninsula
Rushy Point
Little Grove
MU3
Limekilns Point
Goode
Bay View Drive
Queen Street
Mill Park
Grove Street W
Gordon Street
Little Grove
Chipana Drive
Newdegate Parade
Frenchman Bay Road
O'Donnell Street
Symons Street
Spring Street
Torndirrup Road
26m
Diamond Street
Torndirrup Road
Groove Park Public Golf Links
Big Grove
Panorama Road
Humphrey Road
Rainbows End
LEGEND
Shoreline
2022 Erosion
2047 Erosion
2072 Erosion
2122 Erosion
Option for erosion
0 0.25 0.5
Kilometers
1:15,000 at A3
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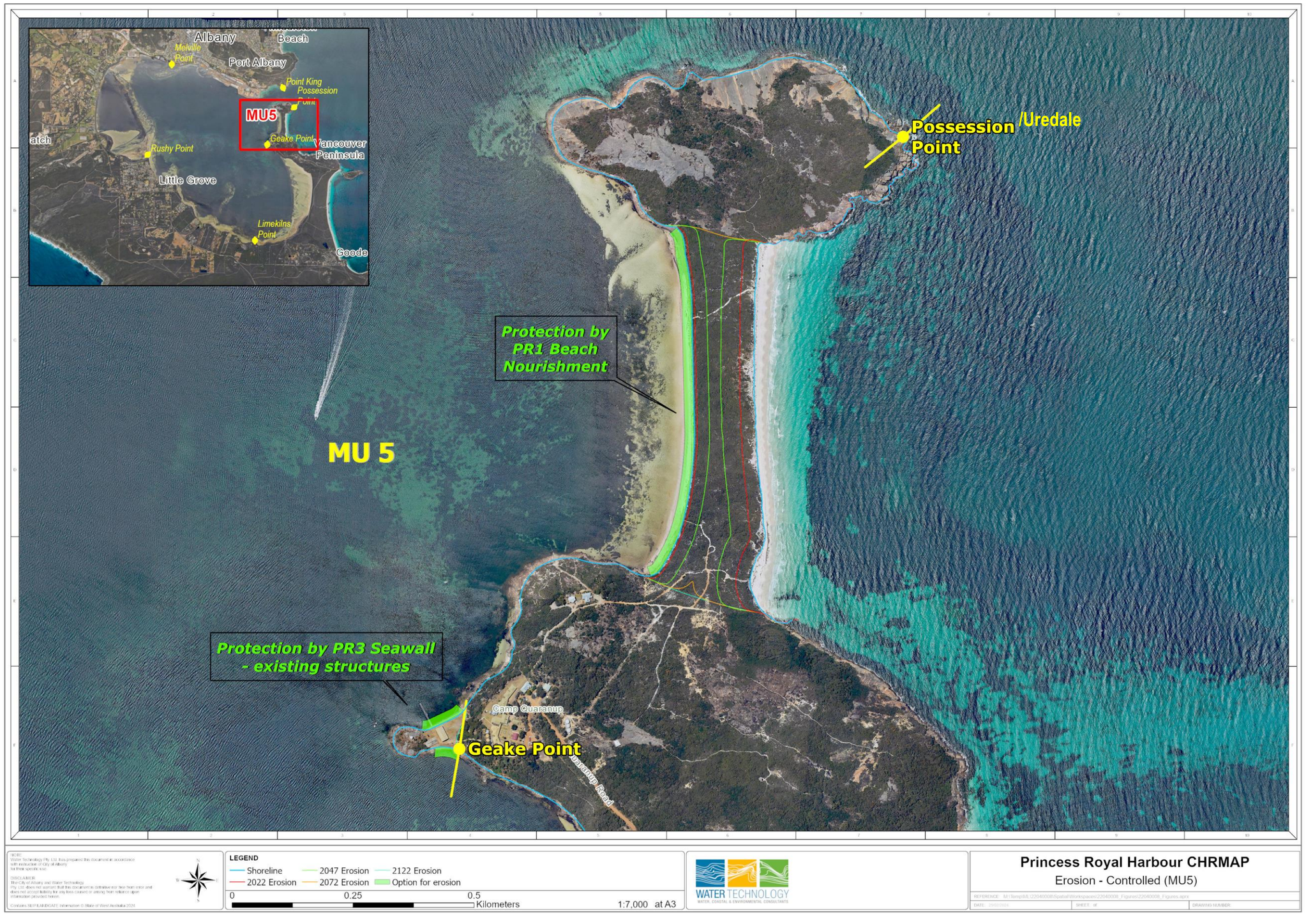
Princess Royal Harbour CHRMAP
Erosion - Controlled (MU3)


Albany
Beach
Melville Point
Port Albany
Point King
Possession Point
Geake Point
Vancouver Peninsula
Rushy Point
Little Grove
MU4
Limekilns Point
Goode
Geake Point
Camp Quarantup
Quarantup Road
Vancouver Peninsula
Mistaken Island
Planned/Managed Retreat
by PMR4 Voluntary Acquisition
MU 4
Quarantup Road
Panoramic Road
Limekilns Point
Quarantup Road
Lake Vancouver
LEGEND
Shoreline
2022 Erosion
2047 Erosion
2072 Erosion
2122 Erosion
0 0.25 0.5
Kilometers
1:16,000 at A3
WATER TECHNOLOGY
Princess Royal Harbour CHRMAP
Erosion - Controlled (MU4)


Albany
Beach
Melville Point
Port Albany
Point King
Possession Point
MU5
Geake Point
Vancouver Peninsula
Rushy Point
Little Grove
Limekilns Point
Goode
Possession /Uredale Point
Protection by PR1 Beach Nourishment
MU 5
Protection by PR3 Seawall - existing structures
Camp Quaranup
Geake Point
Quaranup Road
LEGEND
Shoreline
2022 Erosion
2047 Erosion
2072 Erosion
2122 Erosion
Option for erosion
0
0.25
0.5
Kilometers
1:7,000 at A3
WATER TECHNOLOGY
Princess Royal Harbour CHRMAP
Erosion - Controlled (MU5)

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

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LEGEND
- Shoreline
- Inundation Extent - 2122
- Inundation Extent - 2072
- Inundation Extent - 2047
- Inundation Extent - 2022

0 0.25 0.5 Kilometers

1:11,000 at A3

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Princess Royal Harbour CHRMAP
Inundation - Controlled (MU1)

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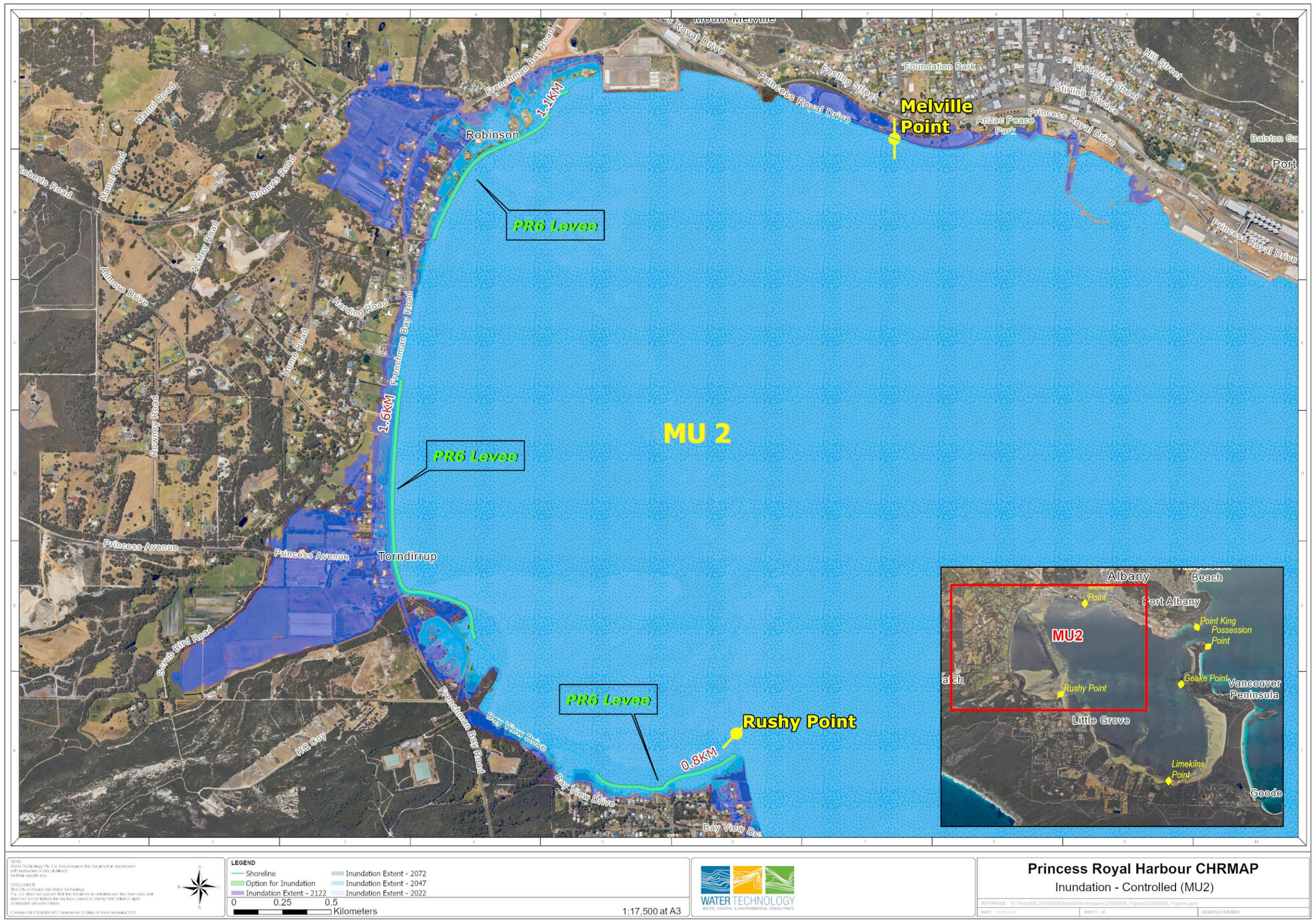
Mount Melville
Princess Royal Drive
Frenchman Bay Road
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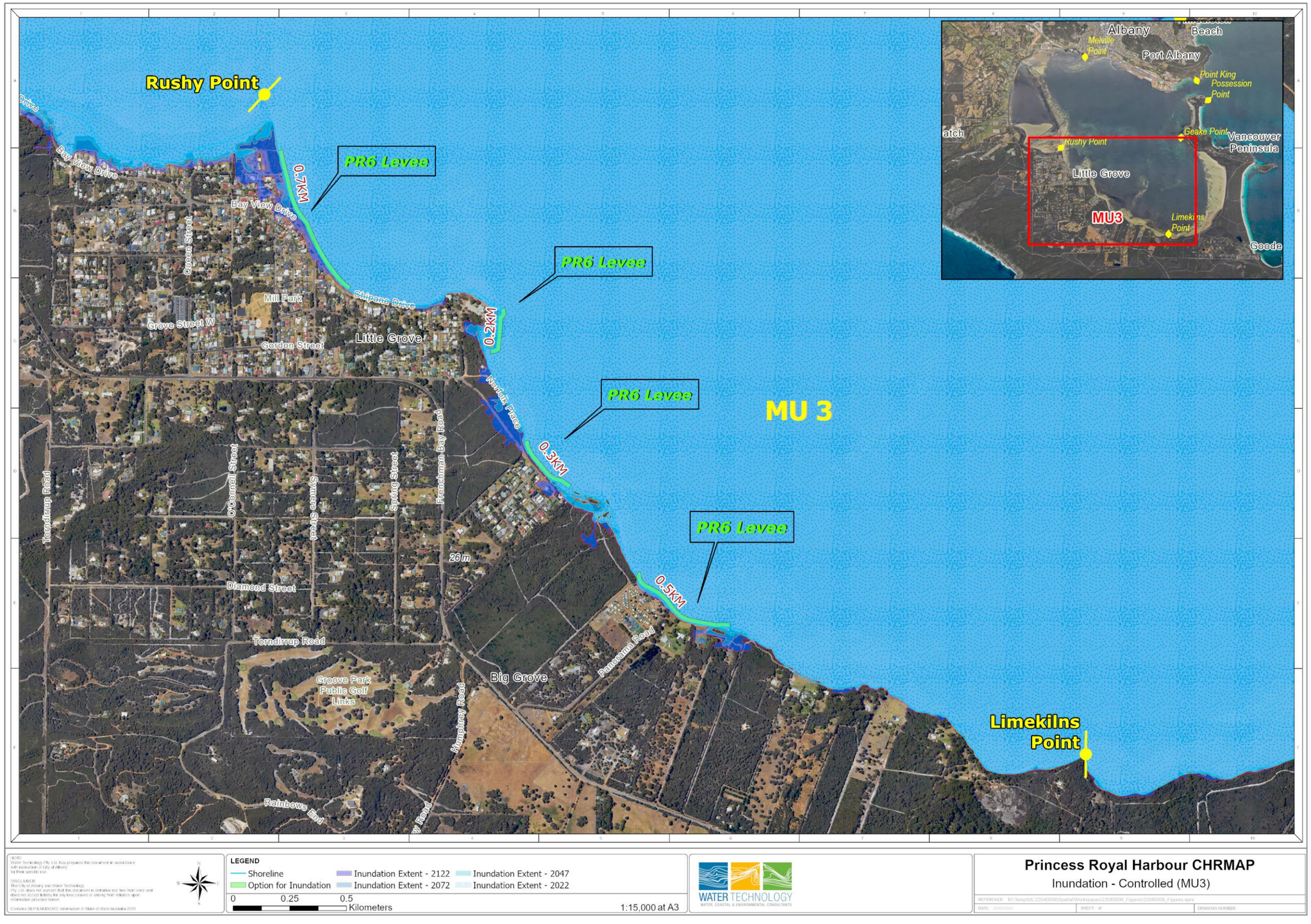
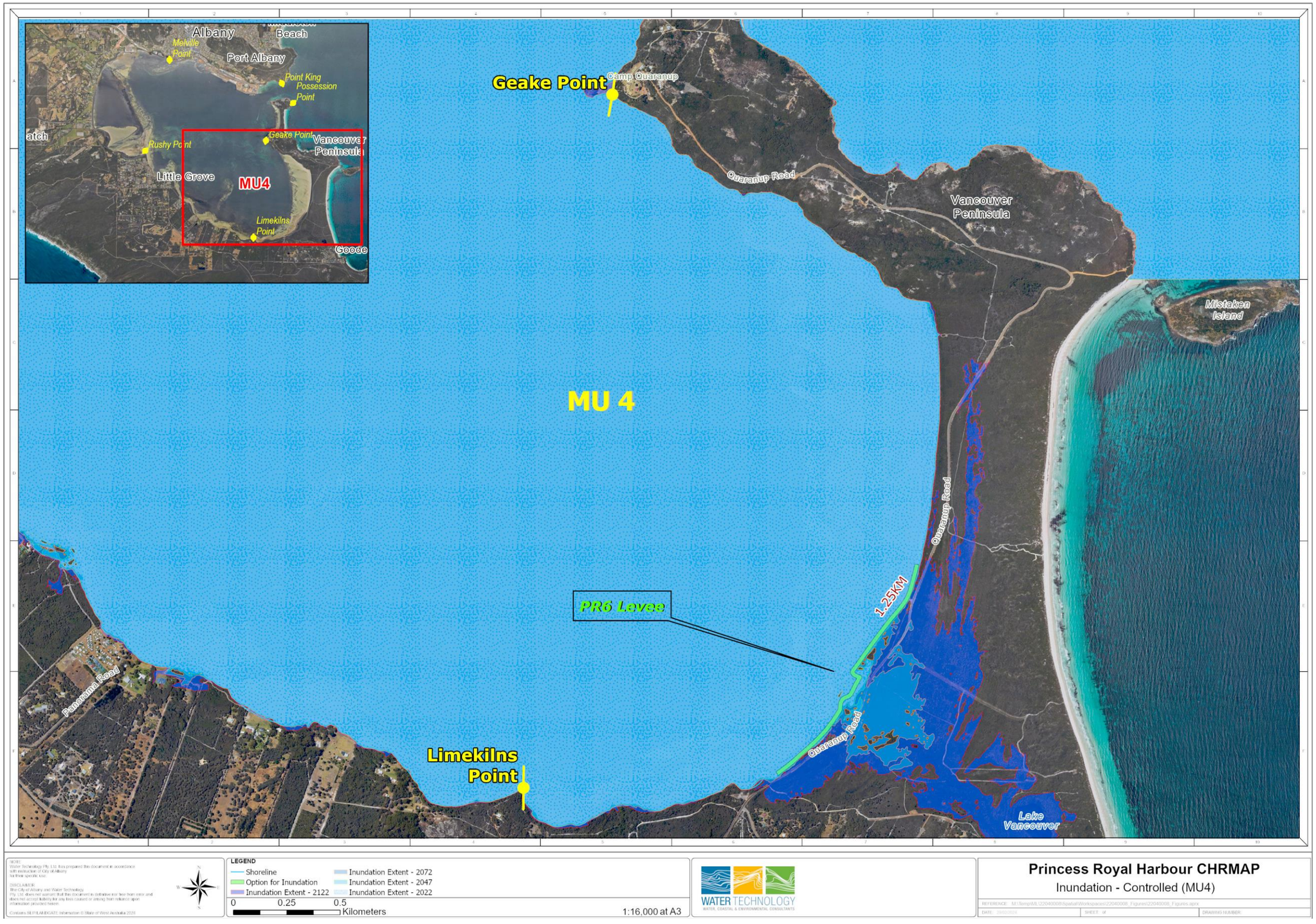
Robinson
Melville Point
Foundation Park
Fasting Street
Princess Royal Drive
Anzac Peace Park
Stirling Terrace
Frederick Street
Hill Street
Balston Ga
Port
Princess Royal Drive
PR6 Levee
Wanni Road
Roberts Road
Ackley Road
Allmore Drive
Harding Road
Home Road
Rowley Road
1.6KM
Frenchman Bay Road
PR6 Levee
MU 2
Princess Avenue
Princess Avenue
Torndirrup
Scenic Bird Road
HQ Bay
Frenchman Bay Road
Bay View Drive
Bay View Drive
PR6 Levee
Rushy Point
0.8KM
Albany
Beach
Port Albany
MU2
Point King
Possession Point
Rushy Point
Geake Point
Vancouver Peninsula
Little Grove
Limekilns Point
Goode
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
WATER TECHNOLOGY
Princess Royal Harbour CHRMAP
Inundation - Controlled (MU2)


Rushy Point
PR6 Levee
0.7KM
PR6 Levee
0.2KM
PR6 Levee
0.3KM
PR6 Levee
0.5KM
MU 3
Limekilns Point
Bay View Drive
Queen Street
Mill Park
Chipana Drive
Grove Street W
Gordon Street
Little Grove
Newdegate Place
O'Connell Street
Spring Street
Frenchman Bay Road
Torndirrup Road
Symons Street
26m
Diamond Street
Torndirrup Road
Groove Park Public Golf Links
Big Grove
Panorama Road
Humphrey Road
Rainbows End
Albany
Beach
Melville Point
Port Albany
Point King
Possession Point
Geake Point
Vancouver Peninsula
Rushy Point
Little Grove
MU3
Limekilns Point
Goode
LEGEND
Shoreline
Option for Inundation
Inundation Extent - 2122
Inundation Extent - 2072
Inundation Extent - 2047
Inundation Extent - 2022
0 0.25 0.5
Kilometers
1:15,000 at A3
WATER TECHNOLOGY
Princess Royal Harbour CHRMAP
Inundation - Controlled (MU3)


Albany
Beach
Melville Point
Port Albany
Point King
Possession Point
Geake Point
Vancouver Peninsula
Rushy Point
Little Grove
MU4
Limekilns Point
Goode
Geake Point
Camp Quaranup
Quaranup Road
Vancouver Peninsula
Mistaken Island
MU 4
Quaranup Road
1.25KM
PR6 Levee
Panorama Road
Quaranup Road
Limekilns Point
Lake Vancouver
LEGEND
Shoreline
Option for Inundation
Inundation Extent - 2122
Inundation Extent - 2072
Inundation Extent - 2047
Inundation Extent - 2022
0 0.25 0.5
Kilometers
1:16,000 at A3
WATER TECHNOLOGY
Princess Royal Harbour CHRMAP
Inundation - Controlled (MU4)


Albany
Beach
Melville Point
Port Albany
Point King
Possession Point
MU5
Geake Point
Vancouver Peninsula
Rushy Point
Little Grove
Limekilns Point
Goode
Possession Point /Uredale
PR6 Levee
0.05 KM
MU 5
PR6 Levee
0.3KM
Geake Point
Camp Quaranup
Quaranup Road
LEGEND
Shoreline
Option for Inundation
Inundation Extent - 2122
Inundation Extent - 2072
Inundation Extent - 2047
Inundation Extent - 2022
0
0.25
0.5
Kilometers
1:7,000 at A3
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Princess Royal Harbour CHRMAP
Inundation - Controlled (MU5)

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