Town of Cottesloe CHRMAP

Chapter Report: Implementation

Town of Cottesloe

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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 Whadjuk Noongar people.

Artwork by Maurice Goolagong 2023. This piece was commissioned by Water Technology and visualises the important connections we have to water, and the cultural significance of journeys taken by traditional custodians of our land to meeting places, where communities connect with each other around waterways.

The symbolism in the artwork includes:

- *Seven circles representing each of the States and Territories in Australia where we do our work*
- *Blue dots between each circle representing the waterways that connect us*
- *The animals that rely on healthy waterways for their home*
- *Black and white dots representing all the different communities that we visit in our work*
- *Hands that are for the people we help on our journey*

EXECUTIVE SUMMARY

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 statutory 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 management authorities develop a Coastal Hazard Risk Management and Adaptation Plan (CHRMAP) for land use or development that is potentially vulnerable to coastal hazards. Specific guidelines have been developed to assist in this process (WAPC, 2019).

SPP2.6 requires adequate risk management planning is undertaken where 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 that are intolerable to the community, and other stakeholders such as local governments, Indigenous and cultural interests, and private enterprise. Risk Management measures are then developed according to the risk management and adaptation hierarchy outlined in SPP2.6.

The Town of Cottesloe (Town) has been identified as potentially exposed to significant erosion and minor inundation hazard. The adjacent foreshore reserves support a variety of recreational and commercial land uses, including substantial built infrastructure situated in close proximity to the shoreline. Such infrastructure includes the Cottesloe and North Cottesloe Surf Life Saving Clubs (SLSC), Indiana Teahouse, restaurants and cafes, playgrounds, footpaths, and several carparks, which may be subject to the impacts of coastal hazards at present or into the future. 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 the Town of Cottesloe.

The objective of this CHRMAP project is to increase knowledge and understanding of coastal hazard risks, and to 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 the objectives identified by these guidelines and SPP2.6. The project will identify the strategic direction for coastal adaptation scenarios from the present-day to 2123 (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 Implementation Chapter Report, which details short-, medium- and long-term implementation plans, Land use planning measures, funding recommendations, and a Benefit Distribution Analysis (BDA). Based on the previous stage results, beach nourishment has been recommended to proceed for further investigation and/or implementation for both Management Units (MUs) for erosion for all timeframes. The recommendations have considered holistically as well as being cognisant of the findings of previous stages of the CHRMAP.

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

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The study area for this CHRMAP is the entire shoreline within the Town's jurisdiction (see Figure 1-1). The study has been undertaken across two Management Units (MUs) being Management Unit 1 (North of Cottesloe Groyne, including the groyne) and Management Unit 2 (South of Cottesloe Groyne). The study area is shown in Figure 1-1, Figure 1-2, and Figure 1-3. The study area consists of various shoreline types and many coastal assets, involving multiple stakeholders:

- Physical controls – rubble mound rock groynes at Beach Street and Cottesloe Beach; seawalls at Cottesloe Beach.
- Sandy pocket and "perched" beaches backed and underlain by rock shelves and adjacent narrow foreshore reserve.
- Presence of various rock features including shore-attached reef and rock outcrops and cliffs.
- Roads along the shoreline – Curtin Avenue and Marine Parade.
- Two Surf Life Saving Clubs.
- Registered Aboriginal Heritage Site at Mudurup Rocks, south of the Cottesloe Surf Life Saving Club.
- Significant built infrastructure – buildings, car parks, shore-parallel dual use path, utilities, playgrounds.
- Large number of foreshore amenities such as showers, fencing, information signage, access paths and stairways.
- Highly valued recreational assets – beach and ocean areas used heavily by locals and visitors for many different pursuits.
- Commercial and residential property owners/ operators.

The objective of this CHRMAP stage is to increase knowledge and understanding of coastal hazard risks, and to 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 and adaptation 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 2123 (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 (100 years).

Delivery of this project will occur over 8 stages (as summarised in Figure 1-4), each of which represents a key hold point. The staged approached is developed according to the Town of Cottesloe scope and is in line with the CHRMAP Guidelines (WAPC, 2019). This report presents the Implementation and Monitor and Review Stages. The red bubble displayed in Figure 1-4 indicates where this component sits with reference to the greater study.

The previous project stage was the Cost Benefit Analysis which detailed beach nourishment as the preferred coastal hazard mitigation option for both MU1 and MU2.

Figure 1-1 Study Area

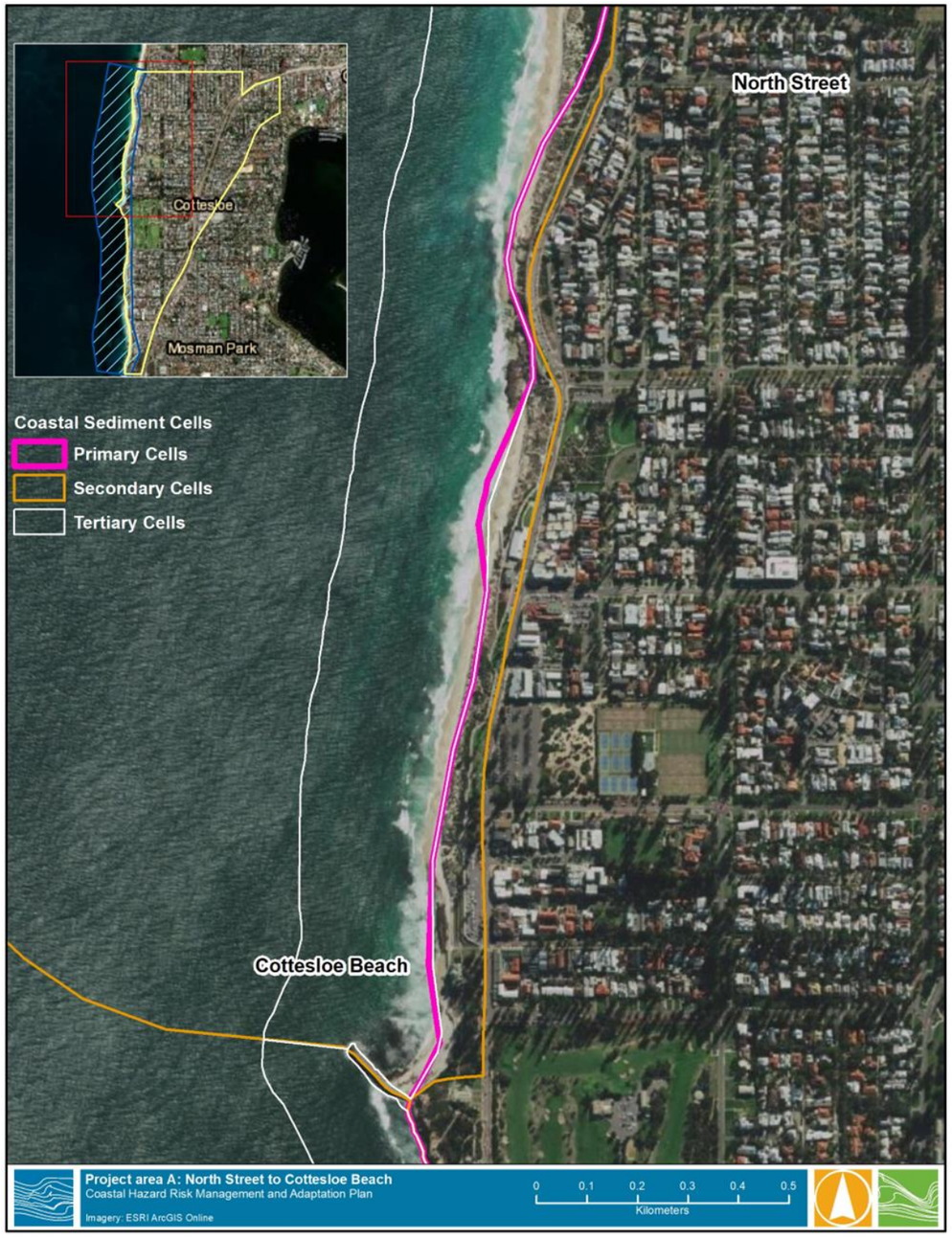

Figure 1-2 MU 1 North of Cottesloe Groyne, including Groyne, to the North End of Town's Jurisdiction

Figure 1-3 MU 2 South of Cottesloe Groyne to the South End of Town's Jurisdiction

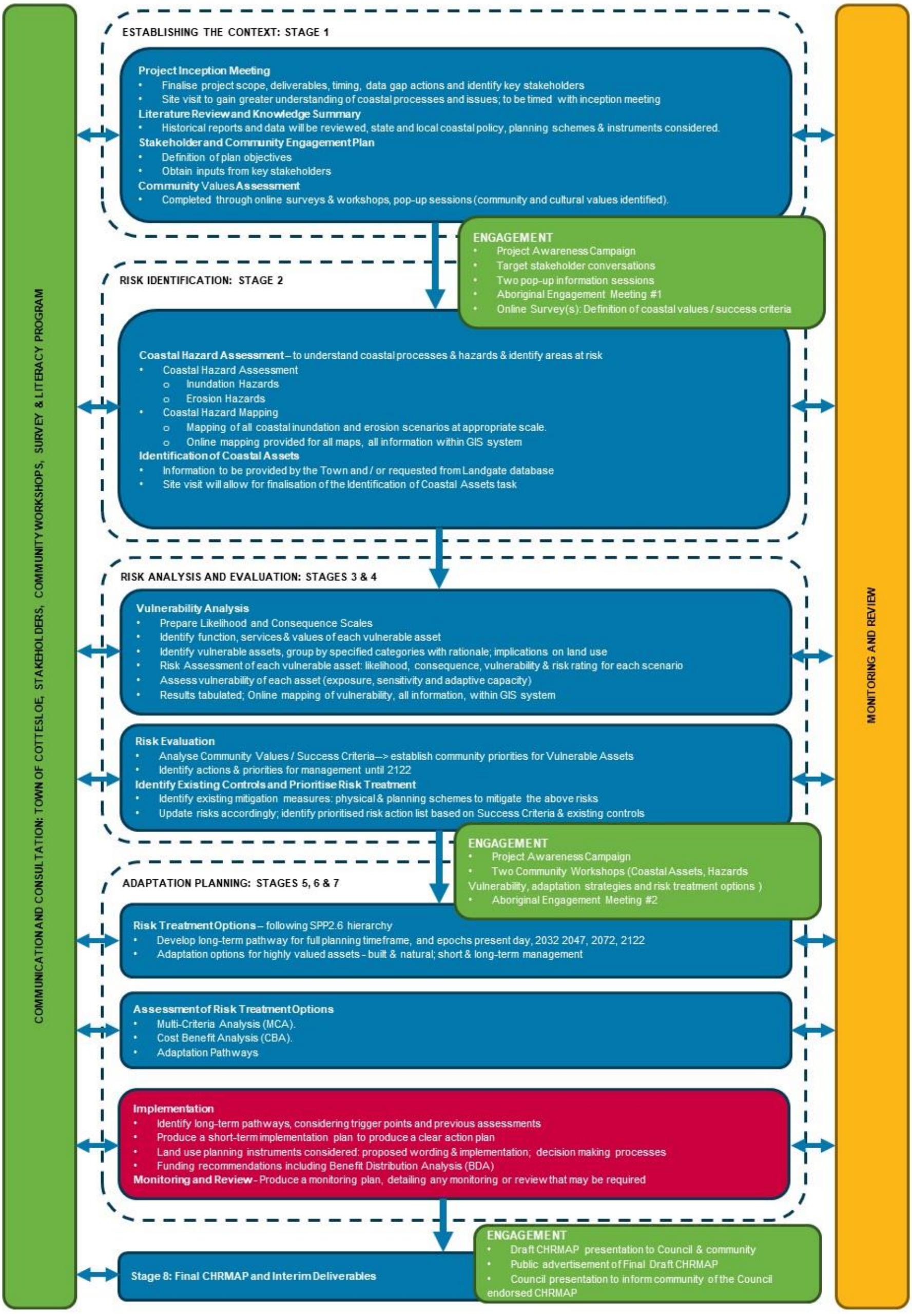

Figure 1-4 Methodology

2 LAND USE PLANNING INSTRUMENTS

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 surge 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.

2.1 Existing Controls

2.1.1 Planning Controls

A summary of relevant planning controls for the study area is provided in *Establish the Context Chapter Report (Water Technology, 2023).* This study area is guided by the State Government planning framework and the Town's local planning framework which comprises of a planning scheme, strategies, policies and guidelines. While the existing local planning framework makes reference to coastal hazards, there are limited planning controls that can be used to adapt to the coastal hazards identified. As such, the existing planning controls do not change the assigned vulnerability ratings for the CHRMAP study area.

This CHRMAP will consider what planning controls may be appropriate as adaptation measures within the study area.

2.1.2 Physical Controls

The existing physical controls in the study area are reported in *Establish the Context Chapter Report (Water Technology, 2023)* and *Risk Identification Chapter Report (Cardno, 2023)* and include coastal protection structures such as groynes/breakwaters and seawalls. Where appropriate, these have already been considered in the hazard and vulnerability assessment. As such, the vulnerability results remain the same as previously reported. No changes to the vulnerability results are required.

2.2 Planning Control Options

This section outlines the key planning-based mechanisms which can be implemented by the Town in response to the coastal hazards identified in the CHRMAP. As the coastal inundation hazard has been identified as insignificant for this study area, the planning mechanisms have been prepared to respond to the impacts of coastal erosion only.

2.2.1 Special Control Areas

The introduction of a Special Control Area (SCA) into the Town's local planning scheme is considered the most appropriate statutory planning mechanism to holistically address coastal erosion. An amendment to the local planning scheme will be required to introduce the SCA over all zoned land located seaward of the 2123 coastal processes setback line.

An SCA is typically put in place to establish special provisions to target a single issue or related set of issues often overlapping zone and reserve boundaries. The provisions of an SCA would establish the purposes and objectives, specific development requirements and referral requirements to agencies relevant to the SCA.

The CHRMAP Guidelines (WAPC 2019) provides draft amendment text including the purpose, objectives and provisions to be contained within an SCA. The purpose of the SCA is to provide guidance as to the appropriate scope of land use and development to be permitted within a coastal hazard risk area. This would be achieved through the following overarching objectives:

- To ensure land in the coastal zone is continuously provided for coastal foreshore management, public access, recreation, and conservation.
- To ensure public safety and reduce risk associated with coastal erosion and inundation.
- To avoid inappropriate land use and development of land at risk from coastal erosion and inundation.
- To ensure land use and development does not accelerate coastal erosion or inundation risks; or have a detrimental impact on the functions of public reserves.
- To ensure that development addresses the Town of Cottesloe CHRMAP prepared in accordance with SPP 2.6.

The SCA would also include additional provisions to ensure development and use of land subject to erosion over the 100-year planning timeframe. The additional provisions to be included within the SCA will include requirements relating to:

- The need to obtain development approval for all development, including development that is considered exempt under the Deemed Provisions and the local planning scheme.
- Temporary or time limited approvals with the option to seek extensions where the risk from coastal processes is still considered acceptable.
- The referral of development applications to relevant agencies for comment and advice, including the Department of Transport, the Department of Planning, Lands and Heritage and any other relevant authority.
- Construction and servicing design requirements.
- The Town will be responsible for assessing development against the objectives and provisions of the SCA which will only apply to land zoned under the Local Planning Scheme. Development within the Parks and Recreation reserve will continue to be determined by the WAPC, taking into consideration the objectives and provisions under the Metropolitan Region Scheme (MRS).

2.2.2 Coastal Local Planning Policy

A local planning policy (LPP) can be prepared by a local government in accordance with Schedule 2 of the Planning and Development (Local Planning Schemes) Regulations 2015. The purpose of a LPP is to guide the development and use of land in relation to a particular matter. LPPs allow a level of discretion and flexibility to be applied in the decision-making process given they are a due regard planning instrument.

The Town can prepare a Coastal LPP to ensure future development aligns with the overarching objectives of the SCA. The Coastal LPP will include provisions relating to strategic planning proposals, subdivision and development applications on land identified as being prone to coastal erosion.

2.2.3 Notification on Title

Freehold land identified as being at risk of coastal erosion should have a notification registered on its certificate of title to ensure current and future landowners are aware of the potential for the land to be impacted by coastal processes. The notification shall state the following noting that shorter timeframe than 100 years may be appropriate where identified in the CHRMAP:

'This lot is located in an area likely to be subject to erosion over the next 100 years from the date this notification is registered.' (WAPC, 2013)

Notifications can be registered on the certificate of title as part of the decision-making process for subdivision and development applications under the following legislation:

- The WAPC requires a notification pursuant to Section 165 of the Planning and Development Act 2005 to be registered on the lots associated with a subdivision approval; and
- The Town requires a notification pursuant to Section 70A of the Transfer of Land Act 1893 to be registered on the lot associated with a development approval.

Landowners can also voluntarily seek to register a notification on the certificate of title pursuant to Section 70A of the Transfer of Land Act 1893.

2.2.4 Other Instruments

Additional instruments that can be considered for implementation include:

- Updates to the Local Planning Strategy to reference SPP2.6 and avoid the identification of at-risk land for further intensification of development through rezoning or subdivision.
- Preparation of a foreshore management plan to provide a strategy to deliver the recommendations of the CHRMAP for foreshore reserves throughout the Town.
- The use of restrictive covenants to restrict development in high-risk areas or limit the use of certain protective barriers which may contradict the recommendations of the CHRMAP.
- Introduction of special area rates to equitably distribute costs associated with protection options across beneficiaries.
- The application of SPP2.6 in the structure planning process where the comprehensive redevelopment of land remains an option.
- Internal processes and systems to ensure coastal hazard information and data is readily available and accessible to landowners, prospective buyers and the real estate industry.

The intent of these instruments aligns with guidance provided in the WA Coastal Zone Strategy, noting that private parties are responsible for managing risks to their private assets and incomes, which might arise from coastal erosion and inundation hazards.

More details of Land Use Planning Instruments are available in Appendix A.

3 FUNDING OPTIONS

Stage 6, *Assessment of Risk Treatment Options Chapter Report (Water Technology, 2024),* provides details of the Cost Benefit Analysis (CBA), and presents a summary of financial and economic implications to inform the Town 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:

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

3.1 Operating Budget, General Rates and Coastal Management Fund

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

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

3.2 Specified Area Rate

Where adaptation options are designed to protect specific sections of coastal land and assets, such as private property, it is recommended that the LGA progress the establishment of a specified area rate in line with the outcomes of benefit distribution analysis, please refer next Chapter, Chapter 4- 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.

3.3 Levies

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

3.4 Lease Land Management

Coastal land vested with coastal managers in the study area and leased to third parties represents a unique scenario whereby implementation of some options may require specific lease clauses, but there is also potential to raise funds for coastal management. During considerations of lease renewal, coastal managers should consider the land use, vulnerability of the land, projected timeframe of unacceptable vulnerability, length

of lease, recommended implementation options and need for any specific clause around triggers or required management actions by the lessee. Increases in lease amounts may be able to raise funds to help offset the cost of management.

3.5 State Grants – CoastWA

CoastWA aims to implement a strategic response to the growing impacts of coastal hazards to ensure sustainable land use and development on the coast for the long-term CoastWA has committed $33.5 million of funding over five years from 2021-2026. For further information visit:

https://www.wa.gov.au/government/document-collections/coastwa-grants

It comprises the following grant programs:

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

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

- 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.

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.

Coastal Management Plan Assistance Program (CMPAP) grants support eligible coastal land managers to develop 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.

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:

Royalties for Regions (www.wa.gov.au)

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 often require matching cash or in-kind 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.

3.6 Federal Grants

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

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

3.6.1 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 to 2028, with funding to be matched by the applicants. DRF Round Two opening date was Monday, 22 January 2024. For more information visit:

Disaster Ready Fund - Round Two | National Emergency Management Agency (nema.gov.au)

3.6.2 Coastal and Estuarine Risk Mitigation Program

The mitigation program, which is funded by the Emergency Response Fund, supports priority projects that reduce the impact of disasters on coastal communities and economies. Areas of focus for the program include:

- Adaptation and resilience actions, including investment in grey infrastructure and green-blue infrastructure (which includes nature-based solutions);
- Planning, including local and regional risk assessments and mapping, business case development, preparation of community focused regional coastal management programs; and
- Investment in monitoring infrastructure and activities to understand the coastal and estuarine zone over time.

For more information visit:

https://nema.gov.au/programs/emergency-response-fund/coastal-estuarine-risk-mitigation-program#Overview

3.7 Beneficiary (user) Pays

Beneficiary or ‘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 (see chapter 4).
- 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 next chapter provides recommendations on options for methods and proportions by which the Town could fund coastal works from direct beneficiaries.

4 BENEFIT DISTRIBUTION ANALYSIS

4.1 Analysis Approach

A Benefit Distribution Analysis (BDA) was undertaken to assess the potential benefits and beneficiaries of implementing coastal protection. An assessment of the resultant relative distribution of benefits between stakeholders has been determined. The BDA provides an insight into how costs could be apportioned through the beneficiary pays principle in accordance with SPP2.6. This will provide an avenue to ensure that funding arrangements reflect the benefits derived from such actions, minimise subsidies, and avoid additional burden on local ratepayers.

A geographic analysis is undertaken to assess private versus public land area protected for the different management units at different years. This approach has the following features:

- Considers the land parcels projected to be impacted by erosion in 2123 holistically.
- Does not consider the sequencing of the projected erosion of individual assets such as the presence of Town land/assets between the ocean and private property. The proximity of private property to erosion has historically driven urgent decision making in many WA coastal locations.
- Is not reliant on competing economic valuation methods which are often lacking for social, and environmental assets.
- Does not include other considerations of economic valuation – notional market property values, improved values, other infrastructure value, use and non-use values, avoided travel related costs (e.g., traffic detours because of road closures), avoided clean-up costs from storm damage, avoided amenity impacts on foreshore reserve. This results in a much more transparent method. This is especially important when much of the economic values are estimates based on many layers of assumptions, thus potentially leading to inaccurate or meaningless results; and disputes between beneficiaries.
- Assumes that for any land parcel the 2123 erosion hazard line is touching then the whole land parcel is assumed impacted and included in the calculations. Storm erosion typically undermines the structural footing of an asset rendering it unsafe and unsuitable for further habitation or use. For this reason, the full value of an asset is assumed to be lost when the erosion hazard line reaches the footprint of an asset or property – because for functional purposes it will be.

Given the size of the study area and the accuracy of the erosion modelling used, we consider this method is suitable for the purposes of BDA.

4.2 BDA Method

The following steps summarise the BDA methodology undertaken for the Geographic Analysis:

1. Use erosion hazard assessment mapping outputs from Cardno (2023) – (Horizontal Setback Datum, and nominal erosion projections for 2023, 2048, 2073 and 2123) to identify impacted land parcels within each erosion hazard area between the Horizontal Setback Datum and each nominal erosion hazard line.
2. Create a database of the affected areas for each of the seven categories used for CBA.
3. Group the seven categories into the following overarching categories:
    a. Private land (Residential property and Commercial property)
    b. Public land (Developed Foreshore Reserve, Roads, Public and Community, Environmental, Heritage)
4. Define the proportionate beneficiaries as the relative areas of private and public land protected as a percentage comparison for each erosion hazard timeframe, for each Management Unit.

4.3 BDA Results

The areas of land for each category protected by implementation of a coastal erosion protection option are presented in Table 4-1.

Table 4-1 Affected Categories Areas (m^2) Showing Affected Area for 2123 Erosion Hazard Zone for Each MU

Category	MU 1	MU 2
Commercial property	12,685	0
Residential property	44,220	39,217
Developed Foreshore Reserve	82,523	63,660
Roads	46,463	52,239
Public and Community	10,792	23,089
Environmental	0	13,826
Heritage	33,513	32,569

The BDA area and percentage results are presented in Table 4-2.

Table 4-2 BDA Results for 2123 Erosion Hazard Zone

Management Unit	Private Area (m^2)	Public Area (m^2)	Private %	Public %
MU 1	56,905	173,292	25 %	75 %
MU 2	39,217	185,384	17 %	83 %

4.4 BDA Discussion

The method relies on interpretation of the land use maps received from the Town, which may no longer be current and require updating before any more detailed investigations can be undertaken.

4.4.1 Limitations

The geographic BDA method provides a snapshot of the relative areas of private and public land projected to be impacted by erosion between the 2023 HSD and 2123 erosion hazard lines. As the HSD moves because of erosion and accretion, the areas will change over time. Similarly, if the erosion hazard line is recalculated, the areas will change. Changes in individual management units may vary, but because of the large amount of public land present as foreshore reserve, with projected future erosion, and migration of the HSD inland, the area of public land on the landward side of the HSD is considered likely to decrease over time. This would result in a decrease of the public percentage and corresponding increase in the private percentage. Land at the back of the management units may become “newly vulnerable” to erosion, but generally that land is a mixture of private and public compared to the existing foreshore.

4.4.2 Utilisation of BDA Findings

Based on the findings presented above it is reasonable for the Town to consider future scenarios where the private landholders benefiting from a protection option pay in the order of 25% and 17% of the cost for MU 1 and MU 2 respectively. This analysis has detailed several assumptions and limitations which should be considered in further detail, and issues of intergenerational and geographical equity also need to be considered in subsequent analysis. If beneficiaries are to financially contribute, the mechanism must be fair and reasonable across current and future landholders and consideration of intangible community benefits needs further discussion. Protection of a section of coast may allow for additional community benefits that could not

be adequately quantified in this analysis, such as opportunities for improved social/tourism amenities for the broader Cottesloe community to enjoy (represented by the Town) and potentially many other Western Australians and visitors (represented by state government departments). Additional beneficiary pays considerations, not included in the above BDA analysis, should be considered such as for visitors to the town, as users of the coastline, to contribute in the form of a levy applied to their accommodation, or paid parking at key tourist sites. This could, in part, be realised by implementation of the CHRMAP recommendations, extension of the developed foreshore areas and the provision of increased amenity. Further investigations and decision-making around the concept of “beneficiary pays” needs to acknowledge these requirements.

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. Six monthly beach profile surveys at forty locations along the entire extent of the Town's shoreline, extending from the top of primary dune or fixed infrastructure to the approximate depth of closure offshore.
2. Remote shoreline imagery collected every hour (during daylight hours) from, three vantage points.
3. Sporadic storm monitoring of Cottesloe main beach, including:
    a. Additional beach profile surveys collected before and after storm events
    b. Beach sediment samples collected for analysis of particle size distribution before and after storm events
    c. Installation of an additional remote imagery camera for one of the winter storm monitoring periods
4. Shoreline vegetation movement analysis from aerial photos undertaken by DoT
5. Regional water level monitoring undertaken by DoT
6. Wave monitoring at Cottesloe and Rottnest Waverider Buoys undertaken by DoT
7. Bathymetric surveys commissioned 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.

Regular monitoring of the coastal management structures is recommended (Protection Structure Audit – NR2) – e.g., seawalls and groynes. These 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 then be incorporated into the Town's existing asset management reporting systems.

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 Storm Erosion Allowance 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 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 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, or
  - 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.

5.5 Surf Life Saving Clubs

Throughout the engagement activities undertaken during this CHRMAP project the important nature and role of the Cottesloe and North Cottesloe Surf Life Saving Clubs to the local and broader community has been clearly and repeatedly raised by community members.

SPP2.6 (WAPC, 2013) recognises that Surf Life Saving Clubs and their facilities may need to occur within an area identified to be potentially impacted by physical coastal processes within the 100 year planning timeframe. SPP2.6 requires they be considered within a CHRMAP framework, identified in a strategic plan and co-located with other public recreation and coastal node facilities. Any proposed development will be assessed on a case-by-case basis against the SPP2.6 Policy Measures and in consultation with other relevant agencies and community.

5.5.1 North Cottesloe Surf Life Saving Club

The North Cottesloe Surf Life Saving Club is co-located with other public buildings some of which are leased for private commercial business such as cafes/restaurant. These buildings are projected to become directly vulnerable to coastal erosion around 2033. As such it is recommended that these facilities are investigated in more detail as a priority site for the Town. Should protection via beach nourishment be implemented by the Town for MU1 then these buildings will also be protected. Alternatively further investigations could consider an alternative location for these facilities or targeted protection measures.

5.5.2 Cottesloe Surf Life Saving Club

The Cottesloe Surf Life Saving Club is projected to become directly vulnerable to coastal erosion around 2073, but only if no active management occurs to the section of coast immediately north of the Cottesloe groyne. As such it is recommended that these facilities are investigated in more detail after key decision making occurs for MU1. If protection is implemented, then the Club facilities will also be protected. It is recommended that the section of coast immediately north of the Cottesloe groyne are investigated in more detail as a priority site for the Town, following confirmation of the condition and remaining design life of the relevant coastal protection structures.

6 IMPLEMENTATION

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

Detailed implementation plans for MU1 and MU2 are presented in Table 6-1 and Table 6-2.

6.1 Short-Term Implementation

Short-term coastal management actions (i.e., "options"), for each Management Unit were designed to be compatible with medium and long-term adaptation actions and include the following information:

- Recommended risk treatment option(s),
- Responsibility,
- Trigger,
- Cost,
- Potential funding source(s), and
- Timeframe.

6.1.1 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 address priority areas and 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 works). 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's could be further split based on the projected hazard extents and predominant foreshore use.

6.1.2 Further Investigations

Information gaps identified in the CHRMAP should be addressed early. Some of these gaps can be closed by the collection of data, as discussed previously in Section 5.1 and 5.2. 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 following investigations are recommended:

1. Preparation of an Asset Management Plan to identify existing infrastructure and recreational facilities in the coastal erosion hazard zone and provide 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.
2. 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.
3. Investigate opportunities for demarcating Special Control Areas, and for introducing development restrictions.
4. Sand source feasibility study – Both MU's have recommended sand nourishment as the preferred option. 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 study 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 used 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.
5. More detailed investigation of coastal hazards and the feasibility of treatment options at priority locations such as the North Cottesloe Surf Life Saving Club and the section of coast immediately north of the Cottesloe groyne. Targeted CBA and BDA analysis should be undertaken for prioritised sections of coast following the collection of suitable data and information.
6. Foreshore Management Plans (FMPs) - Updated foreshore management plans for the study area may increase the protective capacity of the natural dune system. Foreshore management plans should address:
    a. The requirements of SPP2.6 and its supporting documentation.
    b. The findings of this CHRMAP - noting protection via sand nourishment has been recommended. Focus should be given to protection of the coastal foreshore reserves, and the existing land use and development east of Marine Parade.
    c. Potential environmental issues such as biodiversity and environmental impacts and detail a weed management strategy for the coastline.

d. Incorporate findings of Asset Management Plans as appropriate.

e. Include review of existing beach access points, ensuring appropriately fenced and signed paths, and signage for dune repair.

f. 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 and FAQ's. The education strategy should also include appropriate on-ground signage and information for beach access.

g. Monitor impacts of general beach access on nesting habitats and migratory bird species in dune areas.

6.2 Medium and Long-Term Implementation

Medium (25 – 50 years) and long-term (50 – 100 years) implementation provides a strategic consideration of how the Town 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.
- 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.
- Implementing planned managed retreat if protection is found not to be feasible.

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

The two primary coastal management actions for mitigating erosion hazards at Town of Cottesloe are:

- 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.

6.3 Detailed Implementation Plan

Detailed Implementation Plans for MU 1 and MU 2 are presented in Table 6-1 and Table 6-2 respectively with recommendations listed in priority order.

Table 6-1 MU 1 (North of Cottesloe Groyne, including Groyne to the North end of Town's Jurisdiction) Recommendations in Priority Order

Recommendation	Notes	Responsibility	Trigger	Cost	Funding	2024-2025	2025-2049	2049-2074	2074-2124
INVESTIGATION 1 Update Foreshore Management Plans (FMPs)	■ Prepare an updated Foreshore Management Plan (FMP) ■ An updated FMP could help increase the protective capacity of the natural foreshore dune system. Updates should address the requirements of SPP2.6 and incorporate the findings of this CHRMAP ■ Increased protective capacity by better management of beach and dune ensures better erosion resilience.	■ LGA	■ Completed CHRMAP	■ $30,000 ■ Assumes only undertaken for this MU in isolation, but synergies should be investigated.	■ Operational ■ Grants	x	x	x	x
INVESTIGATION 2 Detailed investigation of coastal hazards and feasibility of treatment options at priority locations such as North Cottesloe Surf Life Saving Club, coast immediately north of Cottesloe groyne	■ Site specific details of coastal hazards could help increase the protective capacity of the assets.	■ LGA	■ Completed CHRMAP	■ $30,000 .	■ Operational ■ Grants	x	x	x	x
INVESTIGATION 3 Sand Source Feasibility Study	■ Determine the capacity and cost of local sand supplies, including both land-based and marine sources. ■ Likely requires repetition over Medium-term.	■ LGA	■ Completed CHRMAP	■ $75,000 Assumes one sand source study for both MUs, hence half of the price mentioned here.	■ Operational ■ Grants	x	x		
Monitoring (NR1)	■ Bathymetric survey to monitor nearshore zone approximately every 5 years. ■ Six monthly beach profile surveys along the entire extent of the Town's shoreline, extending from the top of primary dune or fixed infrastructure to the approximate depth of closure offshore.	■ LGA ■ Can seek support and assistance from DoT	■ Completed CHRMAP ■ Severe storm event(s)	■ $10,000 annually	■ Operational ■ Grants	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	x	x		
Protection Structure Audit (NR2)	■ Item cost to inspect coastal asset condition, influence on sediment transport and remaining design life on all coastal management structures. ■ Includes rubble mound rock groynes at Beach Street and Cottesloe Beach, seawalls at Cottesloe Beach.	■ LGA	■ Completed CHRMAP	■ $30,000 ■ (Plus 2% annual maintenance of $3,000)	■ Operational ■ Grants	x	x	x	x

Recommendation	Notes	Responsibility	Trigger	Cost	Funding	2024-2025	2025-2049	2049-2074	2074-2124
Demolition / removal / relocation of asset from inside hazard area (PMR2)	■ Preparation of Asset Management Plan to 2048 for public-built assets. ■ Maintenance assumes ongoing allowance for foreshore reserve. ■ Removal / Relocation of assets as required.	■ LGA	■ Audit of assets within 2048 erosion 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		
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	x	x		
Leaving assets unprotected (PMR1)	■ To 2048 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 2048 erosion 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 Short Term option to address Erosion is Protection with Beach Nourishment (PR1)	■ Assumes suitable sand source available (grain size, volume, cleanliness, proximity). ■ 2023 implementation is allowed for, with sand source feasibility study being priority.	■ LGA	■ Monitoring ■ Updated CHRMAP	■ Approximate capital cost of $19.14M at NPV 4% ■ Annual maintenance estimate of approximately $0.2M	■ Operational ■ Grants ■ Direct beneficiaries		x	x	x

Table 6-2 MU 2 (South of Cottesloe Groyne to the South end of Town's Jurisdiction) Recommendations in Priority Order

Recommendation	Notes	Responsibility	Trigger	Cost	Funding	2024-2025	2025-2049	2049-2074	2074-2124
INVESTIGATION 1 Update Foreshore Management Plans (FMPs)	■ Prepare an updated Foreshore Management Plan (FMP). ■ An updated FMP could help increase the protective capacity of the natural foreshore 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	x	x	x	x
INVESTIGATION 2 Sand Source Feasibility Study	■ Determine the capacity and cost of local sand supplies, including both land-based and marine sources ■ Likely requires repetition over Medium-term.	■ LGA	■ Completed CHRMAP	■ $75,000 ■ Assumes one sand source study for both MUs, hence half of the price mentioned here.	■ Operational ■ Grants	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)	■ Bathymetric survey to monitor foreshore dune banks, approximately every 5 years. ■ Six monthly beach profile surveys along the entire extent of the Town's shoreline, extending from the top of primary dune or fixed infrastructure to the approximate depth of closure offshore.	■ LGA ■ Can seek support and assistance from DoT	■ Completed CHRMAP ■ Severe storm event(s)	■ $10,000 annually	■ Operational ■ Grants	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	x	x		
Protection Structure Audit (NR2)	■ Item cost to inspect coastal asset condition, influence on sediment transport and remaining design life on all coastal management structures. ■ Includes rubble mound rock groynes at Beach Street and Cottesloe Beach, seawalls at Cottesloe Beach.	■ LGA,	■ Completed CHRMAP	■ Included in MU1	■ Operational ■ Grants	x	x	x	x
Demolition / removal / relocation of asset from inside hazard area (PMR2)	■ Preparation of Asset Management Plan to 2048 for public-built assets. ■ Maintenance assumes ongoing allowance for foreshore reserve. ■ Removal / Relocation of assets as required.	■ LGA	■ Audit of assets within 2048 erosion 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		

Recommendation	Notes	Responsibility	Trigger	Cost	Funding	2024-2025	2025-2049	2049-2074	2074-2124
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	x	x		
Leaving assets unprotected (PMR1)	■ To 2048 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 2048 erosion 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 Short Term option to address Erosion is Protection with Beach Nourishment (PR1)	■ Assumes suitable sand source available (grain size, volume, cleanliness, proximity) to be confirmed with sand source feasibility study. ■ 2047 implementation is allowed for, so there are no priority actions in short-term.	■ LGA	■ Monitoring ■ Updated CHRMAP	■ Approximate capital cost of $8.45M at NPV 4% ■ Annual maintenance estimate of approximately $0.2M	■ Operational ■ Grants ■ Direct beneficiaries		x	x	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 erosion. The recommendations have considered the CBA results holistically as well as being cognisant of the findings of previous stages of the CHRMAP.

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

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WATER TECHNOLOGY
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