

The Cocos (Keeling) Islands

Coastal Hazard Risk Management and Adaptation Plan

A Plan for Managing Impact to Settlements and
assets from the Ocean

CHRMAP Summary



Australian Government

**Department of Infrastructure, Transport,
Regional Development, Communications, Sport and the Arts**



**Department of Planning,
Lands and Heritage**

What's happening?

A small island Territory

Cocos (Keeling) Islands (CKI) is approximately 2,950 km north-west of Perth, and 900 kilometres south-southwest of Christmas Island. There are 27 coral islands with a total land area of 14 square kilometres. CKI has a tropical climate, high humidity, and average rainfall around 2000 millimetres per annum, and averages 2.6 tropical cyclones annually, resulting in large waves and occasional storm surges. Only West Island and Home Island are inhabited, with 593 residents in 2021.

A changing environment

Our CKI community faces challenges from coastal hazards like erosion and flooding - Home Island frequently floods, affecting daily life, while West Island is also at risk from erosion and rising sea levels.

Since 1992, rising sea levels have posed a significant threat, increasing by 4mm annually.

A Coastal Vulnerability Study (CVS) prepared in 2021 by the Australian Government and other key stakeholders highlighted the risks associated with erosion and flooding for the next century. Subsequently, the Australian Government has collaborated with the Western Australian Department of Planning, Lands and Heritage (DPLH) to develop a **Coastal Hazard Risk Management and Adaptation Plan (CHRMAP)** to support the Shire of CKI (the Shire) and the community of CKI to make long term decisions that adequately consider future risk.

CHRMAP

The CHRMAP incorporates insights from the CVS and community feedback, outlining strategies for Home and West Islands and the uninhabited islands, guiding future coastal development.

The CHRMAP process involved the community, discussing coastal hazards and adaptation strategies, emphasising the cultural and economic significance of coastal areas, and considering suitable responses.

These dialogues illustrate the collaborative role of the Australian and Western Australian Government, in managing coastal challenges, with local stakeholders including the Shire and community members actively participating in considering effective adaptation strategies, even when tough decisions need to be made.

Aims of the CHRMAP

The CHRMAP provides a land use and development decision-making framework for CKI, to guide the Government, DPLH, the Shire, landowners and other key stakeholders to:

- Ensure land in identified coastal zones is continuously provided for coastal foreshore management, public access, recreation and conservation;
- Ensure public safety and reduce risks associated with coastal erosion and inundation;
- Avoid and address inappropriate land use and development of land within and outside of the settlements at risk from coastal erosion and inundation; and
- Ensure land use and development does not accelerate coastal erosion, exacerbate inundation risks or have a detrimental impact on the function of public reserves.

What is a CHRMAP?

CHRMAP is the acronym for a 'Coastal Hazard Risk Management and Adaptation Plan'. It is a study prepared to communicate information about future coastal planning. It includes a technical assessment to understand the existing and projected coastal processes, includes a social assessment to understand the community values associated with the coastline being studied, and considers financial and environmental implications.

The WA Government's CHRMAP Guidelines (July 2019) provide guidance for decision-makers to develop and implement effective CHRMAPs. These guidelines apply to the CKI.

The CHRMAP estimates where the coastlines are likely to be located in the short, medium and long-term future. By understanding where the coastline is likely to be in the future, it allows us to understand what infrastructure may be impacted by coastal processes and investigate which options for managing these impacts might be appropriate in particular areas.

What are coastal hazards?

The two main coastal processes that are considered hazards are erosion and inundation. The CHRMAP identifies areas that could potentially be impacted by these hazards at different time frames within the next 100 years, relative to storm events and projected sea level rise. Please refer to [the full CHRMAP report](#) for more information.

What are the options for adapting to coastal hazards?

The WA State Government's State Planning Policy 2.6 – State Coastal Planning Policy (SPP 2.6) identifies a hierarchy of four options for adapting to coastal hazards:



Avoid

Identify future 'no build' areas and use planning controls to prevent new development in areas that are vulnerable now or in the future



Planned and Managed Retreat

Withdraw, relocate or abandon assets that are vulnerable; ecosystems are allowed to move landward as sea levels rise



Accommodate

Continue to use the land but accommodate changes by building on piles, converting land uses or growing flood or salt-tolerant plants



Protect

Use hard structures (e.g. sea walls) or soft solutions (e.g. dunes and vegetation) to protect assets from the sea. May be prohibitively expensive, especially in the long-term

Please refer to [the full CHRMAP report](#) to learn more about these options and the additional options of 'No Regrets' and 'Do Nothing' that have been considered in the risk assessment.

What else is in a CHRMAP?

The CHRMAP is a technical assessment used for planning. It is a basis for decision making, rather than laying out decisions and implementation plans.

It recommends ongoing research and study to understand existing and projected coastal impacts across the inhabited islands of West Island and Home Island and also considers other islands in the atoll, on the basis of current and future use and protection.

The components of a CHRMAP include:

- Coastal hazard risk identification and assessment;
- Coastal risk evaluation based on community and stakeholder engagement and an assessment of community safety;
- Identification of adaptation options to mitigate coastal hazard risk; and
- Assessment of adaptation options to identify preferred options.

The CHRMAP process takes into account the uncertainty associated with predictions of coastal change and provides a flexible decision-making pathway that decision-makers can use over time as coastal hazards emerge.



Figure 1: Community members participating in the value mapping activity

Possible scenarios

What has the study found?

Coastal erosion and inundation will significantly affect all assets, infrastructure, and people on CKI in the short, medium, and long term.

Many assets currently rank as 'high' or 'very high' vulnerability to these risks, putting them at risk of damage from storms or changes in sea level.

Vulnerability will become more acute by 2068, as indicated in [Table 1](#). Inundation impacts slightly more assets than erosion, however, the combination is significant.

Existing protection is predominantly for erosion, via the seawalls located around the islands. They have a short design life, with only three of the existing eleven seawalls assessed as able to withstand a significant storm event.

How much damage would it cause?

The analysis suggests that hazards could lead to hundreds of millions of dollars in economic losses from erosion and inundation on CKI by 2068. Replacement costs for infrastructure are projected to be in the hundreds of millions (excluding the airport). Overall costs for addressing coastal hazards across CKI could reach billions.

A 'do nothing' approach won't help reduce the effects of coastal erosion and flooding. Action is required.

Table 1: Vulnerability level and number of assets identified as being at risk

LOCATION	VULNERABILITY LEVEL	NUMBER OF ASSETS VULNERABLE (TO EITHER EROSION OR INUNDATION)					
		Current Day		2068		2118	
Home Island	High	● 106	● 107	● 67	● 37	● 7	● 20
	Very High	● 32	● 91	● 78	● 174	● 138	● 198
West Island	High	● 178	● 89	● 103	● 33	● 7	● 29
	Very High	● 35	● 62	● 117	● 129	● 213	● 151

Erosion Vulnerability: ● Low ● Medium ● High ● Very High
 Inundation Vulnerability: ● Low ● Medium ● High ● Very High
 ○ N/A

What are the options?

Immediate actions

To ensure effective decision-making, it is necessary to develop strategic planning and policy documents and complete some additional studies. This includes:

- Emergency management planning
- Groundwater studies
- Investigating sand sources and raw materials
- Heritage management plans
- Long-Term Settlement Planning in partnership with the community

Land use planning framework

A contemporary land use planning framework is essential to prevent new permanent residential developments in coastal hazard zones, to avoid intensifying vulnerable land uses where they would be at risk. This is all part of Long-Term Settlement Planning.

Short term actions

Protection of assets across CKI with the highest economic, cultural, historical and environmental value is necessary in the short term. It is important to note that some assets may be so vulnerable that protection is not viable. In these instances, moving the assets to other areas on the Island/s will need to be considered.

Long-term adaptation

Projections indicate limited land for a permanent population on CKI, as both erosion and inundation risks are serious.

Long-Term Settlement Planning in the Short and Medium-term will confirm the most suitable option to protect lives in a socially, economically and environmentally respectful way in this time frame.

Summary of Options

- **Undertake** strategic and regulatory planning, and establish policy or governance interventions that can be applied to all assets.
- **Further investigate** all options with detailed design and **continued stakeholder and community engagement**.
- **Prohibit** new permanent residential development and other vulnerable land uses **in coastal hazard areas**.
- **Retreat – areas outside the settlement areas**, except for critical assets that cannot be relocated. Where retreat is identified, **begin preparing as soon as possible**.

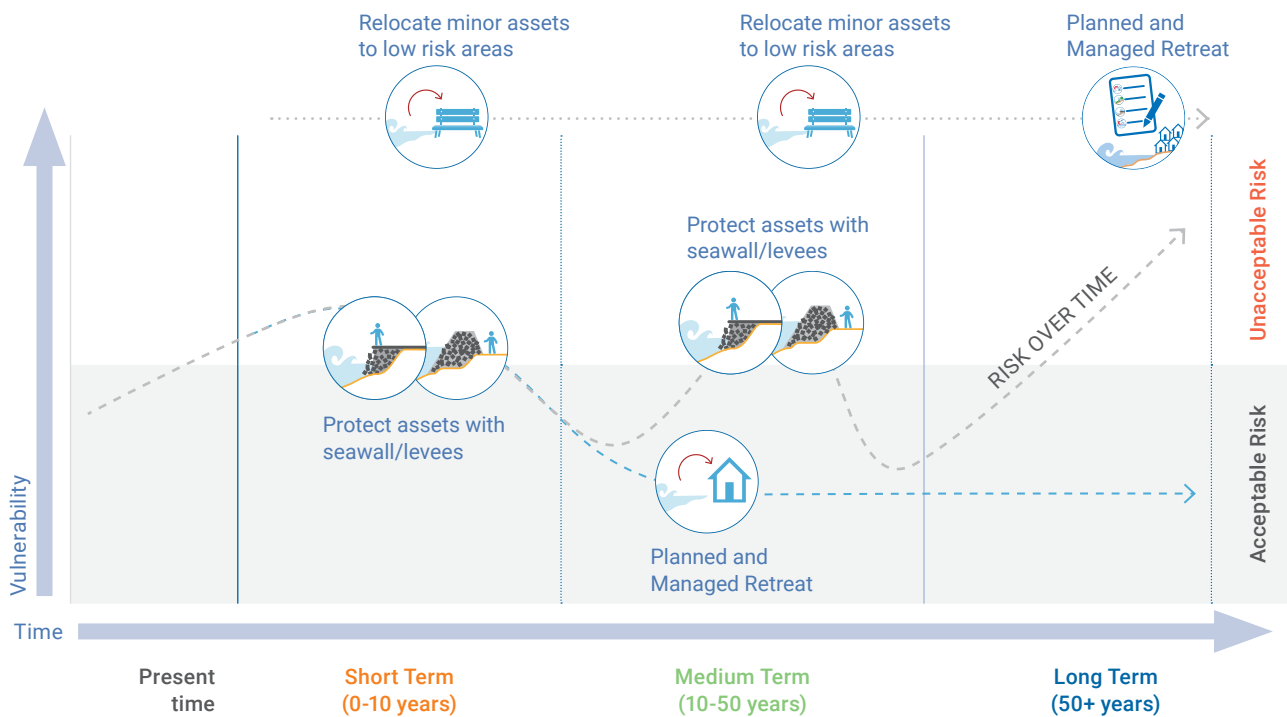
Who will pay for adaptation?

The CHRMAP itself is a planning tool to inform decision-makers and the community. The support of decision-makers and the community for the CHRMAP recommendations is an important first step towards identifying and implementing an appropriate response.

Further work will be done to consider the CHRMAP findings and recommendations and to identify potential funding sources in response.

When to respond to risks?

The diagram below indicates the suggested timing for proposed action. It shows that protecting with seawalls and levees are proposed, but reflects that over time these will need to be replaced to withstand risks in the long term, or a different option needs to be progressed. Long Term Settlement Planning is required to determine the ultimate response option for CKI.



Response options

Undeveloped Areas	Avoid Avoid further development, Long-Term Settlement Planning		
Home Island Developed Areas	Protect Protect with seawall and levees	Protect Protect essential infrastructure beyond 2068	Protect Protect essential infrastructure beyond 2068
West Island Developed Areas	Protect Protect with seawall and levees Retreat pathway Relocate minor assets and services to a lower risk area	Planned and Managed Retreat Relocate vulnerable assets in accordance with Long Term Settlement Planning Relocate minor assets and services to a lower risk area	Planned and Managed Retreat Relocate vulnerable assets in accordance with Long Term Settlement Planning Relocate minor assets and services to a lower risk area
All Scenarios	No Regrets Monitoring and Assess		

Figure 2: Proposed CHRMAP recommendations and suggested timing

At a glance

Home Island Coastal Hazard Risks and Response Options Summary

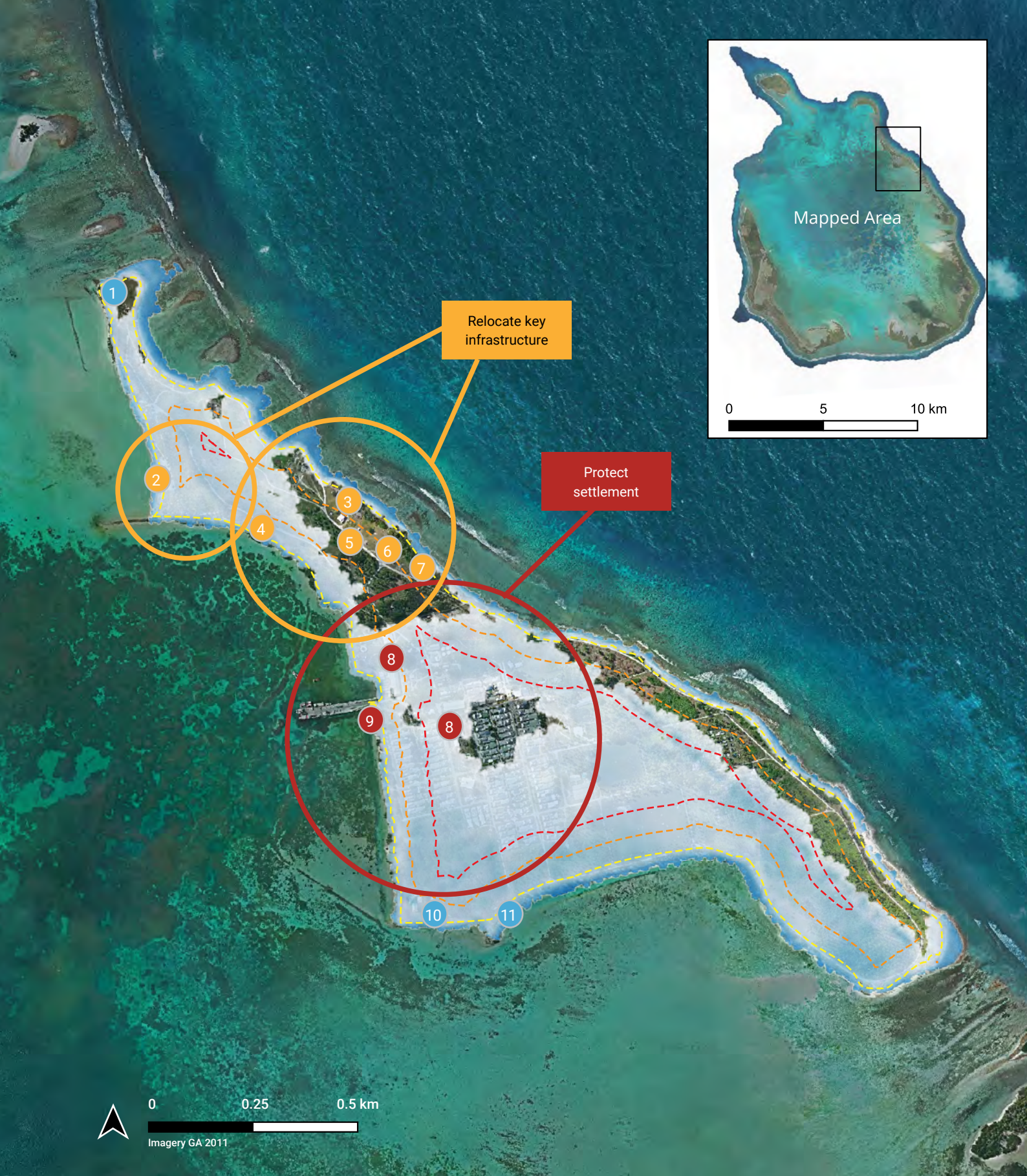
All assets on Home Island have a 'high' to 'very high' vulnerability rating for erosion and inundation at the present day (PD). A majority of assets will have a 'very high' vulnerability rating by 2068.

The table below outlines **high level response options** for the short, medium and long-term. This may change to a planned and managed retreat pathway depending on further studies and Long Term Settlement Planning. If risks from erosion or inundation are experienced more rapidly than predicted, adaptation responses may occur sooner.

Table 2: Vulnerability level for specific assets identified as being at risk at Present Day (PD), 2068 and 2118, and proposed CHRMAP recommendations and suggested timing - Home Island

ASSETS	VULNERABILITY			RESPONSE OPTIONS		
	PD	2068	2118	SHORT TERM (0-10 YEARS)	MEDIUM TERM (10-50 YEARS)	LONG TERM (50+ YEARS)
1 Pulu Gangsa Cemetery	●●	●●	●●	Protect		Long Term Settlement Planning
2 Seawater production bores	●●	●●	●●	Protect		Retreat pathway
3 Refuse Station	●●	●●	●●	Protect		Retreat pathway
4 Potable Water Pump Station	●●	●●	●●	Protect		Retreat pathway
5 Water treatment plant and potable water facility	●●	●●	●●	Protect		Retreat pathway
6 Fuel Station	●●	●●	●●	Protect		Retreat pathway
7 Power Station	●●	●●	●●	Protect		Retreat pathway
8 Kampong, Mosque, Shops	●●	●●	●●	Protect		As per Long Term Settlement Planning
9 Home Island Jetty	●●	●●	●●	Protect		Protect
10 Oceania House	●●	●●	●●	Protect		As per Long Term Settlement Planning
11 Yacht Club	●●	●●	●●	Protect		Retreat pathway

Erosion Vulnerability: ● Low ● Medium ● High ● Very High ○ N/A
 Inundation Vulnerability: ● Low ● Medium ● High ● Very High ○ N/A



**Home Island
Erosion and
Inundation
Hazard**

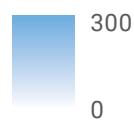
Erosion Hazard Line

(The extent of the area predicted to be vulnerable to erosion at that point in time)

- 2018 erosion hazard line
- 2068 erosion hazard line
- 2118 erosion hazard line

2068 500 year ARI Flood Depth (cm)

(The extent of the area predicted to flood during a 1 in 500 year flood event in 2068)



West Island Coastal Hazard Risks & Response Options Summary

Most assets on West Island have a 'high' to 'very high' vulnerability rating for erosion and inundation at the present day (PD). A majority of assets will have a 'very high' vulnerability rating by 2068.

The table below outlines **high level response options** for the short, medium and long-term. While the protect pathway is mostly recommended for West Island, this may change to a planned and managed retreat pathway depending on further studies and Long Term Settlement Planning. If risks from erosion or inundation are experienced more rapidly than predicted, adaptation responses may occur sooner.

Table 3: Vulnerability level for specific assets identified as being at risk at Present Day (PD), 2068 and 2118, and proposed CHRMAP recommendations and suggested timing - West Island

ASSETS	VULNERABILITY			RESPONSE OPTIONS		
	PD	2068	2118	SHORT TERM (0-10 YEARS)	MEDIUM TERM (10-50 YEARS)	LONG TERM (50+ YEARS)
1 Fuel station	●●	●●	●●	Protect	Monitor/Protect	Protect
2 Rumah Baru and associated infrastructure	●●	●●	●●	Protect	Monitor/Protect	Protect
3 Airfield storage	●●	●●	●●	Protect	Monitor/Protect	Monitor/Protect
4 GA geomagnetic observatory and Bureau of Meteorology site, GA GNSS Mark, GA Seismic station	●●	●●	●●	Protect	Monitor/Protect	Monitor/Protect
5 Airport (runway, IOTT tower, water treatment plant potable storage tanks)	●●	●●	●●	Protect	Monitor/Protect	Monitor/Protect
6 Power Station and industrial area	○●	○●	○●	Protect	Monitor/Protect	Monitor/Protect
7 Settlement	●●	●●	●●	Protect	As per Long Term Settlement Planning	
8 Trannies beach Parks and Recreation Reserve	●○	●○	●○	Retreat pathway	Relocate	Monitor/Relocate
9 Transmitter Site	●●	●●	●●	Retreat pathway	Assess/Protect	Monitor/Protect
10 Sydney Highway, power and fuel line	●●	●●	●●	Retreat pathway	Assess/Protect	Monitor/Protect
11 Wastewater treatment plant	●○	●○	●●	Retreat pathway	Assess/Protect	Monitor/Protect
12 Communication array	●●	●●	●●	Retreat pathway	Monitor/ Planned and Managed Retreat	
13 Twiss Memorial Plaque, Substation	●●	●●	●●	Retreat pathway	Monitor/ Planned and Managed Retreat	
14 Access road	●●	●●	●●	Retreat pathway	Monitor/ Planned and Managed Retreat	
15 Scout Park reserve	●○	●○	●○	Retreat pathway	Monitor/ Planned and Managed Retreat	
16 Boat ramp, Yacht club Pondok (shelter)	●○	●○	●○	Retreat pathway	Monitor/ Planned and Managed Retreat	

Erosion Vulnerability: ● Low ● Medium ● High ● Very High ○ N/A
 Inundation Vulnerability: ● Low ● Medium ● High ● Very High ○ N/A

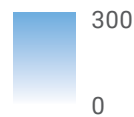


**West Island
Erosion and
Inundation
Hazard**

Erosion Hazard Line
(The extent of the area predicted to be vulnerable to erosion at that point in time)

- 2018 erosion hazard line
- 2068 erosion hazard line
- 2118 erosion hazard line

2068 500 year ARI Flood Depth (cm)
(The extent of the area predicted to flood during a 1 in 500 year flood event in 2068)



Recommended Actions

Immediate (actioned as soon as possible)

Planning

▶ Final CHRMAP released

- Prepare detailed implementation plan

▶ Final CHRMAP released

- Develop a Community Engagement Plan and communications program to continue information sharing and gathering with the community regarding the CHRMAP and ongoing management

▶ Local Planning Framework

- Develop Local Planning Strategy – in collaboration with the community, including detailed engagement on Long-Term Settlement Planning, and ensuring that the vulnerability of the study area is adequately identified in the strategic planning framework
- Local Planning Scheme – Establish a Special Control Area to control land use planning on land identified as being vulnerable

📅 Ongoing

- Shire Infrastructure Asset Planning to make sure that future assets are sensibly located to manage risk to assets
- Australian Government infrastructure asset planning to make sure that future assets are sensibly located to manage risk to assets

▶ As soon as scoped and funded

- Preparation of an emergency management plan to protect the safety of the community should a significant storm event occur

Planning and monitoring

▶ As soon as scoped and funded

- Resilience Planning including monitoring (in some cases immediate) to support natural hazard management through dune vegetation. Monitoring plan development.

Investigation

▶ As soon as scoped and funded

- Strategic and regulatory planning for longer term adaptation and settlement planning
- Completion of a sand source and raw materials investigation to determine the capacity of local sand supply within the atoll and external options (i.e. importation of basic raw materials)
- 🏠 Home Island Assessment of groundwater/flooding to confirm timing for longer term planning
- 🏠 West Island Assess Rumah Baru and the seawall currently protecting the fuel station to inform timing of the upgrade of critical service infrastructure assets at Rumah Baru and the fuel station
- 🏠 West Island Boat ramp assessment to consider maintenance or design alterations in existing sites, or relocation to more appropriate sites

Short term (0 to 10 years)

Planning

📅 Ongoing

- Notification on titles to advise property owners where land is identified as being at risk

📅 2026/27

- Preparation of a Local Planning Policy to work alongside the Special Control Areas

Planning and Design

▶ On completion of Cost Benefit Analysis

- 🏠 Home Island Protect pathway design and staging following Cost Benefit Analysis

Investigation

📅 Ongoing

- 🏝️ West Island Condition assessment and monitoring of existing seawalls to determine timing of upgrade

📅 2026/27

- Property Acquisition Investigation

📅 2026/27

- Preparation of a Local Heritage Survey and Cultural Heritage Management Plan to understand how to protect or manage loss of cultural heritage values

▶ As soon as scoped and funded

- 🏝️ West Island Investigate the management of existing vulnerable assets on the coastal side

Physical works

📅 Ongoing

- Strategic vegetation planting and dune care (out of settlement areas)

Monitoring

📅 Ongoing

- Condition inspection of structures (complementary to avoiding further development in Hazard Zones) [Annually]
- Monitoring of storm events, ocean induced and terrestrial events as set out in Monitoring Plan. [As events occur]
- Aerial photo review [Every 5 years]
- Bi-annual beach profile surveys
- 🏝️ West Island Ongoing monitoring of Kite Beach, Yacht Club and Scout Park, to confirm timing of when to relocate

Review



📅 Ongoing

- Progress review [<3 years]
- CHRMAP to be updated every 5 years or as new information becomes available, to support decision-making [Every 5 years]


Medium term (10 to 50 years)

Principles

▶ As soon as scoped and funded

-  **West Island** Transition from planned and managed retreat to a protect pathway for relocatable, critical service infrastructure assets outside of the settlement (Defence site, water treatment plant and refuse station)
-  **West Island** Planned and managed retreat planning: using planning instruments to progressively move assets out of the hazard zone for all non-critical service infrastructure assets

📅 By 2068


-  **West Island** Managed retreat planning – short-medium term to 2068 for management of existing vulnerable assets, including:
 - > Transmitter site – immediately confirm building floor levels, raise if necessary to lift building higher than flood levels.
 - > Sydney Highway
 - > Assets at Trannies Beach, Big Barge Art Centre

Planning and physical works

▶ Trigger 1: Planning / Trigger 2: Proximity


- Planned and managed retreat Planning - Relocate assets within land parcels away from hazard zone (outside of settlement areas), and remove non-critical service infrastructure assets from site

📅 By 2068

-  **Home Island** Progress agreed option for the future of the settlement (in collaboration with the community through Long-term Settlement Planning)

Monitor




▶ Where assessed as necessary

-  **West Island** Transmitter site – monitor shoreline, as planned and managed retreat may be necessary

Long term (50+ years)

Planning and design

▶ Trigger 1: Planning / Trigger 2: Proximity

-  **West Island** Protection design requirements for Sydney Highway, Waste Water Treatment Plant, Refuse Station
-  **Home Island**  **West Island** Progress agreed option for the future of the settlement (in collaboration with the community through Long-term Settlement Planning)

Immediate (actioned as soon as possible)

- Levee protection – south to south west point of Home Island
- Road raising on the western side of Home Island

1

Short term (0 to 10 years)

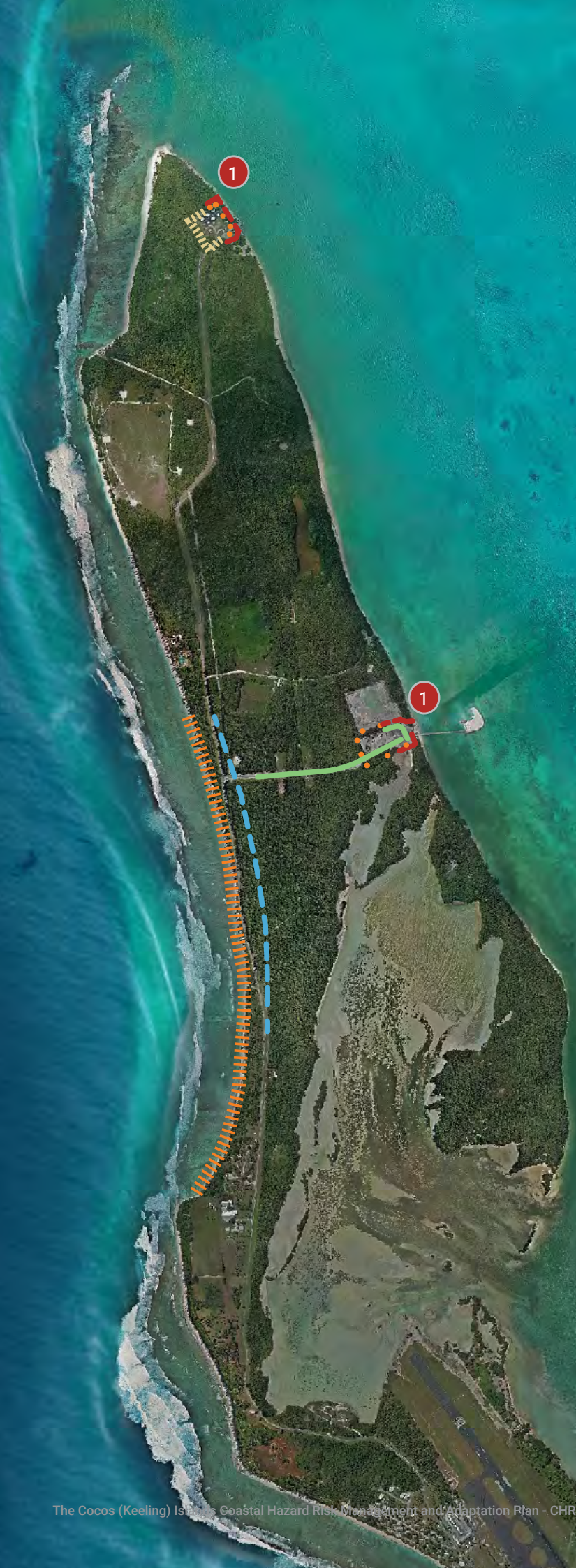
- 1 Protect the cemetery with seawall and levees, including land reclamation
- Levee protection on the north-western and south eastern side of the Home Island settlement
- Seawall protection on the western side of the Home Island settlement

Medium term (10 to 50 years)



- Road raising - medium to long term
- Levee and Seawall protection – medium term
- Levee protection – medium term

Replace seawalls and sandbags (approximately 2050/60)



West Island North



Immediate (actioned as soon as possible)

-  New seawalls on the lagoon side of West Island
-  Move Sydney Highway and underground services


Short term (0 to 10 years)

-  Short term levee protection
-  Raise road and pavement above flood level


Medium term (10 to 50 years)

-  Medium term levee protection

Long term (50+ years)

-  Potential long term seawall beyond 2068

Immediate (actioned as soon as possible)



-  Short term seawall protection north and south of existing seawall to protect settlement

Protect pathway design and staging, detailed costing and a monitoring program for Settlement Area and critical assets outside of settlement

Short term (0 to 10 years)

-  CKI Runway seawalls

Replace existing sandbag seawalls adjacent William Keeling Crescent with a concrete seawall. All existing seawalls should also be assessed at this time

-  Levees, followed by potential seawalls
- 

Medium term (10 to 50 years)


-  Medium term levee protection

Relocate by 2068 – Lagoon side assets including transfer station, waste water treatment plant, Airport and associated infrastructure, Bureau of Meteorology, geomagnetic observatory




Replace all seabee seawalls, with crest increased 1 metre

Long term (50+ years)

-  Potential long term seawall beyond 2068

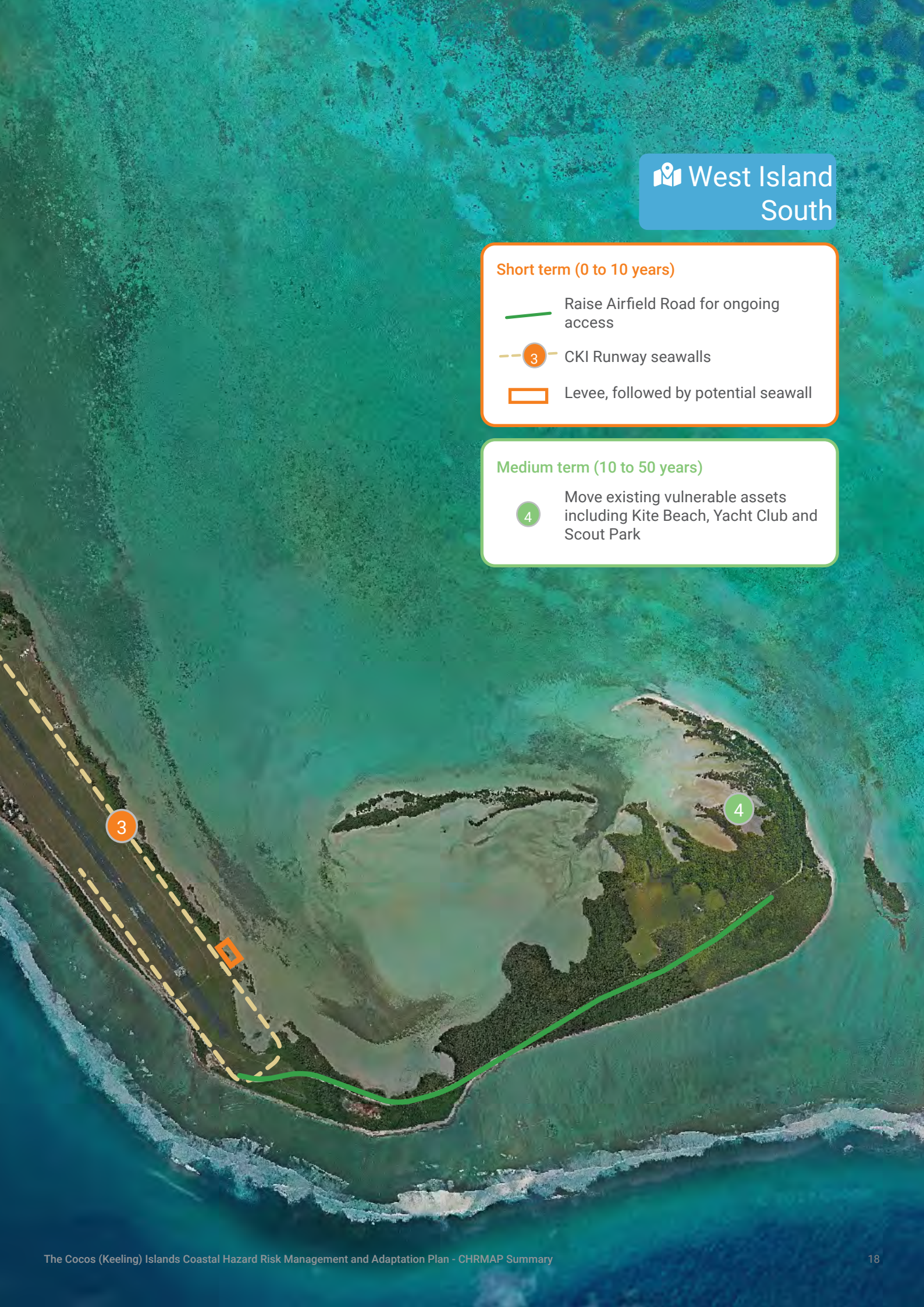
 West Island
South

Short term (0 to 10 years)

-  Raise Airfield Road for ongoing access
-  CKI Runway seawalls
-  Levee, followed by potential seawall


Medium term (10 to 50 years)

-  Move existing vulnerable assets including Kite Beach, Yacht Club and Scout Park



How will this affect me?

Coastal hazards affect people differently based on location and how they interact with and enjoy the coastline.

I AM A...	I MAY BE AFFECTED BY...
 <p>Private property owner in the coastal hazard zone</p>	<p>Land Use Planning Controls - The land use planning framework provides for continuation of existing development or land uses until the coastal hazard risk or impacts become unacceptable. The land use planning framework then provides opportunities to introduce less vulnerable forms of use or development.</p> <p>Notification on titles - This indicates to current and future owners that an asset is vulnerable, to help them make informed decisions about the level of risk they are willing to accept, and that risk management and adaptation is likely to be required. If a planning or development application is submitted for a lot located in a coastal hazard area then SPP 2.6 enables a notification to be placed on the Certificate of Title as a condition of approval, identifying that the lot may be vulnerable to coastal hazards.</p>
 <p>User of the coastline</p>	<p>Some areas of the Cocos (Keeling) Islands coastlines will become vulnerable over the next 100 years. This includes beaches, access ways, footpaths, carparks, jetty areas, toilets, roads and public open space areas.</p> <p>The CHRMAP report details recommended short-term actions focused on monitoring, planning controls, and emergency management to prepare decision-makers for future coastal hazard management.</p> <p>In areas identified for potential future protection, the construction of structures such as seawalls will mean that the natural sandy beach will eventually be lost in these locations and that access to those stretches of coastline might be affected.</p> <p>In areas identified for future planned and managed retreat, existing infrastructure may gradually be permanently removed or relocated if coastal hazards cause damage during storm events. In those cases the natural sandy beach and dunes will be given room to move, and thus the natural foreshore be retained.</p>
<p>The Cocos (Keeling) Island peoples' Land Trust, held in Trust by the Shire of Cocos (Keeling) Islands*</p> <p>*Identified in the Trust Deed as the Cocos Keeling Islands Council</p>	<p>The Cocos (Keeling) Island peoples' Land Trust is affected in a similar way to private property owners and in the same way as other users of the coastline. This coastal user is also affected as a group by damage to or planned and managed retreat of valued assets such as the family pondoks located on the other islands of the atoll. Development of Trust Land will also be affected by land use planning controls and notification on titles as per the private property owner category.</p> <p>Engagement with the Cocos (Keeling) Islands' Elders and the Cocos Malay community will continue to occur to ensure the rights and obligations of the Land Trust are respected.</p>

Pulu Cocos

Perancangan Pinggir Laut

Ringkasan Pelan CHRMAP



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**GOVERNMENT OF
WESTERN AUSTRALIA**