WATER TECHNOLOGY
WATER, COASTAL & ENVIRONMENTAL CONSULTANTS

Princess Royal Harbour CHRMAP

Vulnerability Scales Analysis

City of Albany

20 February 2023

Document Status

Version	Doc type	Reviewed by	Approved by	Date issued
V01	DRAFT	Joanna Garcia-Webb	Joanna Garcia-Webb	14/10/2022
V02	DRAFT	Joanna Garcia-Webb	Joanna Garcia-Webb	28/11/2022
V03	FINAL	Julia Lima	Gildas Colleter	20/02/2023

Project Details

Project Name	Vulnerability Scales Analysis
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Document Number	22040008_PRH_CHRMAP_R03_V03

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EXECUTIVE SUMMARY

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

The Princess Royal Harbour region has been identified in Western Australia as a projected inundation hazard location and Little Grove (located within Princess Royal Harbour) is in the watchlist for coastal erosion (Seashore Engineering, 2019). This coastal hazard risk is a key trigger for the requirement of this CHRMAP. The aim of the present study is therefore to investigate and plan for coastal hazards which are likely to affect Princess Royal Harbour– refer Figure 1-1 for locality and study area extent. 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, which is a significant exporter for the state.

This CHRMAP project is expected 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 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 the objectives identified by these guidelines and SPP2.6. The project will identify the strategic direction for coastal adaptation scenarios from the present 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 policy making for the short-term (0-25 years), medium-term (25-50 years), and long-term (100 years).

This report presents the Stage 3 – Vulnerability Analysis Chapter Report, which outlines the key assets and risks to guide for adaptation in the future chapters. The flow chart displayed in Figure 1-2 indicates where this component sits with reference to the greater study; the Vulnerability Assessment stage has the following sections– Consequences, likelihood, level of risk, adaptive capacity and asset vulnerability matrix. The analysis presented on Table 4-2 and Table 4-3 have shown a significant vulnerability at all Management Units and the major vulnerability from erosion rather than inundation, mainly because of a lower adaptative capacity of the assets to erosion. In most management units some form of adaptation is required from present day.

The next report will present the risk evaluation, which updates the risk priorities in context of any physical and planning controls. Risk treatment options will also be identified and assessed with a multi-criteria analysis. Risk treatment options will be considered for each management unit and asset category.

CONTENTS

APPENDICES

LIST OF FIGURES

LIST OF TABLES

1 INTRODUCTION

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

One of the key objectives of SPP2.6 is to establish coastal foreshore reserves which include allowances for the protection, conservation and enhancement of coastal values across the state. Risk assessment processes are then utilised to identify risks that are intolerable to the community, and other stakeholders such as local governments, indigenous and cultural interests, and private enterprise. Adaptation measures are then developed according to the preferential 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 along the shoreline protected by physical controls
- Shallow sandy foreshore backed by vegetation
- River mouths and channels through the sand bar
- Sailing club, boat ramp and other coastal infrastructure
- Presence of rock features

This CHRMAP project is expected 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 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 the objectives identified by these guidelines and SPP2.6. The project will identify the strategic direction for coastal adaptation scenarios from the present to 2122 (100-year management time frame) and detail an implementation plan describing risk management measures to be undertaken to achieve preferred risk treatments. Overall, this CHRMAP will develop a flexible adaptation pathway for Princess Royal Harbour and serve as a key reference for management, planning and policy making for the short-term (0-25 years), medium-term (25-50 years), and long-term (50-100 years).

This report presents the Vulnerability Analysis Chapter Report, which assess the vulnerability of the assets within the coastal hazard zone. The flow chart displayed in Figure 1-2 indicates where this component sits with reference to the greater study; the 'Vulnerability Analysis' phase corresponds to the bubble shaded in red. The Vulnerability Analysis uses the following concepts:

- Sensitivity = Consequence of coastal asset being impacted,
- Exposure = Likelihood of coastal hazard occurring.
- Potential impact = Risk to coastal assets as a product of consequence and likelihood.

- Adaptive Capacity = The capacity for an asset to accommodate the coastal hazard impact and recover.
- Vulnerability = Final risk rating which incorporates the adaptive capacity of the asset.

Delivery of this project will occur over 8 stages (as summarised in Figure 1-2), each of which represents a key hold point. The staged approached is developed according to the City of Albany's scope and is in line with CHRMAP Guidelines (WAPC, 2019).

Figure 1-1 Princess Royal Harbour Study Area

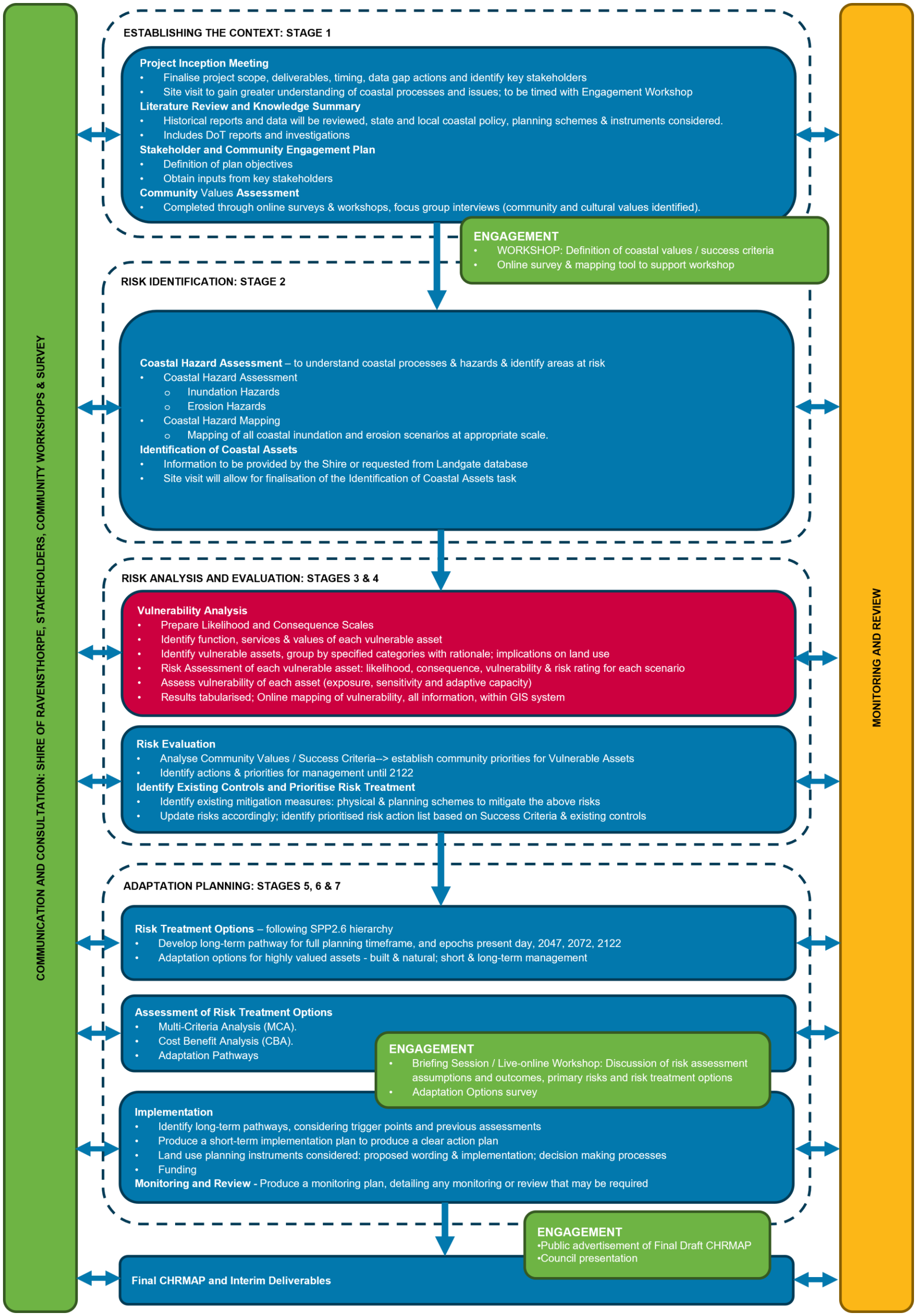

Figure 1-2 CHRMAP methodology summary

2 ASSET CLASSIFICATIONS

To facilitate the coastal hazard assessment and development of adaptation options, the study area is delineated into several management units. These are largely determined by coastal processes and potential hazard types. The extent of each management unit is displayed in Figure 1-1.

Assets at risk of coastal erosion and inundation have been identified by overlaying the hazard extents over recent aerial imagery of the Princess Royal Harbour coastline and evaluated together with the City's Local Planning Scheme No. 1. (refer to Appendix C). Each asset was categorised into a classification. This aims to simplify the adaptation planning process in subsequent phases of the project. The asset classifications are described below.

- Residential
  - Private houses and apartments and supporting structures such as sheds and garages, and rural properties
  - Corresponding Local Planning Scheme zones are: Regional Centre, Residential, Rural Small Holdings, Rural Residential, Rural Enterprise, Rural townsite, Private community purposes,
- Commercial
  - This includes shops, businesses, offices etc.
  - Corresponding Local Planning Scheme zones are, Light Industry, General Industry, Tourism, Urban & Industrial Development, Commercial, mixed use, service commercial.
- Developed Foreshore reserve
  - Reserve containing public assets, e.g., car parks, public ablutions, playgrounds, walkway, access structures
  - Corresponding Local Planning Scheme zones are Car Park, Public Open Space, Public Purpose, Public Purposes; Recreational
- Public & Community
  - This item mainly relates land that is publicly owned, and includes public infrastructure, the marine facility and its structures, the port and public parks.
  - Corresponding Local Planning Scheme zones are: Cemetery, Civic and Community, Cultural Facilities, Drainage/Waterway; Education, Emergency Services; Government Services; Infrastructure; Medical Services, Neighbourhood Centre; Railways, Social Care Facilities, Special Purpose; Strategic Industry and Infrastructure, Special Use
  - Special Purpose Areas within this category include
    - Public drinking water sources special control areas
    - Albany port special control area
- Roads
  - Corresponding Local Planning Scheme zones are Distribution, Local, Major and Priority Roads
- Environmental
  - This category covers all undeveloped foreshore
  - A large area of the foreshore is classified as Environmental Conservation within the Local Planning Scheme.

- Heritage
  - This includes any Historical sites within the City and Aboriginal Heritage.
  - Specific Aboriginal Heritage sites are obtained from the Aboriginal Heritage Inquiry System, hosted by the Department of Planning, Lands and Heritage.

3 VULNERABILITY ANALYSIS METHOD

The **exposure/likelihood** of identified assets represents the likelihood of coastal hazards impacting on an asset. That is, the chance of erosion and / or storm surge inundation impacting on existing and future assets and their values (WAPC, 2019). The likelihood scale adopted for this study is presented in Table 3-1.

Table 3-1 Exposure/Likelihood Rating

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

Over the years, there has been significant variation in defining the likelihood ratings based on coastal hazard assessment outcomes. The erosion hazard lines (Cardno, 2022) were developed based on a number of components, each of which has its own assumptions and degree of uncertainty. For instance, the assessment of S1 erosion risk has considered a few different likelihood storm events which, by themselves, represent their likelihood of occurrence, however such occurrences change over the different planning timeframes. Likelihood of sea level rise (SLR) and historic shoreline movement are very difficult to define quantitatively by scientific terms. It is therefore important to adopt a straight-forward approach to transfer the information presented in the coastal hazard maps into likelihood of impact to assets.

Through internal discussion and review, Water Technology has adopted the approach recommended by WAPC (2019) as demonstrated in Figure 3-1 below for the likelihood of erosion hazard. The likelihood of the current study for erosion is thereby determined by the Table 3-3.

For the coastal inundation analysis, Cardno (2022) considered the effects of storm surge inundation and catchment inundation. The allowance for the extent of coastal inundation (S4) was calculated as the maximum extent of storm inundation, which included the peak steady water level, plus wave run-up, for a 500-years average recurrence interval (ARI) ocean water level event. Consideration was given to the likelihood of breaching any manmade structures (overtopping), such as seawalls, or natural barriers, such as dune systems. PRH receives freshwater inflow from adjacent land catchments. As such, consideration was given to the statistical dependence between extreme rainfall and extreme storm surge, as both physical processes can be driven by common meteorological forcings. Low pressure systems for example, may produce strong onshore winds and an inverse barometric effect, leading to an extreme storm surge, while simultaneously generating large quantities of rainfall on the adjacent coastal catchments. By applying the definitions of the likelihood scale of Table 3-1, the likelihood of inundation for the current study is presented in Table 3-4.

Calculation of the probabilities behind the likelihood ratings is extremely complex and simplification is necessary in order to carry out the vulnerability and risk assessments. Any adaptation measures will consider applying triggers before implementation which reduces the risk of this simplification process. For example, a trigger might be reached by an inundation event with certain consequences occurring twice in a given year.

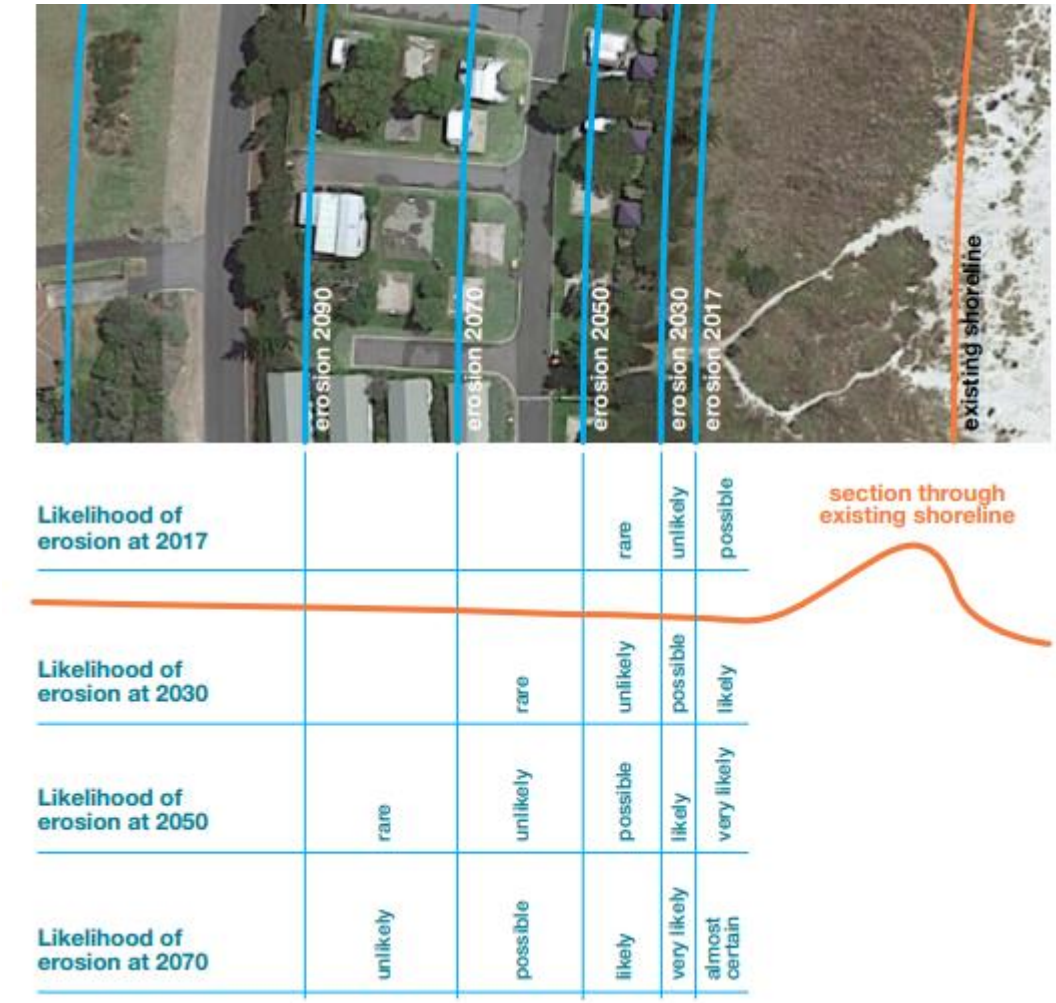

Figure 3-1 Example of likelihood rating based on erosion hazard lines (adapted from WAPC, 2019)

Table 3-2 Inundation event probabilities over planning timeframes

Timeframe (duration)	Probability: 500-year ARI
Present Day (1-year)	0.2%
2047 (25-years)	3%
2070 (…)	6%
2122 (100-years)	18%

Table 3-3 Exposure / Likelihood of coastal erosion hazards across the planning timeframe

Erosion Hazard Line	present	2047	2072	2122
HSD-2022	Possible	Likely	Almost Certain	Almost Certain
2022-2047	Unlikely	Possible	Likely	Almost Certain
2047-2072	Rare	Unlikely	Possible	Likely
2072-2122	Rare	Rare	Unlikely	Possible

Table 3-4 Exposure / Likelihood of inundation hazards across the planning timeframe

Timeframe	500-year ARI Inundation Event
Present Day	Rare
2047	Unlikely
2072	Unlikely
2122	Possible

3.1 Sensitivity/Consequence

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

The consequence ranking presented in Table 3-6 constitutes the physical impact of the event to the asset, as well as that of the values attributed to it by the success criteria defined earlier in the study (replicated below in Table 3-5, for reference). The success criteria were generated (Water Technology, 2021b) from the coastal values assessment, which was undertaken by stakeholder and community engagement.

Table 3-6 can be interpreted as follows:

- The Physical, Financial column considers the physical impact as well as a qualitative assessment of the economic costs associated with the various consequences. These will be assessed in more detail in the cost benefit analysis as part of the adaptation options assessment component of the study (Stage 5 Chapter Report, as per Figure 1-2).
- The remaining columns include the application of the success criteria. The success criteria highlight the importance of the environment and coastal recreation to the community:
  - Environment column considers how the environment may be impacted through an erosion or inundation event, including consideration of if a similar habitat may exist elsewhere.
  - Community / Social & Cultural column considers how impacts to an asset may affect the community, also allowing for if alternatives assets / functions exist elsewhere. Consideration of community safety is also included.

For each hazard, the consequence is assessed against the criteria qualitatively, based on experience of the impacts of coastal erosion and inundation, and the examples presented in the consequence scale. The purpose of assigning vulnerability is to identify and prioritise what requires adaptation.

Table 3-5 Success criteria

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

Table 3-6 Sensitivity / Consequence ranking

Consequence Level	Physical, Financial	Environment	Community / Social & Cultural
Insignificant	No or minimal damage , perhaps requiring increased maintenance Financial loss less than $5,000	Little impact on environment	Minimal short-term inconvenience to asset, services and function, <5% of community affected. Many alternatives exist
Minor	Minor damage to assets resulting in restrictions in capability , financial loss of $5,000 to $20,000	Short term damage to environment. Recovery will be strong. Local or regional alternate habitat exists	Isolated but noticeable (short term) decline or disruption to asset, services and function, <10% of community affected. Alternative sites exist
Moderate	Damage to assets resulting in isolated loss of capability, financial loss of $20,000 to $50,000	Medium term loss of environmental assets. Recovery is likely. Local or regional alternate habitats exist. Environmental damage requiring restitution or internal clean-up.	Moderate (short to medium term) decline or disruption to assets, services and function, <25% of community affected. No convenient alternative exists
Major	Significant damage to many assets resulting in very limited capability, financial loss of $50,000 to $150,000	Long-term damage to environmental assets. Limited chance of recovery. No local alternate habitat(s) exist. Regional habitats exist. Environmental damage requiring restitution or internal clean-up.	Severe (medium-term) decline or disruption to asset, services and function, <50% of community affected. No convenient alternative exists
Severe	Significant damage to most assets resulting in loss of capability, financial loss of over $150,000	Permanent damage to environmental assets. No chance of recovery. No alternate habitat(s) exist. Major breach of legislation or extensive environmental damage requiring third party investigation	Long term or permanent loss of asset, services and function >75% of community affected. No alternative exists

Each asset category is assigned a sensitivity / consequence rating, presented in in Table 3-7 and Table 3-8 for erosion and inundation respectively. In the sub-chapters below, the asset ratings to the hazards are discussed and a vulnerability rating assigned. Assets are grouped according to classification for ease of interpretation. All ratings are somewhat subjective. It is anticipated that the ratings will be discussed in order

to ensure the ratings are reflective of stakeholder knowledge. The ratings will then be updated in the final report.

Table 3-7 Sensitivity / consequence rating by asset category: erosion

Asset Category	Physical, Financial	Environment	Community / Social & Culture	Overall Rating
Residential	Catastrophic	Minor	Major	Catastrophic
Commercial	Catastrophic	Minor	Major	Catastrophic
Developed Foreshore Reserve	Moderate	Moderate	Moderate	Moderate
Public & Community	Major	Moderate	Moderate	Major
Roads	Catastrophic	Minor	Major	Catastrophic
Environmental	Major	Major	Moderate	Major
Heritage	Major	Major	Major	Major

Table 3-8 Sensitivity / consequence rating by asset category: inundation

Asset Category	Physical, Financial	Environment	Community / Social & Culture	Overall Rating
Residential	Major	Minor	Moderate	Major
Commercial	Major	Minor	Moderate	Major
Developed Foreshore Reserve	Moderate	Minor	Moderate	Moderate
Public & Community	Moderate	Minor	Moderate	Moderate
Roads	Minor	Minor	Minor	Minor
Environmental	Minor	Moderate	Minor	Moderate
Heritage	Moderate	Moderate	Moderate	Moderate

3.2 Potential Impact (Level of Risk)

Risk level, or **potential impact**, is calculated as the **product** of exposure and sensitivity (see Table 3-9). It provides a classification of the potential impact of coastal hazards on identified assets, which should be determined for each considered planning timeframes. Level of risk is evaluated mainly based on its tolerability (i.e., consequence). Definitions are provided in Table 3-10.

Table 3-9 Risk Level (Potential Impact) Matrix as Product of Sensitivity (Consequence) and Exposure (Likelihood)

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

Table 3-10 Risk profile definition

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

3.3 Adaptive Capacity

The **adaptive capacity** is the asset's ability to adjust/adapt to the identified hazard. It is determined based on the potential for the system to be modified to cope with the impacts from coastal hazards. Assets with high adaptive capacity can easily be adapted or one that has some capacity to self-adapt with changing conditions. For instance, beach and dune systems often have higher adaptive capacity than coastal infrastructure and residential land. The scale of adaptive capacity is provided in Table 3-11. Rating of adaptive capacity is determined by assets/asset groups as well as opinions from the stakeholders and communities.

Table 3-11 Adaptive Capacity

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

Assigned adaptive capacity ratings by category are presented in Table 3-12 for both erosion and inundation.

Table 3-12 Adaptive capacity rating by asset category

Asset Category	Adaptive Capacity: Erosion	Adaptive Capacity: Inundation
Residential	Low	Moderate
Commercial	Low	Moderate
Developed Foreshore Reserve	High	High
Public & Community	Low	Moderate
Roads	Low	Moderate
Environmental	Moderate	High
Heritage	Low	Moderate

3.4 Vulnerability

Vulnerability is calculated as the **product** of potential impact (risk level) and the adaptive capacity. As per WAPC (2019), four levels of vulnerability are considered in this study which should be assessed for each of the planning timeframes considered by this CHRMAP.

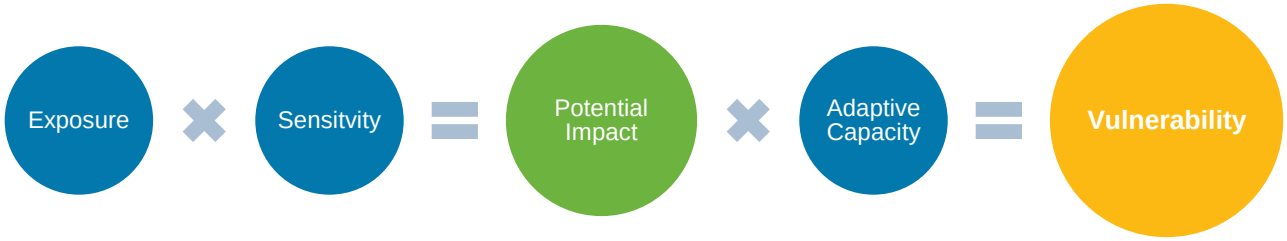

Figure 3-2 Vulnerability relationship

Table 3-13 Vulnerability Matrix as a Product of Risk Level and Adaptive Capacity

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

Applying the described methodology, assets in all management units are identified and categorised in the sections below. **Exposure** level is rated as AC (Almost Certain), L (Likely), P (Possible), U (Unlikely) and R (Rare). **Sensitivity** is rated as IN (Insignificant), MI (Minor), MO (Moderate), MA (Major) and CA (Catastrophic). **Risk / potential impact** and **vulnerability** are rated as EX (extreme), HI (High), ME (Medium) and LO (Low). **Adaptive capacity** is rated as VH (Very High), High (HI), Moderate (MO) and Low (LO).

4 VULNERABILITY ANALYSIS

The method discussed in Section 3 was applied to all identified assets. For each planning horizon, each category was then assigned an overall vulnerability rating, as presented in Table 4-1 to Table 4-3. The full results are presented in Appendix A e Appendix B. High vulnerability has been identified from the present day onwards, with extreme identified from 2072. The main vulnerability is related to erosion, not inundation, this is not so intuitive, and it is mainly related to the lower adaptative capacity at the erosion risk when compared to the inundation risk. We will recommend adaptation options for both risks.

Table 4-1: Number of assets at risk

Management Unit	Erosion				Inundation			
	present	2047	2072	2122	present	2047	2072	2122
MU1-Point King to Melville point								
Residential	0	0	0	9	0	0	0	0
Commercial	0	0	0	2	0	1	1	1
Developed Foreshore Reserve	0	0	0	3	0	0	2	2
Public & Community	1	1	1	5	1	1	3	4
Roads	0	0	0	7	0	1	2	2
Environmental	0	0	0	1	0	0	1	1
Heritage	0	0	0	2	0	0	0	0
MU2 - Melville Point to Rushy Point								
Residential	0	1	3	10	8	11	12	14
Commercial	0	1	6	12	9	13	13	15
Developed Foreshore Reserve	0	1	1	1	1	1	1	1
Public & Community	1	1	1	2	0	0	1	1
Roads	1	4	5	9	5	7	7	8
Environmental	2	3	3	5	2	3	3	3
Heritage	0	1	1	1	0	0	0	0
MU3 - Rushy Point to Limekilns Point								
Residential	0	1	6	10	1	1	2	8
Commercial	0	1	2	6	3	3	3	4
Developed Foreshore Reserve	0	2	2	3	3	1	1	4
Public & Community	0	0	0	0	0	0	0	0
Roads	0	3	3	15	1	0	2	6
Environmental	1	1	2	5	2	2	3	4
Heritage	0	1	1	1	0	1	0	0
MU4 - Limekilns Point to Geake Point								

Residential	0	1	1	3	1	1	1	1
Commercial	0	0	0	0	0	0	0	0
Developed Foreshore Reserve	0	0	0	1	1	0	0	0
Public & Community	0	0	0	1	1	0	0	1
Roads	0	2	5	8	2	2	2	4
Environmental	0	4	4	6	1	3	4	5
Heritage	0	2	2	2	1	0	1	4
MU5 - Geake Point to Possession Point								
Residential	0	0	0	0	0	0	0	0
Commercial	0	0	0	0	0	0	0	0
Developed Foreshore Reserve	0	0	0	0	0	0	0	0
Public & Community	0	0	0	0	0	0	0	0
Roads	0	0	0	0	0	0	0	0
Environmental	0	1	2	2	1	0	0	0
Heritage	0	1	2	2	0	0	0	0

Table 4-2 Vulnerability results for Erosion

Management Unit	Vulnerability				Summary
	present	2047	2072	2122	
MU1-Point King to Melville point					
Residential	High	High	Extreme	Extreme	This is a hardened coast, erosion is a key risk for the 2122 timeframe when the design life of the structures are past due.
Commercial	High	High	Extreme	Extreme	
Developed Foreshore Reserve	Low	Low	Medium	Medium	
Public & Community	High	High	High	Extreme	
Roads	High	High	Extreme	Extreme	
Environmental	Medium	Medium	Medium	Extreme	
Heritage	High	High	High	Extreme	
MU2 - Melville Point to Rushy Point					
Residential	Extreme	Extreme	Extreme	Extreme	This is the MU with most assets categories affected from the present day. Adaptation in some form is required from the present day.
Commercial	Extreme	Extreme	Extreme	Extreme	
Developed Foreshore Reserve	Medium	Medium	Medium	Medium	
Public & Community	High	Extreme	Extreme	Extreme	
Roads	Extreme	Extreme	Extreme	Extreme	
Environmental	Medium	Medium	Extreme	Extreme	
Heritage	High	High	Extreme	Extreme	
MU3 - Rushy Point to Limekilns Point					
Residential	High	Extreme	Extreme	Extreme	
Commercial	High	Extreme	Extreme	Extreme	

Developed Foreshore Reserve	Medium	Medium	Medium	Medium	Erosion is a key risk for 6 of the 7 categories within this management unit. Adaptation in some form is required from the present day.
Public & Community	High	Extreme	Extreme	Extreme	
Roads	Extreme	Extreme	Extreme	Extreme	
Environmental	High	Extreme	Extreme	Extreme	
Heritage	Extreme	Extreme	Extreme	Extreme	
MU4 - Limekilns Point to Geake Point					
Residential	Extreme	Extreme	Extreme	Extreme	This management unit does not contain Commercial assets at risk
Commercial					
Developed Foreshore Reserve	Medium	Medium	Medium	Medium	
Public & Community	High	High	High	Extreme	
Roads	Extreme	Extreme	Extreme	Extreme	
Environmental	High	Extreme	Extreme	Extreme	
Heritage	Extreme	Extreme	Extreme	Extreme	
MU5 - Geake Point to Possession Point					
Residential					This MU is the most preserved one with assets related to conservation areas. There is a huge area in this MU that appears as "Heritage" in DPLH document and not on the City's planning Scheme.
Commercial					
Developed Foreshore Reserve	Medium	Medium	Medium	Medium	
Public & Community					
Roads	High	High	Extreme	Extreme	
Environmental	Extreme	Extreme	Extreme	Extreme	
Heritage	Extreme	Extreme	Extreme	Extreme	

Table 4-3 Vulnerability results for inundation

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

Environmental	Low	Medium	Medium	Medium	
Heritage	Medium	Medium	Medium	Medium	
MU4 - Limekilns Point to Geake Point					
Residential	Medium	Medium	Medium	High	All the natural and developed foreshore area and some residential properties are affected.
Commercial					
Developed Foreshore Reserve	Low	Medium	Medium	Medium	
Public & Community	Medium	Medium	Medium	Medium	
Roads	Medium	Medium	Medium	Medium	
Environmental	Low	Medium	Medium	Medium	
Heritage	Medium	Medium	Medium	Medium	
MU5 - Geake Point to Possession Point					
Residential					This MU is the most preserved one with assets related to conservation areas. Inundation does not affect this management unit in a large area.
Commercial					
Developed Foreshore Reserve					
Public & Community					
Roads	Medium	Medium	Medium	Medium	
Environmental	Low	Medium	Medium	Medium	
Heritage	Medium	Medium	Medium	Medium	

5 SUMMARY & NEXT STEPS

This report presents the vulnerability analysis for the Princess Royal Harbour CHRMAP. The following key observations can be made from the results:

- Erosion presents the largest vulnerability ratings and a higher number of assets at risk than inundation. This is due to the bigger extension of the erosion hazard and the lower adaptative capacity to the erosion hazard.
- From present day the categories all categories at high or extreme vulnerability to erosion. This reflects the diverse mix of categories along PRH coastline.
- The inundation vulnerability ratings maintain low and medium ratings from present day. At the 100-year timeframe the categories Residential, Public and Commercial presents high vulnerability to inundation due to the high sensitivity and the high likelihood of the inundation extents.

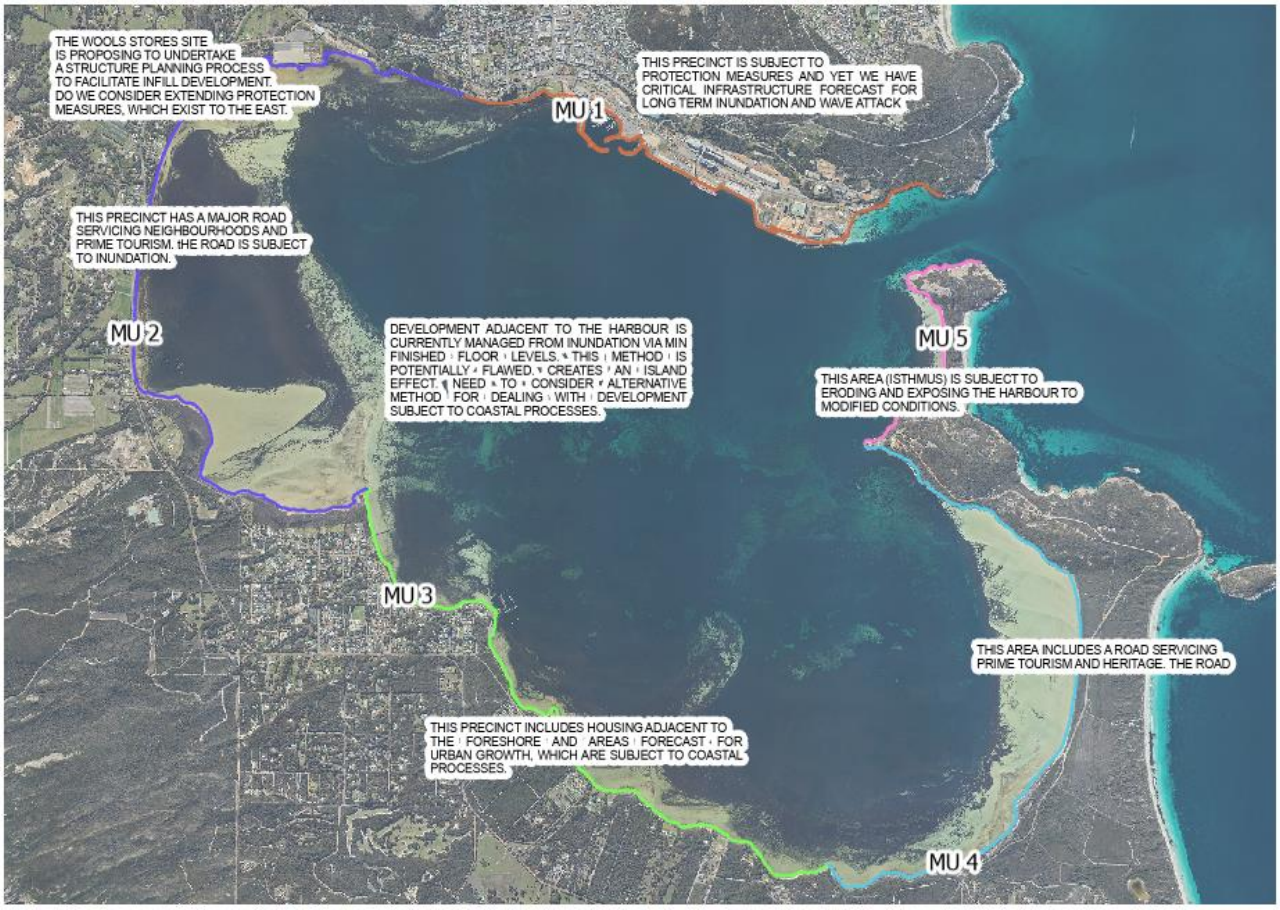

Figure 5-1 Main conclusion for each MU.

The next report will present the risk evaluation, which updates the risk priorities in context of any physical and planning controls. Risk treatment pathways will also be identified and assessed with a multi-criteria analysis. Risk treatment options will be considered for each management unit.

6 REFERENCES

CoastAdapt (2017). *How to conduct a climate change risk assessment*, accessed 17th July 2018, [https://coastadapt.com.au/how-to-pages/how-to-conduct-a-climate-change-risk-assessment], developed by National Climate Change Adaptation Research Facility with funding from Department of the Environment and Energy

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APPENDIX A
VULNERABILITY ANALYSIS: EROSION

Management Unit	Likelihood				Sensitivity	Impact				Adaptative Capacity	Vulnerability			
	present	2047	2072	2122		present	2047	2072	2122		present	2047	2072	2122
MU1-Point King to Melville point														
Residential	rare	rare	unlikely	possible	Catastrophic	medium	medium	high	extreme	Low	High	High	Extreme	Extreme
Commercial	rare	rare	unlikely	possible	Catastrophic	medium	medium	high	extreme	Low	High	High	Extreme	Extreme
Developed Foreshore Reserve	rare	rare	unlikely	possible	Moderate	low	low	medium	medium	High	Low	Low	Medium	Medium
Public & Community	rare	rare	unlikely	possible	Major	medium	medium	medium	high	Low	High	High	High	Extreme
Roads	rare	rare	unlikely	possible	Catastrophic	medium	medium	high	extreme	Low	High	High	Extreme	Extreme
Environmental	rare	rare	unlikely	possible	Major	medium	medium	medium	high	Moderate	Medium	Medium	Medium	Extreme
Heritage	rare	rare	unlikely	possible	Major	medium	medium	medium	high	Low	High	High	High	Extreme
MU2 - Melville Point to Rushy Point														
Residential	unlikely	possible	likely	almost certain	Catastrophic	high	extreme	extreme	extreme	Low	Extreme	Extreme	Extreme	Extreme
Commercial	unlikely	possible	likely	almost certain	Catastrophic	high	extreme	extreme	extreme	Low	Extreme	Extreme	Extreme	Extreme
Developed Foreshore Reserve	unlikely	possible	likely	almost certain	Moderate	medium	medium	high	high	High	Medium	Medium	Medium	Medium
Public & Community	unlikely	possible	likely	almost certain	Major	medium	high	extreme	extreme	Low	High	Extreme	Extreme	Extreme
Roads	unlikely	possible	likely	almost certain	Catastrophic	high	extreme	extreme	extreme	Low	Extreme	Extreme	Extreme	Extreme
Environmental	possible	possible	almost certain	almost certain	Major	medium	high	extreme	extreme	Moderate	Medium	Medium	Extreme	Extreme
Heritage	unlikely	unlikely	unlikely	possible	Major	medium	medium	extreme	extreme	Low	High	High	Extreme	Extreme
MU3 - Rushy Point to Limekilns Point														
Residential	unlikely	possible	likely	almost certain	Catastrophic	high	extreme	extreme	extreme	Low	High	Extreme	Extreme	Extreme
Commercial	unlikely	possible	likely	almost certain	Catastrophic	high	extreme	extreme	extreme	Low	High	Extreme	Extreme	Extreme
Developed Foreshore Reserve	unlikely	possible	likely	almost certain	Moderate	medium	medium	high	high	High	Medium	Medium	Medium	Medium
Public & Community	unlikely	possible	likely	almost certain	Major	medium	high	extreme	extreme	Low	High	Extreme	Extreme	Extreme
Roads	unlikely	possible	likely	almost certain	Catastrophic	high	extreme	extreme	extreme	Low	Extreme	Extreme	Extreme	Extreme
Environmental	possible	likely	likely	almost certain	Major	high	extreme	extreme	extreme	Moderate	High	Extreme	Extreme	Extreme
Heritage	possible	likely	likely	almost certain	Major	high	extreme	extreme	extreme	Low	Extreme	Extreme	Extreme	Extreme
MU4 - Limekilns Point to Geake Point														
Residential	unlikely	possible	likely	almost certain	Catastrophic	high	extreme	extreme	extreme	Low	Extreme	Extreme	Extreme	Extreme
Commercial														
Developed Foreshore Reserve	unlikely	possible	possible	likely	Moderate	medium	medium	medium	high	High	Medium	Medium	Medium	Medium
Public & Community	rare	rare	unlikely	possible	Major	medium	medium	medium	high	Low	High	High	High	Extreme
Roads	unlikely	possible	likely	almost certain	Catastrophic	high	extreme	extreme	extreme	Low	Extreme	Extreme	Extreme	Extreme
Environmental	possible	likely	almost certain	almost certain	Major	high	extreme	extreme	extreme	Moderate	High	Extreme	Extreme	Extreme
Heritage	possible	likely	almost certain	almost certain	Major	high	extreme	extreme	extreme	Low	Extreme	Extreme	Extreme	Extreme
MU5 - Geake Point to Possession Point														
Residential														
Commercial														
Developed Foreshore Reserve	unlikely	possible	possible	likely	Moderate	medium	medium	medium	high	High	Medium	Medium	Medium	Medium
Public & Community														
Roads	rare	rare	unlikely	possible	Catastrophic	medium	medium	high	high	Low	High	High	Extreme	Extreme
Environmental	likely	likely	almost certain	almost certain	Major	extreme	extreme	extreme	extreme	Moderate	Extreme	Extreme	Extreme	Extreme
Heritage	likely	likely	almost certain	almost certain	Major	extreme	extreme	extreme	extreme	Low	Extreme	Extreme	Extreme	Extreme

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APPENDIX B
VULNERABILITY ANALYSIS: INUNDATION

Management Unit	Likelihood				Sensitivity	Impact				Adaptative Capacity	Vulnerability			
	present	2047	2072	2122		present	2047	2072	2122		present	2047	2072	2122
MU1-Point King to Melville point														
Residential	rare	unlikely	unlikely	unlikely	Major	medium	medium	medium	medium	Moderate	Medium	Medium	Medium	Medium
Commercial	rare	unlikely	unlikely	possible	Major	medium	medium	medium	high	Moderate	Medium	Medium	Medium	High
Developed Foreshore Reserve	rare	unlikely	unlikely	possible	Moderate	low	medium	medium	medium	High	Low	Medium	Medium	Medium
Public & Community	rare	unlikely	unlikely	possible	Moderate	low	medium	medium	medium	Moderate	Medium	Medium	Medium	Medium
Roads	rare	unlikely	unlikely	possible	Minor	low	low	low	low	Moderate	Medium	Medium	Medium	Medium
Environmental	rare	unlikely	unlikely	possible	Moderate	low	medium	medium	medium	High	Low	Medium	Medium	Medium
Heritage	rare	unlikely	unlikely	unlikely	Moderate	low	medium	medium	medium	Moderate	Medium	Medium	Medium	Medium
MU2 - Melville Point to Rushy Point														
Residential	rare	unlikely	unlikely	possible	Major	medium	medium	medium	high	Moderate	Medium	Medium	Medium	High
Commercial	rare	unlikely	unlikely	possible	Major	medium	medium	medium	high	Moderate	Medium	Medium	Medium	High
Developed Foreshore Reserve	rare	unlikely	unlikely	possible	Moderate	low	medium	medium	medium	High	Low	Medium	Medium	Medium
Public & Community	rare	unlikely	unlikely	possible	Moderate	low	medium	medium	medium	Moderate	Medium	Medium	Medium	Medium
Roads	rare	unlikely	unlikely	possible	Minor	low	low	low	low	Moderate	Medium	Medium	Medium	Medium
Environmental	rare	unlikely	unlikely	possible	Moderate	low	medium	medium	medium	High	Low	Medium	Medium	Medium
Heritage	rare	unlikely	unlikely	unlikely	Moderate	low	medium	medium	medium	Moderate	Medium	Medium	Medium	Medium
MU3 - Rushy Point to Limekilns Point														
Residential	rare	unlikely	unlikely	possible	Major	medium	medium	medium	high	Moderate	Medium	Medium	Medium	High
Commercial	rare	unlikely	unlikely	possible	Major	medium	medium	medium	high	Moderate	Medium	Medium	Medium	High
Developed Foreshore Reserve	rare	unlikely	unlikely	possible	Moderate	low	medium	medium	medium	High	Low	Medium	Medium	Medium
Public & Community	rare	unlikely	unlikely	unlikely	Moderate	low	medium	medium	medium	Moderate	Medium	Medium	Medium	Medium
Roads	rare	unlikely	unlikely	possible	Minor	low	low	low	low	Moderate	Medium	Medium	Medium	Medium
Environmental	rare	unlikely	unlikely	possible	Moderate	low	medium	medium	medium	High	Low	Medium	Medium	Medium
Heritage	rare	unlikely	unlikely	possible	Moderate	low	medium	medium	medium	Moderate	Medium	Medium	Medium	Medium
MU4 - Limekilns Point to Geake Point														
Residential	rare	unlikely	unlikely	possible	Major	medium	medium	medium	high	Moderate	Medium	Medium	Medium	High
Commercial					Major									
Developed Foreshore Reserve	rare	unlikely	unlikely	possible	Moderate	low	medium	medium	medium	High	Low	Medium	Medium	Medium
Public & Community	rare	unlikely	unlikely	possible	Moderate	low	medium	medium	medium	Moderate	Medium	Medium	Medium	Medium
Roads	rare	unlikely	unlikely	possible	Minor	low	low	low	low	Moderate	Medium	Medium	Medium	Medium
Environmental	rare	unlikely	unlikely	possible	Moderate	low	medium	medium	medium	High	Low	Medium	Medium	Medium
Heritage	rare	unlikely	unlikely	possible	Moderate	low	medium	medium	medium	Moderate	Medium	Medium	Medium	Medium
MU5 - Geake Point to Possession Point														
Residential					Major									
Commercial					Major									
Developed Foreshore Reserve					Moderate									
Public & Community					Moderate									
Roads	rare	unlikely	unlikely	unlikely	Minor	low	low	low	low	Moderate	Medium	Medium	Medium	Medium
Environmental	rare	unlikely	unlikely	possible	Moderate	low	medium	medium	medium	High	Low	Medium	Medium	Medium
Heritage	rare	unlikely	unlikely	possible	Moderate	low	medium	medium	medium	Moderate	Medium	Medium	Medium	Medium

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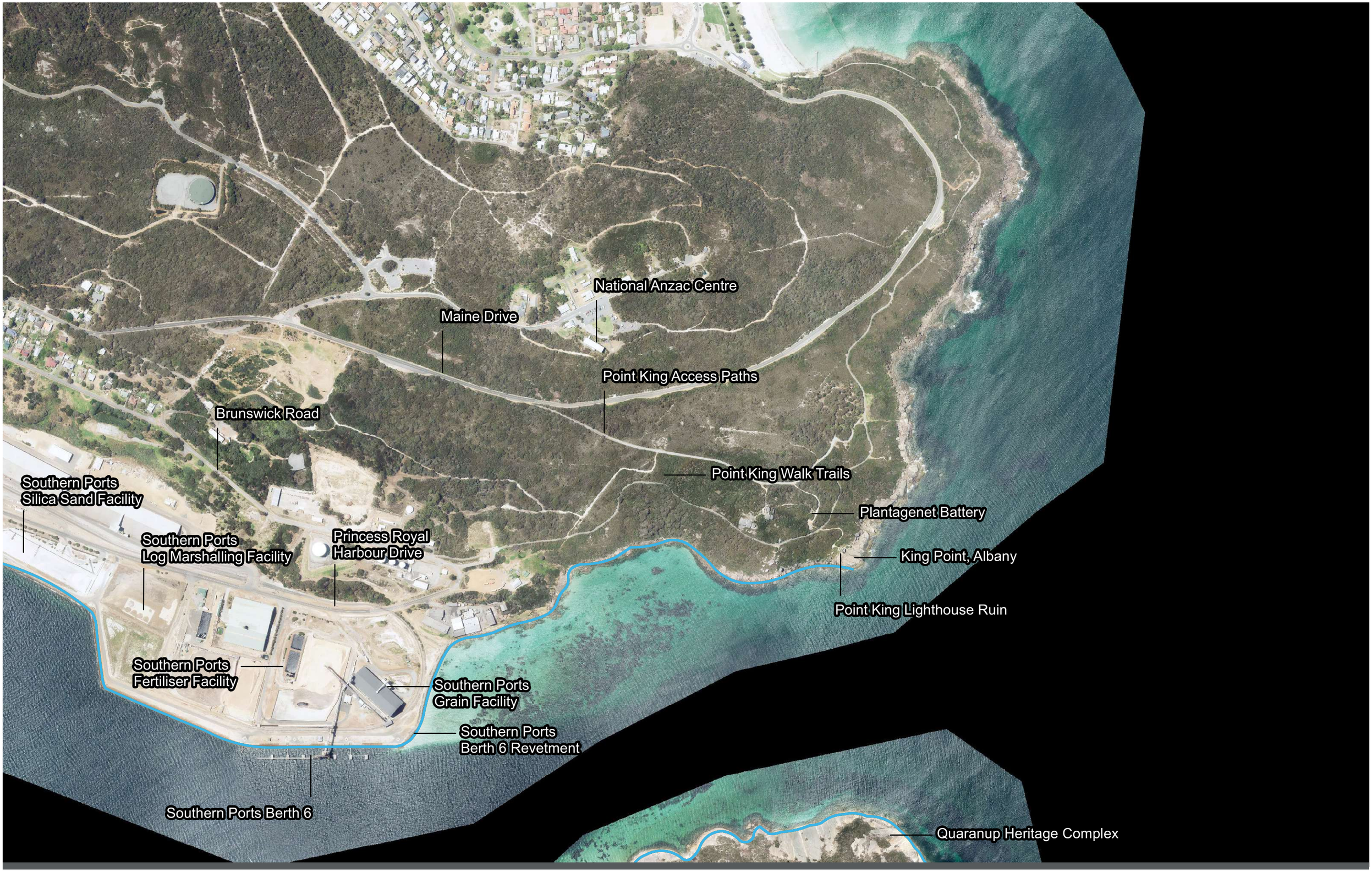
APPENDIX C
HAZARD MAPPING



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Legend

- PRH 2022 Erosion Extents
- PRH 2072 Erosion Extents
- PRH 2047 Erosion Extents
- PRH 2122 Erosion Extents

5/12/2022

Size
A3

Scale
1:7,500

0 50 100 150 200Meters

PRINCESS ROYAL HARBOUR CHRMAP

EROSION - CONTROLLED (MAP SECTOR 1)

CW1200123-GS-005-EROSION

Railway
Lakes
Point Melville Campsite
Princess Royal Harbour Drive
Brig Amity
Anzac Park Revetment
Hanover Bay Jetty
Anzac Park
Albany Entertainment Centre Carpark
Haz Beanz
Albany Entertainment Centre
Albany Waterfront Marina Carpark 3
Albany Waterfront Marina Carpark 2
Albany Boatshed Markets
Due South
Albany Waterfront Marina Western Breakwater
Tug Marina Carpark 1
CBH Facility
Albany Waterfront Marina Eastern Breakwater
Albany Waterfront Marina Eastern Breakwater
Southern Ports Silica Sand Facility
Southern Ports Berth 1
Southern Ports Berth 2
Southern Ports Berth 3

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Legend

- PRH 2022 Erosion Extents
- PRH 2047 Erosion Extents
- PRH 2072 Erosion Extents
- PRH 2122 Erosion Extents

5/12/2022
Size
A3
Scale
1:7,500

0 50 100 150 200Meters

PRINCESS ROYAL HARBOUR CHRMAP

EROSION - CONTROLLED (MAP SECTOR 2)

CW1200123-GS-005-EROSION

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Legend

- PRH 2022 Erosion Extents
- PRH 2072 Erosion Extents
- PRH 2047 Erosion Extents
- PRH 2122 Erosion Extents

5/12/2022

Size
A3

Scale
1:7,500

0 50 100 150 200Meters

PRINCESS ROYAL HARBOUR CHRMAP

EROSION - CONTROLLED (MAP SECTOR 3)

CW1200123-GS-005-EROSION

PRINCESS ROYAL HARBOUR CHRMAP

EROSION - CONTROLLED (MAP SECTOR 4)

Legend

PRH 2022 Erosion Extents
PRH 2072 Erosion Extents
PRH 2047 Erosion Extents
PRH 2122 Erosion Extents

5/12/2022

Size
A3

Scale
1:7,500

0 50 100 150 200Meters

CW1200123-GS-005-EROSION

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Torndirrup Access Path

Torndirrup
Residential Properties

Frenchman Bay Road

Torndirrup
Natural Foreshore Areas

Bay View Drive

Little Grove
Natural Foreshore Areas

South Coast
Progress Association

Little Grove
Residential Areas

Torndirrup Tennis Courts

Rusty Lane

Bay View Drive

Marine Terrace

Stubbs Road

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Legend

- PRH 2022 Erosion Extents
- PRH 2047 Erosion Extents
- PRH 2072 Erosion Extents
- PRH 2122 Erosion Extents

5/12/2022

Size
A3

Scale
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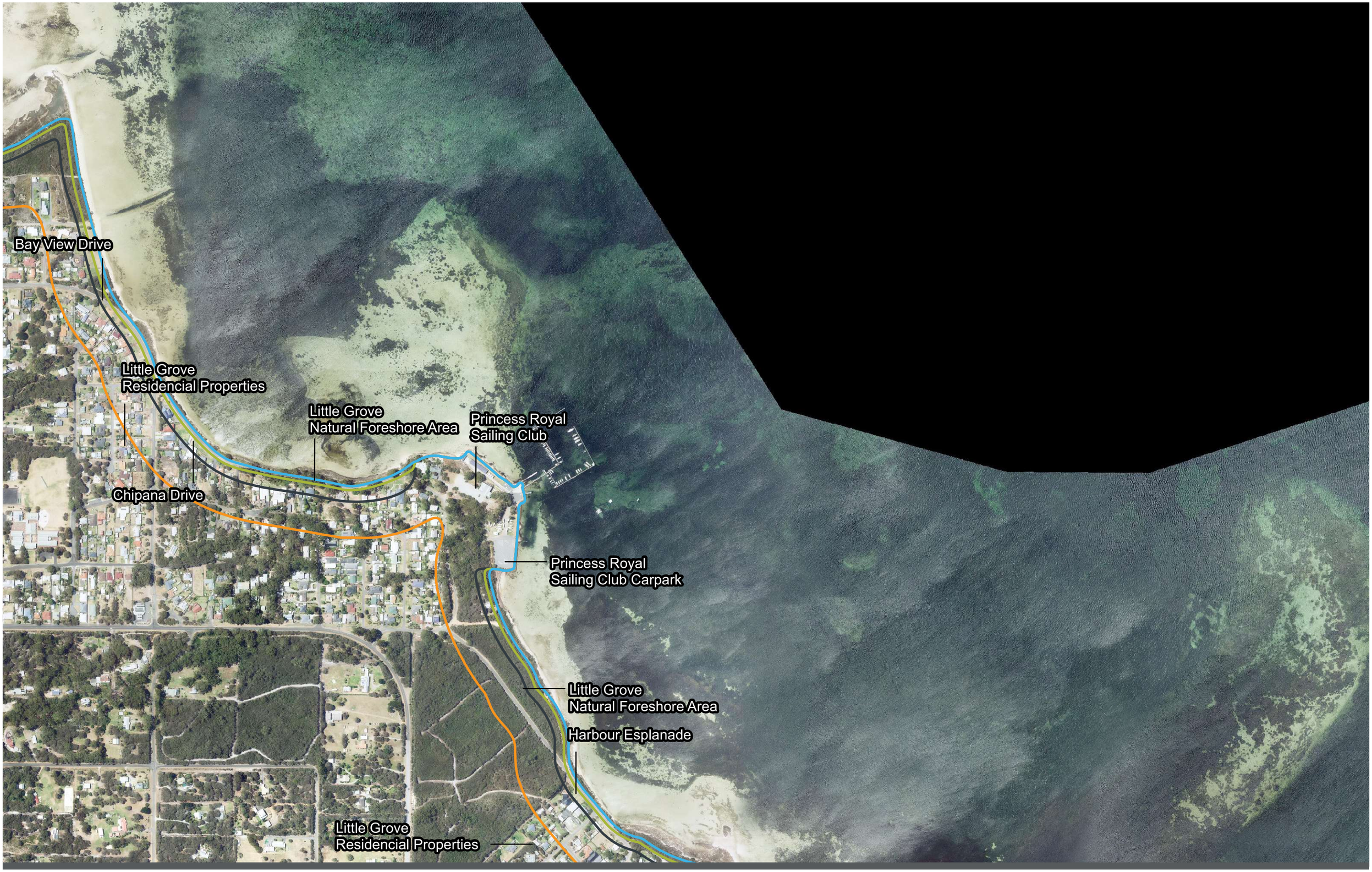
0 50 100 150 200Meters

PRINCESS ROYAL HARBOUR CHRMAP

EROSION - CONTROLLED (MAP SECTOR 5)

CW1200123-GS-005-EROSION



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Legend

- PRH 2022 Erosion Extents
- PRH 2047 Erosion Extents
- PRH 2072 Erosion Extents
- PRH 2122 Erosion Extents

5/12/2022

Size
A3

Scale
1:7,500

0 50 100 150 200Meters

PRINCESS ROYAL HARBOUR CHRMAP

EROSION - CONTROLLED (MAP SECTOR 6)

CW1200123-GS-005-EROSION

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Legend

- PRH 2022 Erosion Extents
- PRH 2072 Erosion Extents
- PRH 2047 Erosion Extents
- PRH 2122 Erosion Extents

5/12/2022

Size
A3

Scale
1:7,500

0 50 100 150 200Meters

PRINCESS ROYAL HARBOUR CHRMAP

EROSION - CONTROLLED (MAP SECTOR 7)

CW1200123-GS-005-EROSION

Jessica's Beach

Vancouver Peninsula
Natural Foreshore Areas

Limekilns Point

Big Grove
Natural Foreshore Areas

Quaranup Road

Big Grove
Residential Properties

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Legend

- PRH 2022 Erosion Extents
- PRH 2072 Erosion Extents
- PRH 2047 Erosion Extents
- PRH 2122 Erosion Extents

5/12/2022

Size
A3

Scale
1:7,500

0 50 100 150 200Meters

PRINCESS ROYAL HARBOUR CHRMAP

EROSION - CONTROLLED (MAP SECTOR 8)

CW1200123-GS-005-EROSION

Quaranup Gate

Quaranup Heritage Complex

Vancouver Peninsula
Natural Foreshore Areas

Vancouver Beach

Quaranup Road

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Legend

- PRH 2022 Erosion Extents
- PRH 2047 Erosion Extents
- PRH 2072 Erosion Extents
- PRH 2122 Erosion Extents

5/12/2022

Size
A3

Scale
1:7,500

0 50 100 150 200Meters

PRINCESS ROYAL HARBOUR CHRMAP

EROSION - CONTROLLED (MAP SECTOR 9)

CW1200123-GS-005-EROSION

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Legend

- PRH 2022 Erosion Extents
- PRH 2047 Erosion Extents
- PRH 2072 Erosion Extents
- PRH 2122 Erosion Extents

5/12/2022

Size
A3

Scale
1:7,500

0 50 100 150 200Meters

PRINCESS ROYAL HARBOUR CHRMAP

EROSION - CONTROLLED (MAP SECTOR 10)

CW1200123-GS-005-EROSION

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Legend

- 2122 Wave Runup Level
- 2022 Inundation Extent
- 2047 Inundation Extent
- 2072 Inundation Extent
- 2122 Inundation Extent

2/12/2022

Size
A3

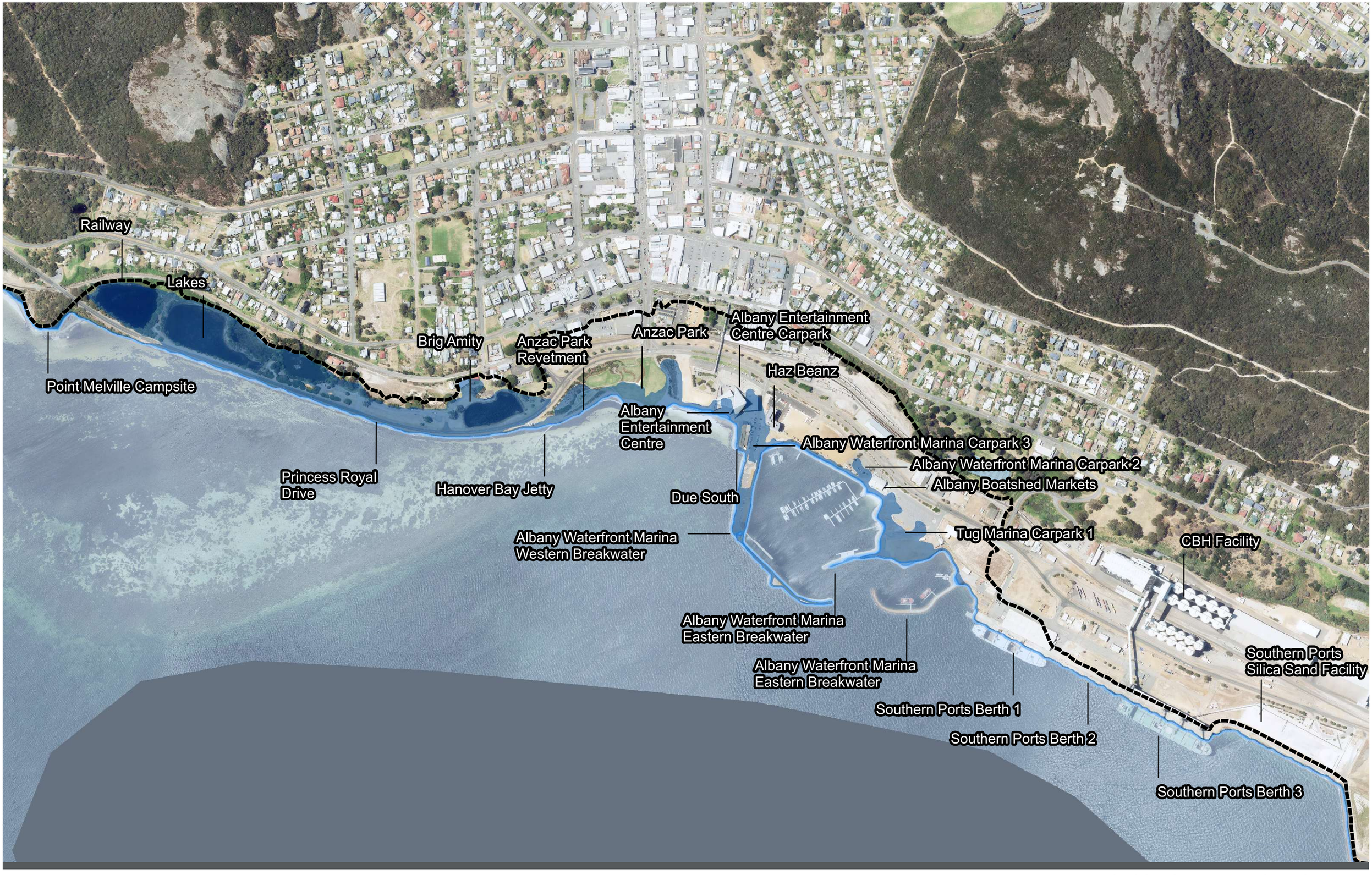
Scale
1:7,500

0 50 100 150 200Meters

PRINCESS ROYAL HARBOUR CHRMAP

INUNDATION (MAP SECTOR 1)

CW1200123-GS-004-INUNDATION



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Legend

- 2122 Wave Runup Level
- 2022 Inundation Extent
- 2047 Inundation Extent
- 2072 Inundation Extent
- 2122 Inundation Extent

2/12/2022

Size
A3

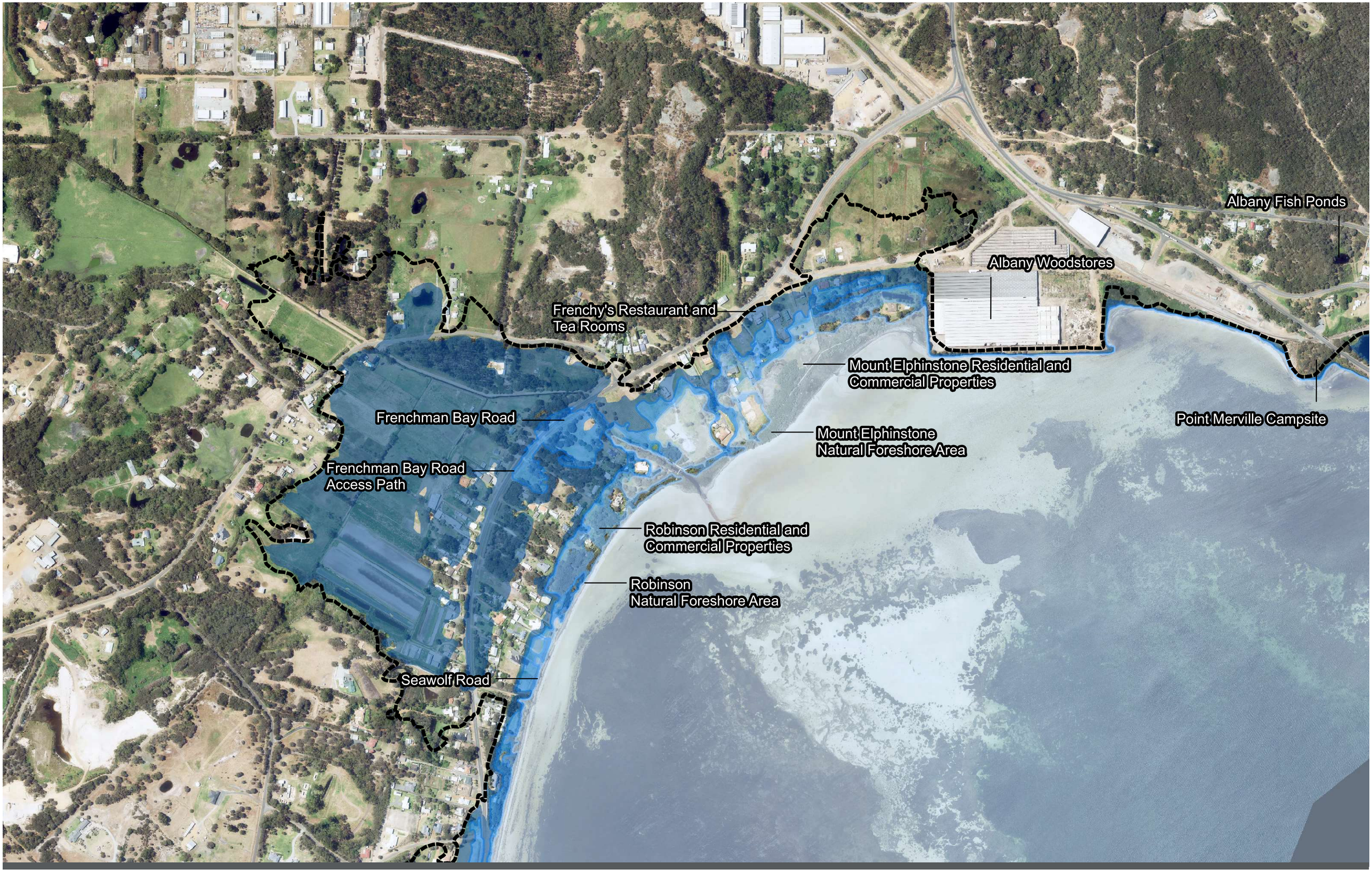
Scale
1:7,500

0 50 100 150 200Meters

PRINCESS ROYAL HARBOUR CHRMAP

INUNDATION (MAP SECTOR 2)

CW1200123-GS-004-INUNDATION



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Legend

- 2122 Wave Runup Level
- 2022 Inundation Extent
- 2047 Inundation Extent
- 2072 Inundation Extent
- 2122 Inundation Extent

1/12/2022

Size
A3

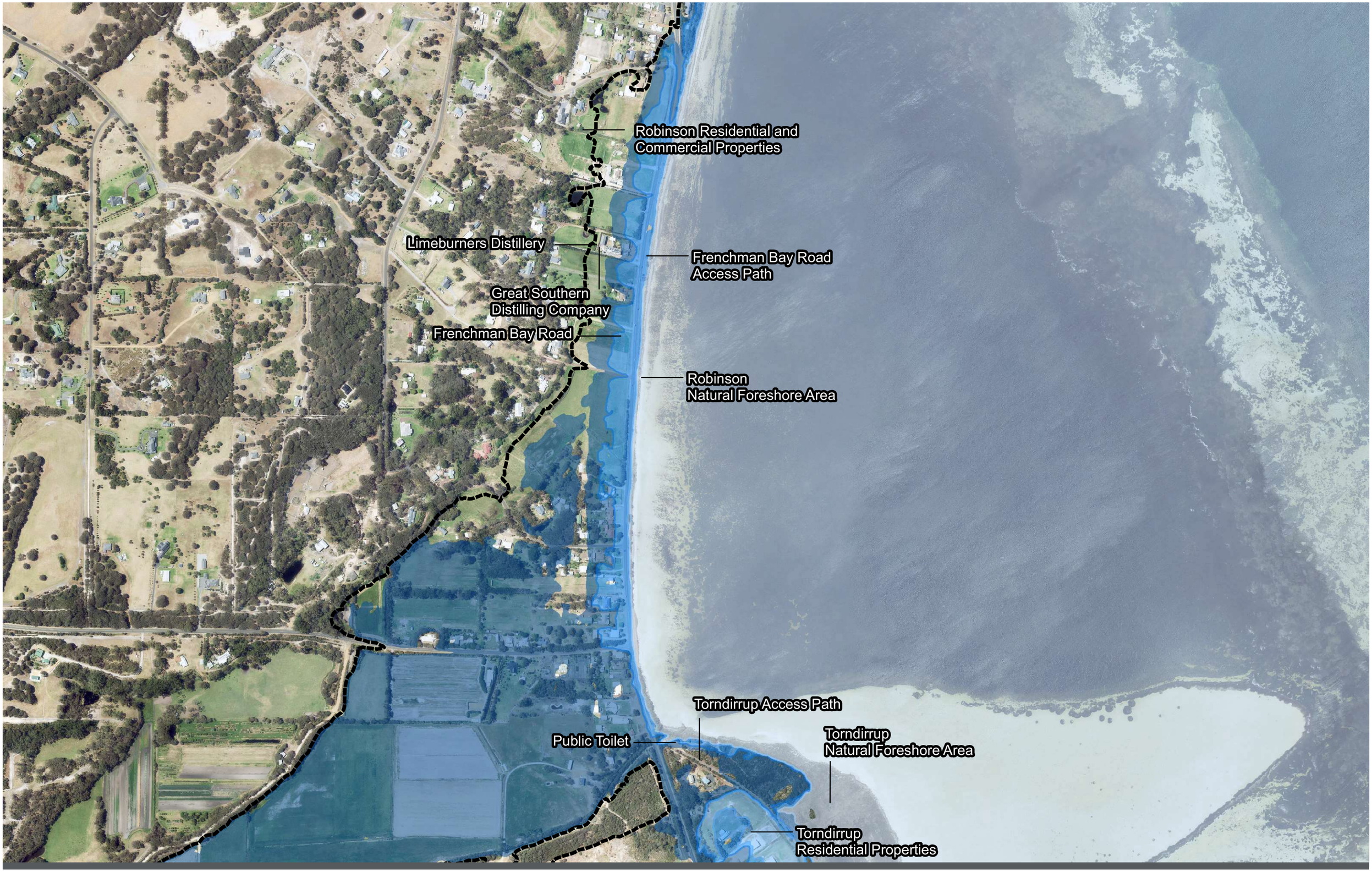
Scale
1:7,500

0 50 100 150 200Meters

PRINCESS ROYAL HARBOUR CHRMAP

INUNDATION (MAP SECTOR 3)

CW1200123-GS-004-INUNDATION



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Legend

- 2122 Wave Runup Level
- 2022 Inundation Extent
- 2047 Inundation Extent
- 2072 Inundation Extent
- 2122 Inundation Extent

1/12/2022

Size
A3

Scale
1:7,500

0 50 100 150 200Meters

PRINCESS ROYAL HARBOUR CHRMAP

INUNDATION (MAP SECTOR 4)

CW1200123-GS-004-INUNDATION

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Legend

- 2122 Wave Runup Level
- 2022 Inundation Extent
- 2047 Inundation Extent
- 2072 Inundation Extent
- 2122 Inundation Extent

1/12/2022

Size
A3

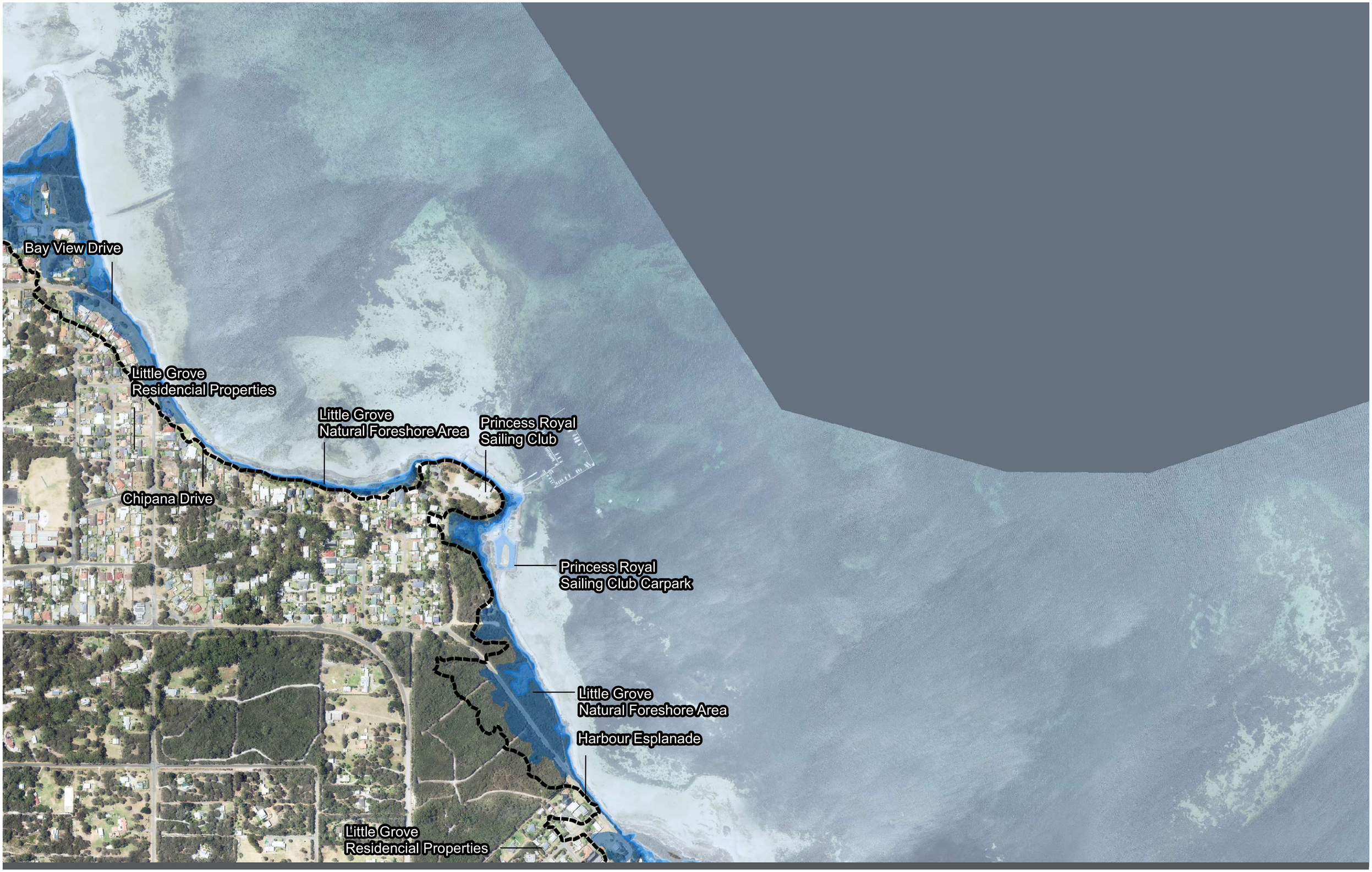
Scale
1:7,500

0 50 100 150 200Meters

Pprincess royal harbour CHRMAP

INUNDATION (MAP SECTOR 5)

CW1200123-GS-004-INUNDATION



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Legend

- 2122 Wave Runup Level
- 2022 Inundation Extent
- 2047 Inundation Extent
- 2072 Inundation Extent
- 2122 Inundation Extent

1/12/2022

Size
A3

Scale
1:7,500

0 50 100 150 200Meters

PRINCESS ROYAL HARBOUR CHRMAP

INUNDATION (MAP SECTOR 6)

CW1200123-GS-004-INUNDATION

Panorama Caravan Park

Big Grove
Natural Foreshore Areas

Big Grove
Residencial Areas

Frechman Bay Road

Legend

- 2122 Wave Runup Level
- 2022 Inundation Extent
- 2047 Inundation Extent
- 2072 Inundation Extent
- 2122 Inundation Extent

PRINCESS ROYAL HARBOUR CHRMAP

INUNDATION (MAP SECTOR 7)

1/12/2022

Size
A3

Scale
1:7,500

0 50 100 150 200Meters

CW1200123-GS-004-INUNDATION

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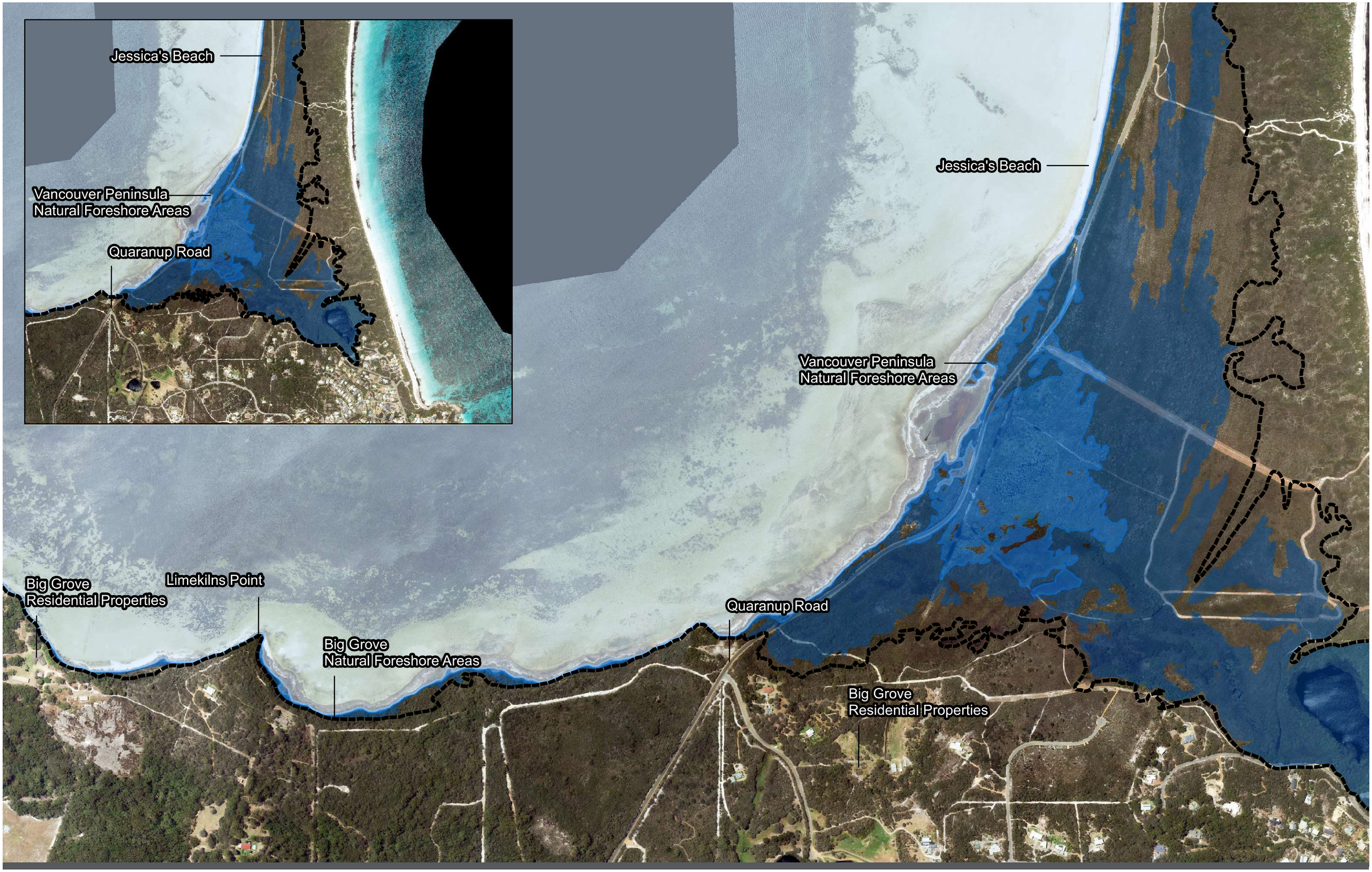

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Legend

- 2122 Wave Runup Level
- 2022 Inundation Extent
- 2047 Inundation Extent
- 2072 Inundation Extent
- 2122 Inundation Extent

1/12/2022

Size
A3

Scale
1:7,500

0 50 100 150 200Meters

PRINCESS ROYAL HARBOUR CHRMAP

INUNDATION (MAP SECTOR 8)

CW1200123-GS-004-INUNDATION

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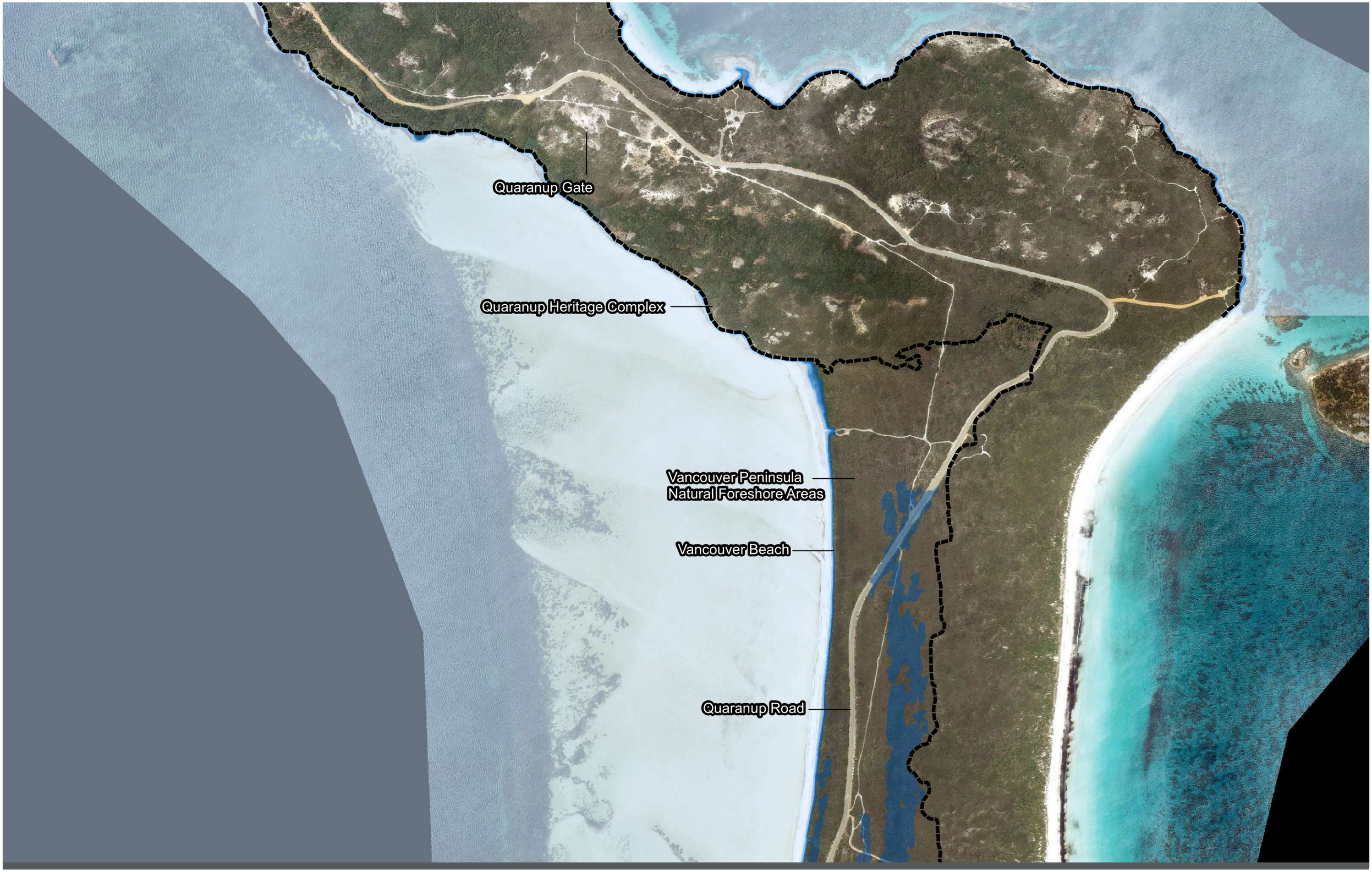

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Legend

- 2122 Wave Runup Level
- 2022 Inundation Extent
- 2047 Inundation Extent
- 2072 Inundation Extent
- 2122 Inundation Extent

1/12/2022

Size
A3

Scale
1:7,500

0 50 100 150 200Meters

PRINCESS ROYAL HARBOUR CHRMAP

INUNDATION (MAP SECTOR 9)

CW1200123-GS-004-INUNDATION

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Legend

- 2122 Wave Runup Level
- 2022 Inundation Extent
- 2047 Inundation Extent
- 2072 Inundation Extent
- 2122 Inundation Extent

1/12/2022

Size
A3

Scale
1:7,500

0 50 100 150 200Meters

PRINCESS ROYAL HARBOUR CHRMAP

INUNDATION (MAP SECTOR 10)

CW1200123-GS-004-INUNDATION

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