Appendix A

Appendix A Cocos (Keeling) Islands Coastal Vulnerability Study - Summary

COCOS (KEELING) ISLANDS COASTALVULNERABILITYSTUDY-SUMMARY

Royal HaskoningDHV (RHDHV) prepared the Cocos (Keeling) Islands Coastal Vulnerability Study (CVS), published in 2021.

The CVS formed a major input to the final CHRMAP, completing extensive technical reporting and analysis of wave, wind, water level, bathymetry and topography from multiple data sets. Based on an analysis of gaps in available data, RHDHV also collected significant additional data for the CVS including metocean monitoring, coastal surveys and a coastal asset database.

This summary presents key information and data provided in the CVS. Direct extracts are quoted.

Objective

"The objective of the [CVS] was to identify coastal hazard risks and assess the vulnerability of built and natural assets to erosion and inundations hazard. The work to meet this objective was guided by the Western Australian Planning Commission's State Planning Policy No. 2.6 – State Coastal Planning Policy (SPP 2.6)".

To ensure the study was robust, RHDHV completed a literature review which considered the reports and data noted in *Table 37*.

Table 37: Available Data and Literature Review

SOURCE / TITLE	DATA TYPE
Investigations for the Proposed Freight and Passenger Facilities at Rumah Baru (Cocos Islands) (DA Lord & Associates, 1999)	Coastal Study for Rumah Baru observing wind, wave, currents, sediment transport and shoreline change
CKI Coastal Management Plan (GHD, 2000)	Coastal management study to inform guidelines for future development and assessment of materials for use in construction
Cocos (Keeling) Islands Coastal Engineering Investigations (DoT, 2010)	Coastal engineering investigation identifying monthly sea levels (1992 - 2010), wind roses (1952-2010) and sediment sampling and analysis

Table 36: Available Data and Literature Review (cont'd)

SOURCE / TITLE	DATA TYPE
Climate change risk assessment for the Australian Indian Ocean Territories – Cocos (Keeling) Islands and Christmas Island (Maunsell-Aecom, 2009)	Risk assessment addressing climate change observations and predictions as well as coastal hazards including sea level rise, inundation, extreme weathers and cyclones showing: • Increase in air temperature of 0.7°C since 1974 • Increase in sea surface temperature of 0.5°C, with stronger warming in winter • Sea level rise of 4mm per year since 1992
CKI Sand Management Strategy Numerical Modelling Report (GHD, 2017b)	An update to the CKI Coastal Management Plan to inform sand management practices
Cocos (Keeling) Islands Site Investigations Summary – October 2017 (DoT, 2017)	Site visit as part of the scoping for this CVS includes the rationale for metocean monitoring locations adopted for this study and assessment of 12 coastal protection structures and sediment samples collected and assessed.
CAWCR hindcast model	Wave data
Bureau of Meteorology (BoM) anemometer (airport)	Wind data
BoM tide gauge (Home Island jetty)	Water level data
Topographic Digital Elevation Model LiDAR (1m resolution)	Bathymetry and topography
Bathymetric LiDAR (~25m resolution)	Bathymetry and topography
General Bathymetric Chart of the Oceans (offshore bathymetry) (2014)	Bathymetry and topography
Geoscience Australia (2011)	LiDAR Survey and Digital Elevation Model
Australian Department of Defence (2012)	LiDAR Survey
A revised model for radial profiles of hurricane winds (Holland, 2010)	Wind field and estimated peak wind speed and direction

CVS Analysis

The literature reviewed as part of the CVS process highlighted an absence of long-term and consistent data collected in vicinity of the Cocos (Keeling) Islands. Targeted monitoring-based studies were then required to improve the knowledge of coastal processes, shoreline movement and sediment transport processes.

As such, the study progressed and completed a number of additional technical assessments, as shown in *Table 38*:

Table 38: CVS Technical Investigations

RHDHV OUTPUTS	OBSERVATIONS
Metocean Data Collection	Metocean data, (measurement of waves, currents and water level variation), collected at key locations and water depths. Eight (8) monitoring sites deployed and data recorded from July 2018 to December 2019. Beach transects captured at regular intervals (up to 50m) and a trial drone survey undertaken on West Island
Numerical Modelling	Numerical modelling focused on the present day (or existing) conditions and future sea level rise conditions.
Conceptual Coastal Processes Model	A model of sediment transport processes identifying sediment sources, sinks, pathways and vulnerable areas. The key points summarised as: • Atolls are resilient. The reef crests are living structures and can grow vertically with sea level rise. • Almost all oceanward beaches are interpreted as having a base of coral shingle, rubble and/or coral boulders, acting to reduce vulnerability to erosion and shoreline recession. • Oceanward beaches are steep. During storm conditions the beach ridges can be overwashed. • Oceanward shorelines of West Island and Home Island are generally stable but some areas are receding (West Island settlement in particular). Existing coastal structures has created a domino effect with each structure moving the erosion issue further downdrift. • Isolated areas on Home Island (e.g. Pulu Gangsa) have suffered significant erosion on its lagoon sides. Conversely the ocean-facing side shows accretion of the beach formed by the reclamation. • Low elevation of Home Island makes it susceptible to inundation. • A key impact of sea-level rise and other climate change stress factors is that living fringing reefs may become less effective at mediating the ocean wave energy before it reaches the islands shores.
Other models and outputs	• Cyclone, including assessment post event • Surges • Overtopping

Coastal Hazard Assessment

The coastal hazard assessments included the definition of appropriate coastal erosion and inundation allowances based on application of SPP 2.6 and the application of the knowledge gained from the background literature review and data collection and analysis.

The following extracts from the CVS provide interesting data points illustrating the existing coastal shoreline movement (*Table 39*) used to directly inform the 'S1' values, and sand volume loss on ocean facing (*Table 40*) and lagoon facing (*Table 41*) shorelines, used to directly inform the 'S2' values in the CHRMAP.

Table 39: Summary of the vegetation line position analysis across all management units for both Islands (CVS Table 20)

WEST ISLAND	SECTOR	VEGETATION LINE	STATUS RATE (M/YEAR)
MU1 West Island Settlement (ocean-facing)	MU1 North	Recession	-0.3
	MU1 Middle	Recession	-0.16
	MU1 South	Recession	-0.02
MU2a The Shack (ocean-facing)	-	Recession	-2.63
MU2b Trannies beach (ocean-facing)	MU2b North	Recession	-0.65
	MU2b South	Recession / Accretion	-0.65 / 1.219
MU3 Old Fuel Jetty (lagoon-facing)	MU3 North	Recession	-3.28
	MU3 South	Recession	-2.8
MU3 Lagoon-facing coast (lagoon facing)	-	Stable	-
MU4 Rumah Baru (lagoon-facing)	-	Stable	-
HOME ISLAND	**SECTOR**	**VEGETATION LINE**	**STATUS RATE (M/YEAR)**
MU7 Jalan revetment (lagoon-facing)	MU7 North	Stable	-
	MU7 South	Accretion	0.59
MU8 Pulu Gangsa (ocean-facing)	-	Accretion	0.6
MU8 Ocean-facing coast (ocean-facing)	-	Stable	-
MU9 Turtle Beach (lagoon-facing)	MU9 North	Recession	-0.86
	MU9 Middle	Accretion	0.22
	MU9 South	Accretion	1.02

Table 40: Eroded sand volume, maximum allowance of the shoreline (level 0m) and the dune (level ~1m) for each profile and respective management unit (CVS Table 21)

MODELLED PROFILE *	MANAGEMENT UNIT	ALLOWANCE DISTANCE (M)		ERODED VOLUME (M3/M)
		AT 0M AHD SHORELINE	AT ~1.5M AHD DUNE	
CBM0 (WI Settlement)	MU1	24.1	-5.9	15.6
WI_GSC02 (The Spot)	MU2	0.0	-0.5	3.36
WI16 (Airforce Road)	MU6	15.3	-7.0	17.0
HI03 (Near Waste Station)	MU8	30.7	-7.1	24.0
HI09 (Pulu Gangsa coast)	MU8	19.9	-12.0	30.6

*Location Descriptions added in brackets - not precise

Table 41: Eroded sand volume, maximum recession of the shoreline (level 0m) and the dune for each profile and respective management unit (CVS Table 22)

MODELLED PROFILE*	MANAGEMENT UNIT	ALLOWANCE DISTANCE (M)		ERODED VOLUME (M3/M)
		AT 0M AHD SHORELINE	AT ~1.5M AHD DUNE	
HI05 (Pulu Gangsa lagoon)	MU9	-1.4	-0.5	12.6
HISW (south west end of island)	MU7	-0.4	-0.1	0.6
HI01 (North of Shire)	MU7	-5.0	-1.3	5.9
NP02 (Fuel Jetty)	MU3	-1.5	-1.2	2.6
VC (meteorological facility)	MU3	0.0	0.0	2.4
RB07 (Rumah Baru)	MU4	-3.7	-2.0	7.1

*Location Descriptions added in brackets - not precise

The results show that most of the ocean-facing beaches on West Island are experiencing erosion. Whilst numerous coastal protection structures exist, the CVS suggests that these structures may be resulting in downdrift deficits and subsequent erosion. Lagoon-facing vegetation lines have been more stable in areas where there was no interaction with coastal structures.

The Home Island coast was observed to be less erosive, with Pulu Gangsa Beach observed to be accretionary. The two lagoon-facing analysis locations comprised protection structures, and accretion was observed south of these structures in both cases.

The allowance for S3 in RHDHV was determined based on the SPP 2.6 values with a vertical sea level rise of 0.4m adopted for the 50-year planning timeframe and 0.9m rise adopted for the 100-year planning timeframe. As the coast is considered a 'sandy coast' in SPP 2.6, S3 is calculated as 40m for the 50-year planning horizon and 90m for the 100-year planning horizon.

As required by SPP 2.6 a 0.2 m/year allowance for uncertainty has also been included.

Coastal Hazard Mapping

The understanding of coastal processes established in the CVS are used to define appropriate allowances for coastal hazards to be mapped in accordance with SPP 2.6 as illustrated in the CHRMAP.

Erosion hazard allowances (S1, S2 and S3) have been defined following SPP 2.6 and have been applied to West Island and Home Island. An extract is provided in *Table 42* (West Island) and *Table 43* (Home Island).

Table 42: West Island summary of erosion allowances (m), S1, S2 and S3 and uncertainty for study area (CVS Table 30)

PLANNING PERIOD	ALLOWANCES	UNPROTECTED SANDY COAST ALLOWANCES (MEASURED LANDWARD FROM HSD)						
		MU1	MU2A	MU2B	MU3	MU4	MU5	MU6
Present day (2018)	S1	6	1	1	2	2	0	7
	S2	0	0	0	0	0	0	0
	S3	0	0	0	0	0	0	0
	Uncertainly [Rate =0.2m/year]	0	0	0	0	0	0	0
	Total allowance	6	1	1	2	2	0	7
2028	S1	6	1	1	2	2	0	7
	S2	3	0	3	0	0	-2	0
	S3	8	8	8	8	8	8	8
	Uncertainly [Rate =0.2m/year]	2	2	2	2	2	2	2
	Total allowance	19	11	14	12	12	8	17
2068	S1	6	1	1	2	2	0	7
	S2	15	0	15	0	0	-10	0
	S3	40	40	40	40	40	40	40
	Uncertainly [Rate =0.2m/year]	10	10	10	10	10	10	10
	Total allowance	71	51	66	52	52	40	57
2118	S1	6	1	1	2	2	2	7
	S2	30	0	30	0	0	-20	0
	S3	90	90	90	90	90	90	90
	Uncertainly [Rate =0.2m/year]	20	20	20	20	20	20	20
	Total allowance	146	111	141	112	112	91	117

Table 43: Home Island summary of erosion allowances (m), S1, S2 and S3 and uncertainty for study area (CVS Table 21)

		UNPROTECTED SANDY COAST ALLOWANCES (MEASURED LANDWARD FROM HSD)			
		MU7		MU8	MU9
		SOUTH SIDE	NORTH SIDE		
Present day (2018)	S1	0.1	1.3	12	0.5
	S2	0	0	0	0
	S3	0	0	0	0
	Uncertainly [Rate =0.2m/year]	0	0	0	0
	Total allowance	0	1	12	1
2028	S1	0.1	1.3	12	0.5
	S2	0	0	0	0
	S3	8	8	8	8
	Uncertainly [Rate =0.2m/year]	2	2	2	2
	Total allowance	10	11	22	11
2068	S1	0.1	1.3	12	0.5
	S2	0	0	0	0
	S3	40	40	40	40
	Uncertainly [Rate =0.2m/year]	10	10	10	10
	Total allowance	50	51	62	51
2118	S1	0.1	1.3	12	0.5
	S2	0	0	0	0
	S3	90	90	90	90
	Uncertainly [Rate =0.2m/year]	20	20	20	20
	Total allowance	110	111	122	111

Coastal Vulnerability Assessment

Based on the CHRMAP guidelines and the completed coastal hazard mapping, RHDHV completed a coastal vulnerability assessment for each asset that was identified as being at risk from erosion and inundation over three planning periods (2018, 2068 and 2118).

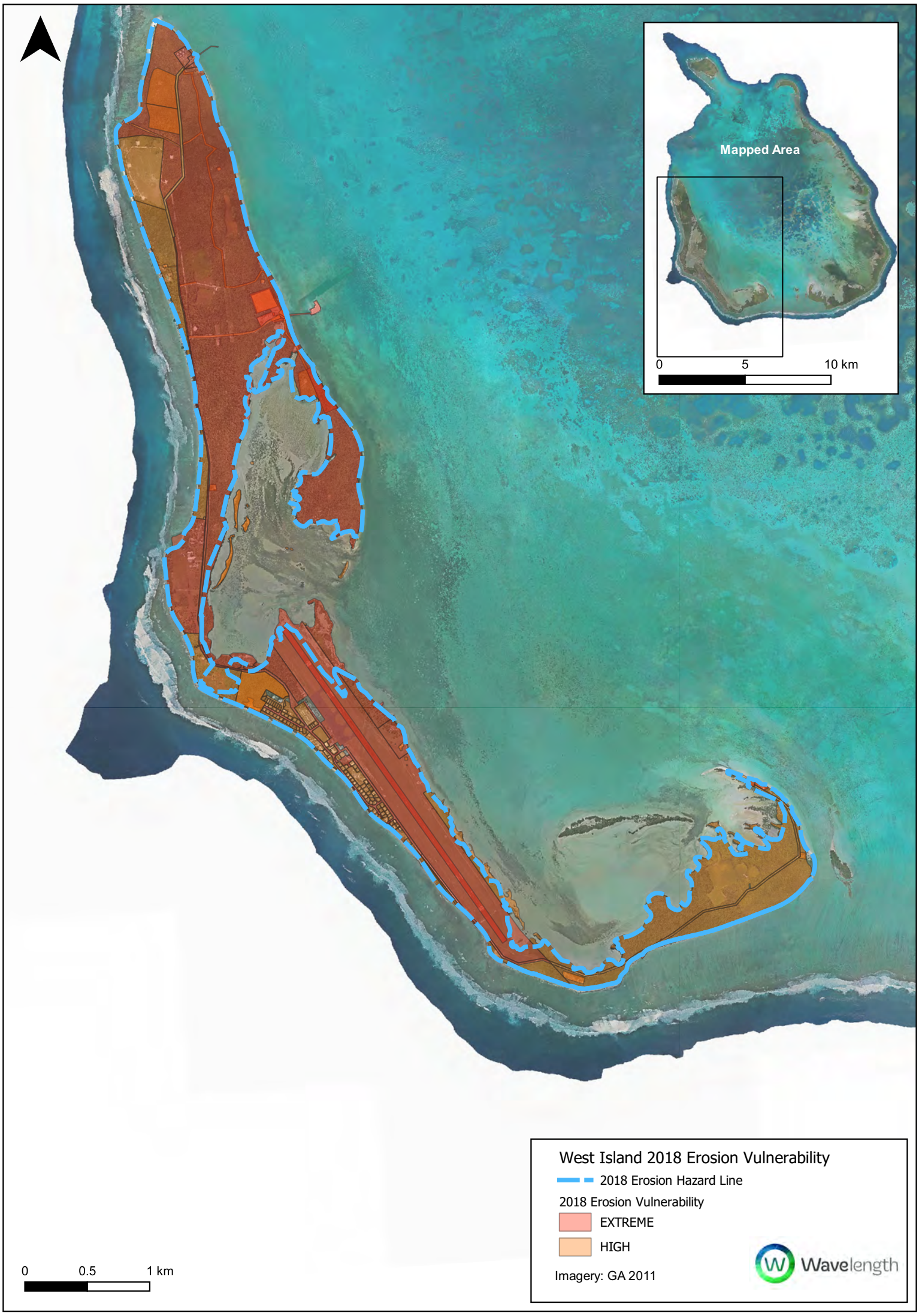
Summary

The completed study, the CVS, provides a wealth of data that has been used for this CHRMAP and a useful classification for each asset that was identified as being at risk from erosion and inundation over the 100-year planning horizon.

Much data exists in the full report, including extensive mapping and modeling outputs. The full CVS is also available here (https://www.wa.gov.au/government/document-collections/indian-ocean-territories-regional-planning).

Appendix B

Appendix B Erosion And Inundation Hazard Maps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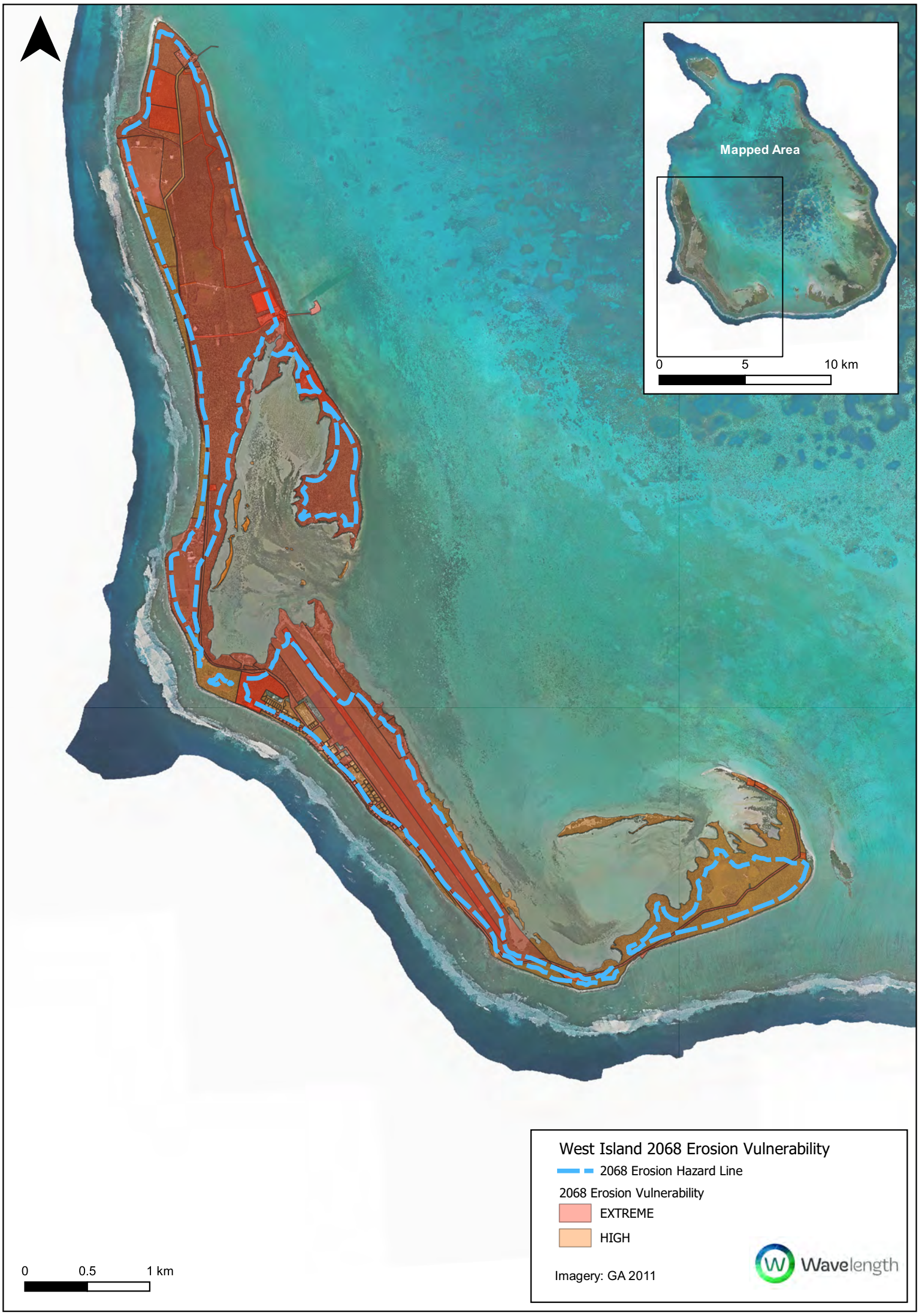
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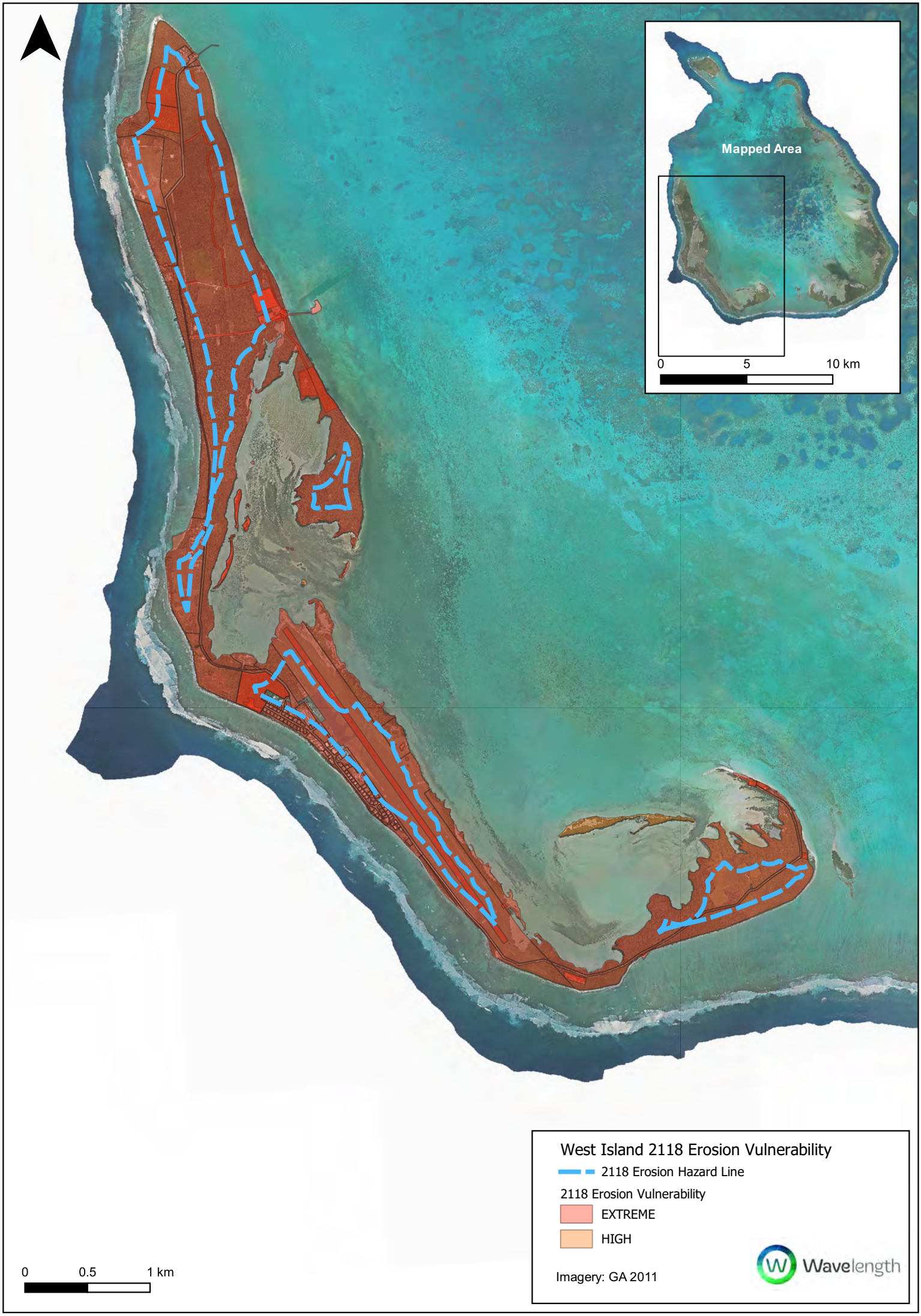
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2118 Erosion Hazard Line
2118 Erosion Vulnerability
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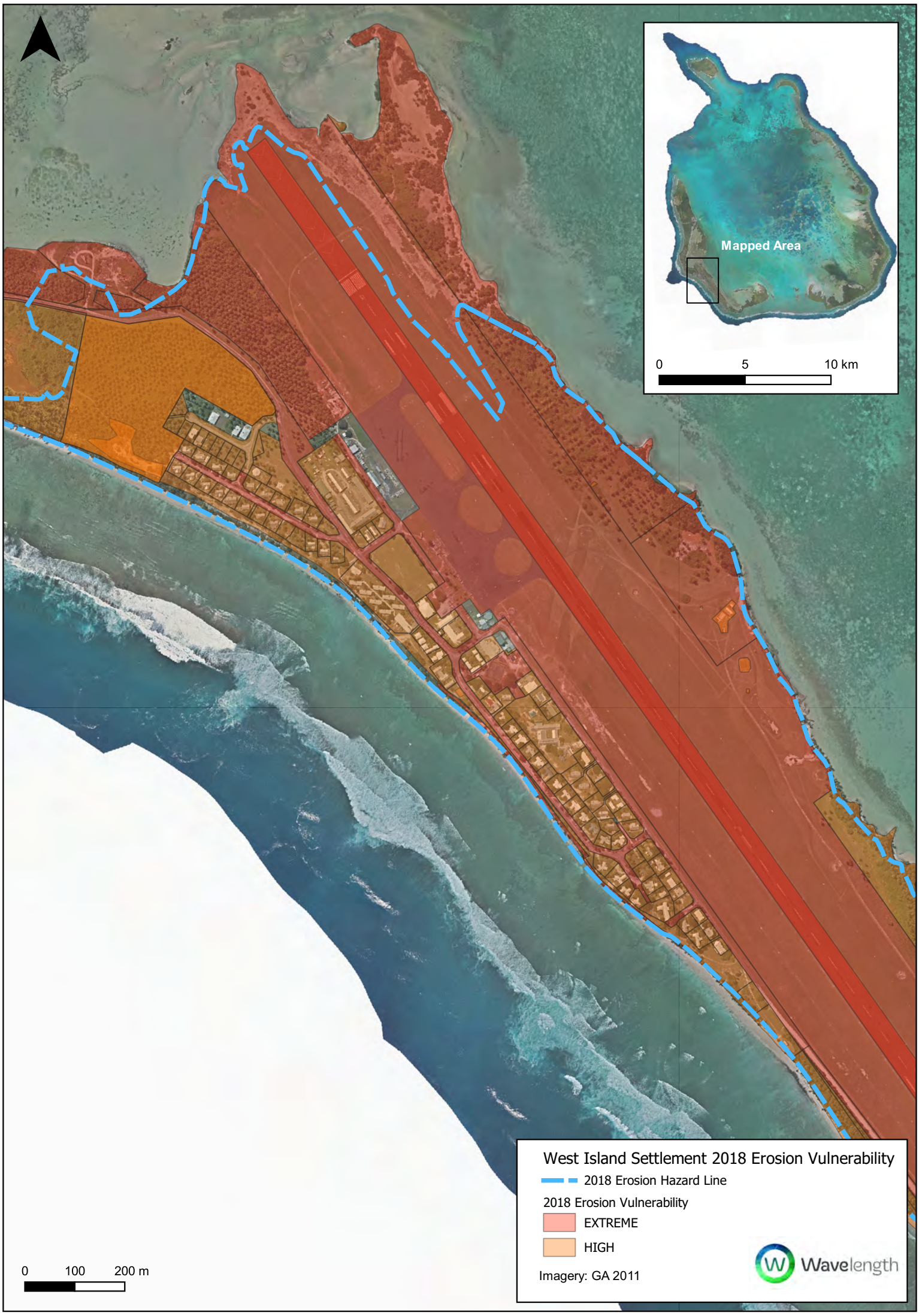
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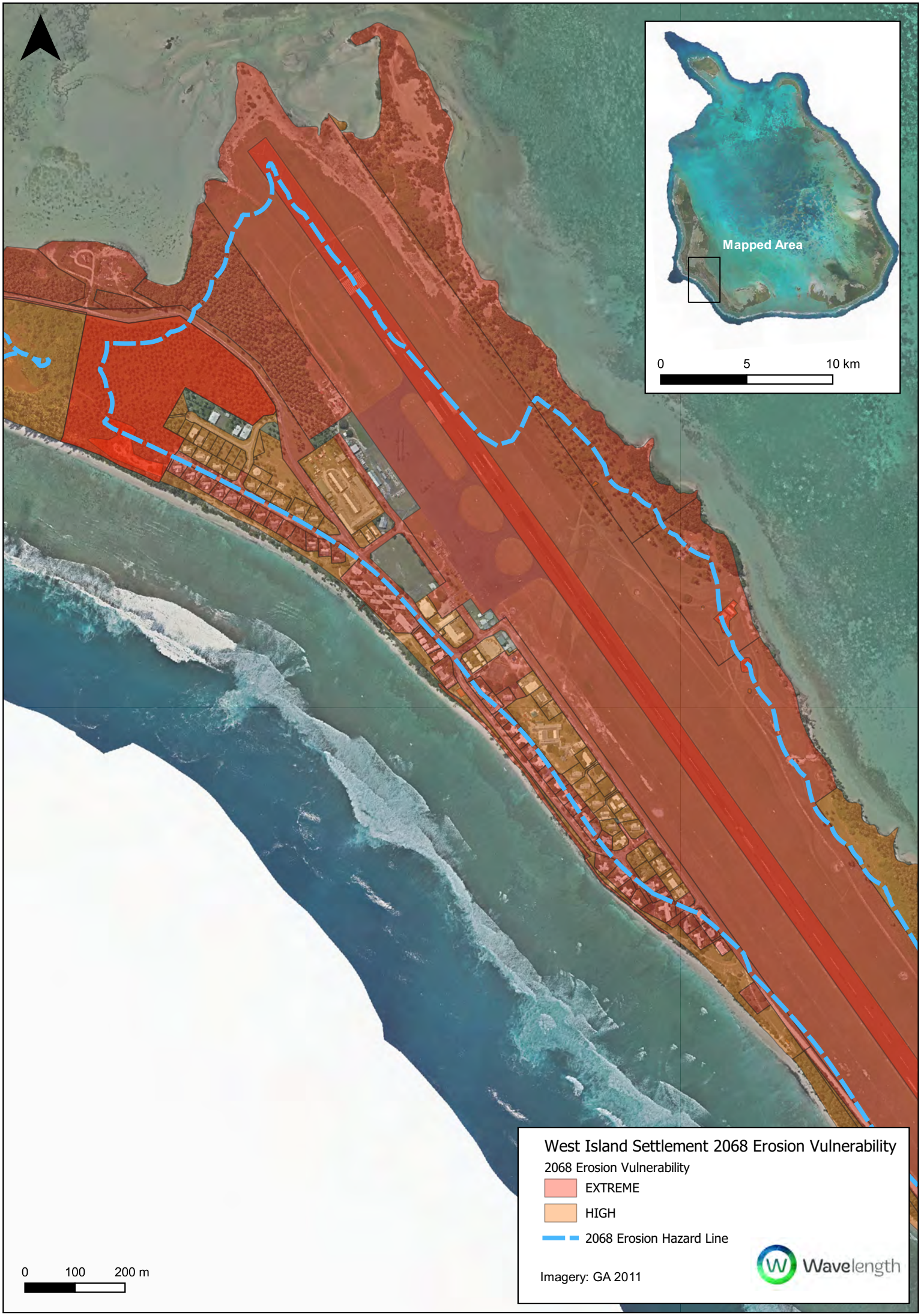
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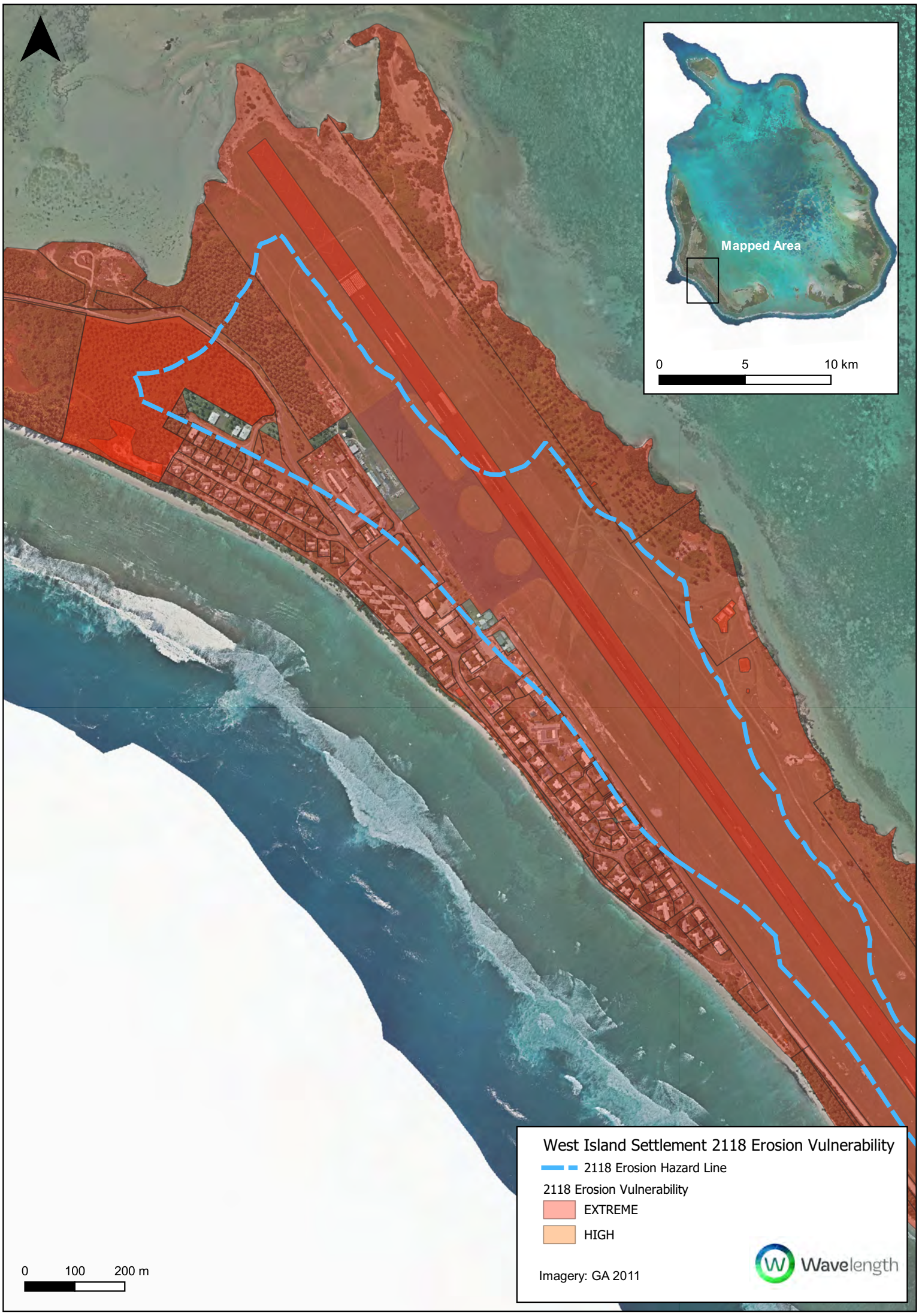
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2018 Erosion Vulnerability
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Reserve Lot
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Home Island 2068 Erosion Vulnerability
2068 Erosion Hazard Line
2068 Erosion Vulnerability
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Imagery: GA 2011
Wavelength


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Reserve Lot
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Home Island 2118 Erosion Vulnerability
2118 Erosion Hazard Line
2118 Erosion Vulnerability
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Imagery: GA 2011
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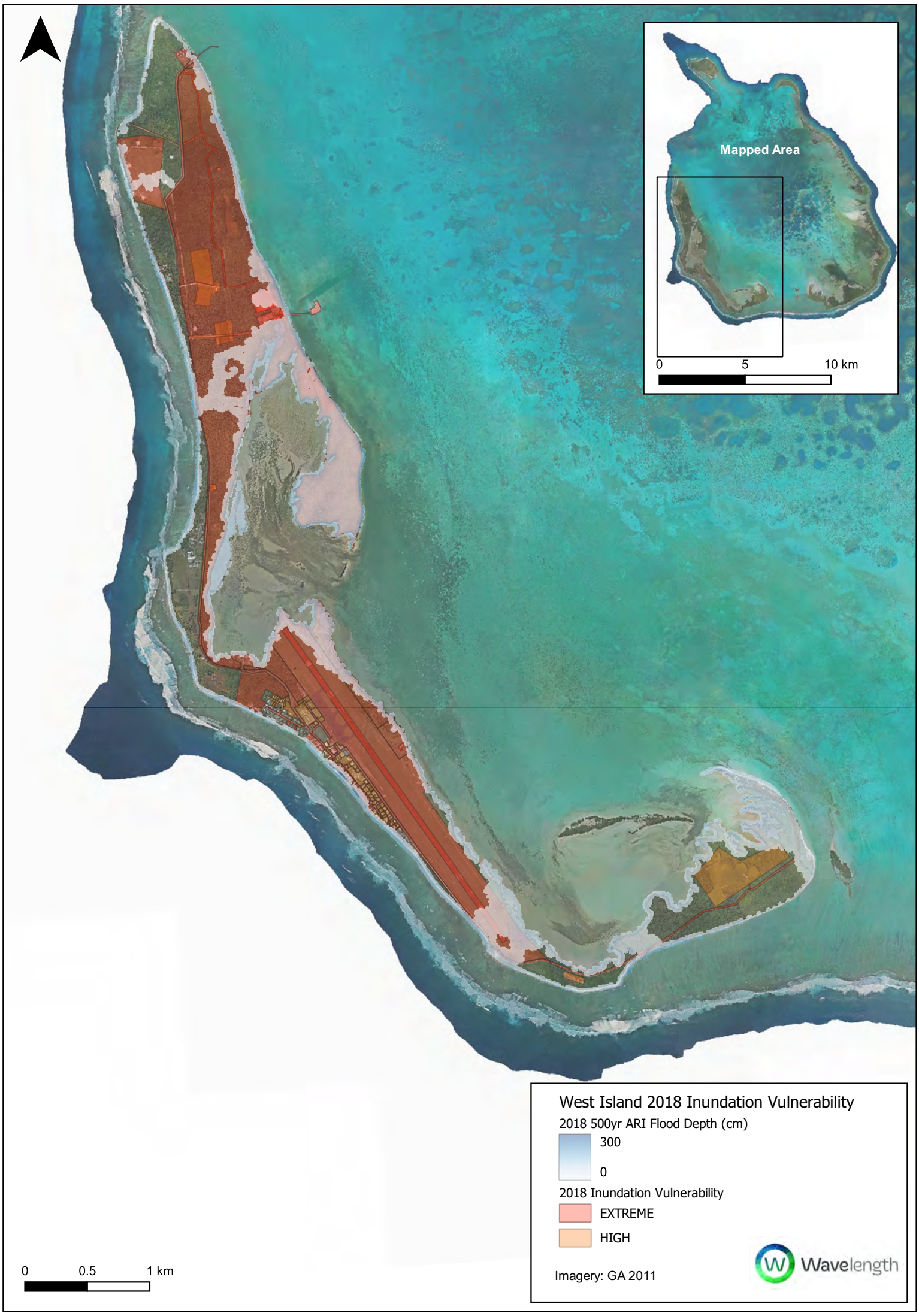
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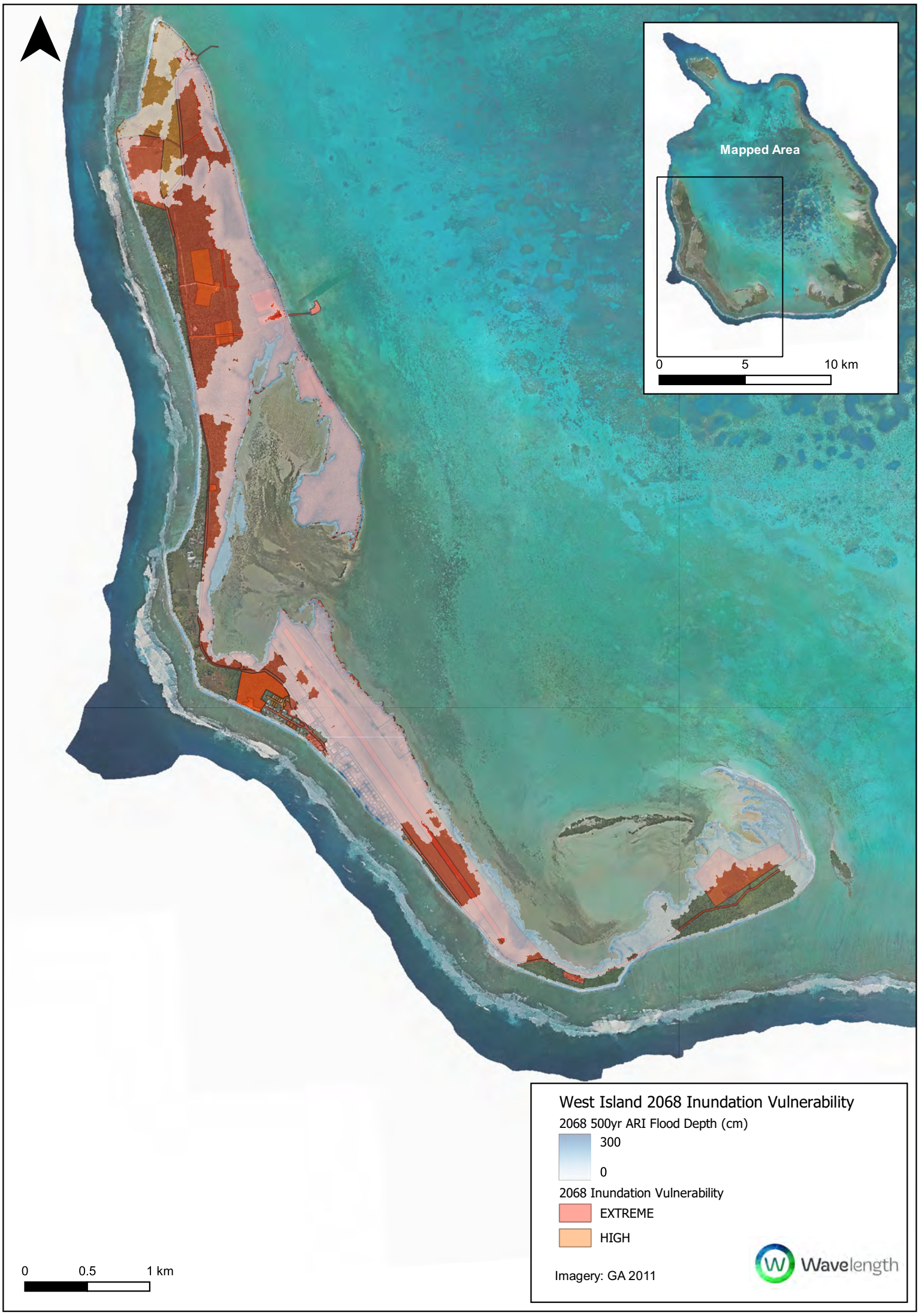
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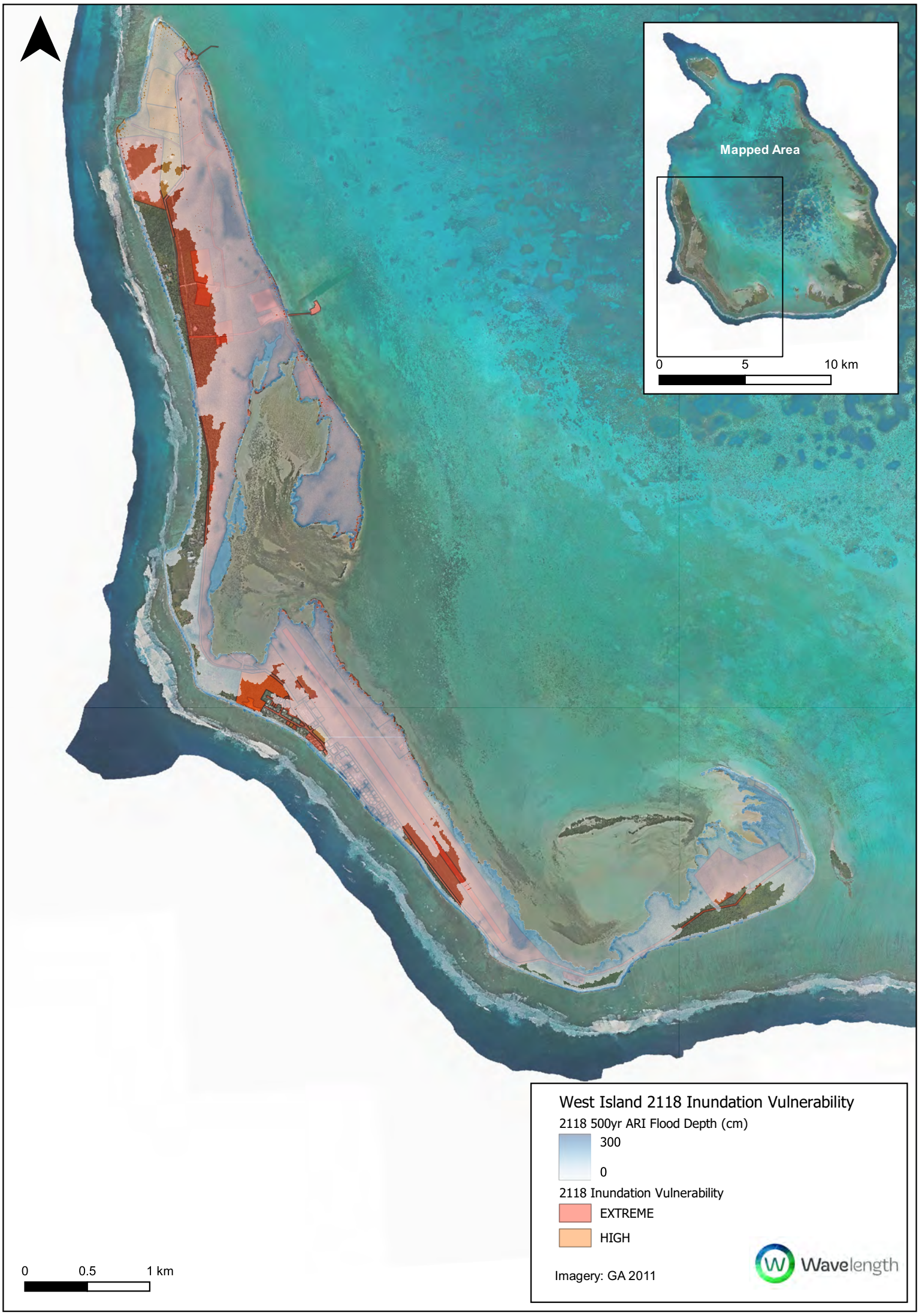
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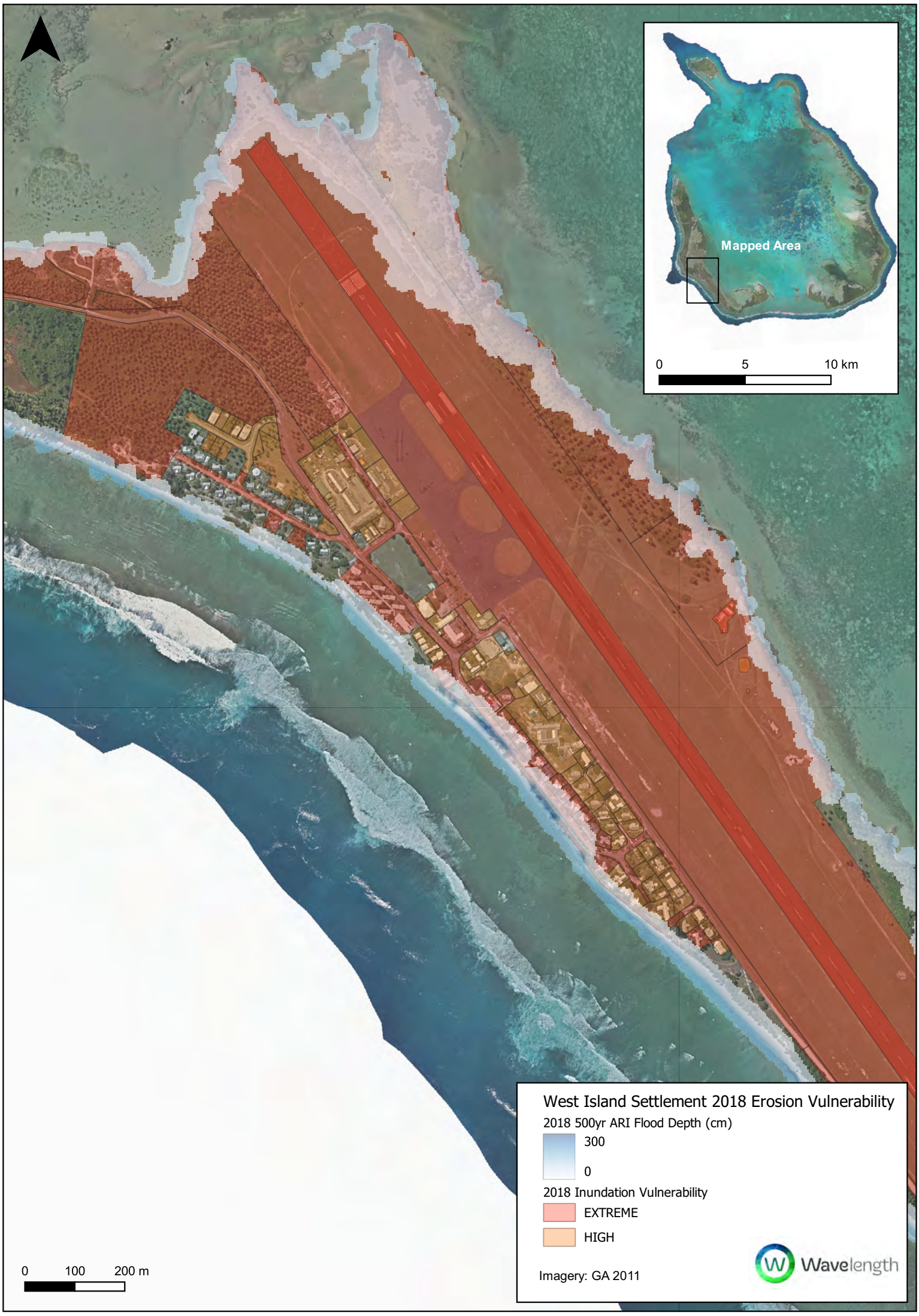
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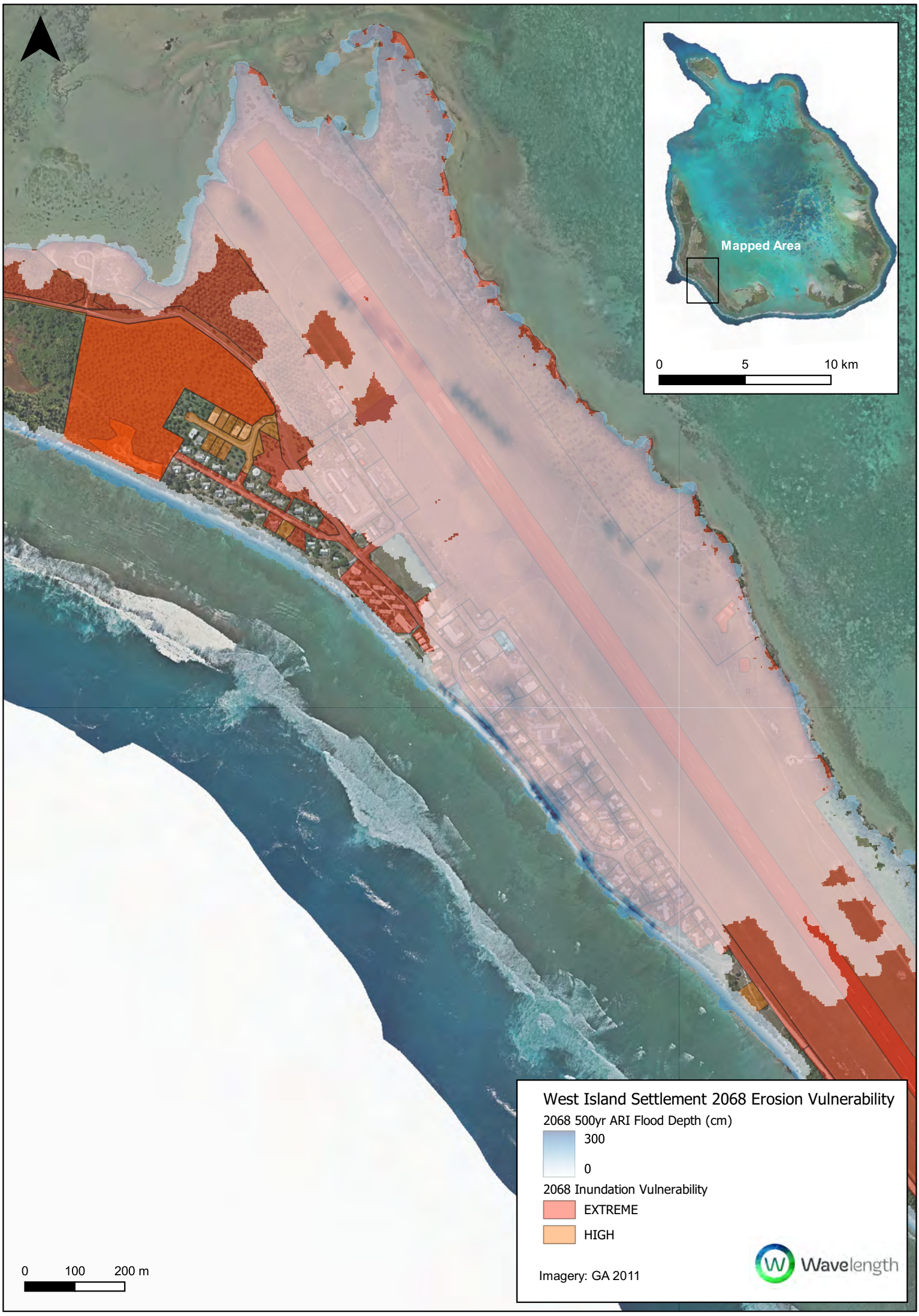
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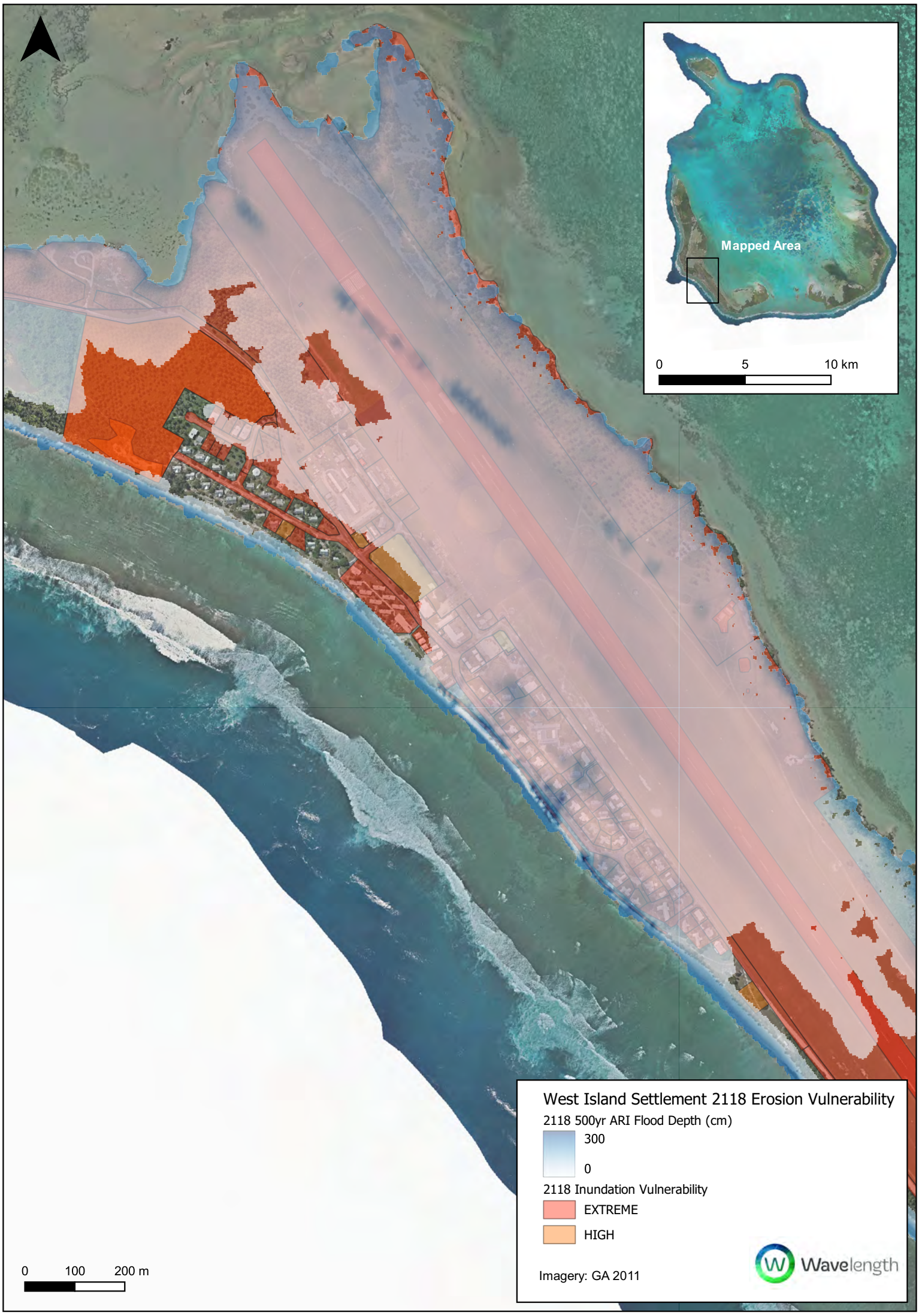
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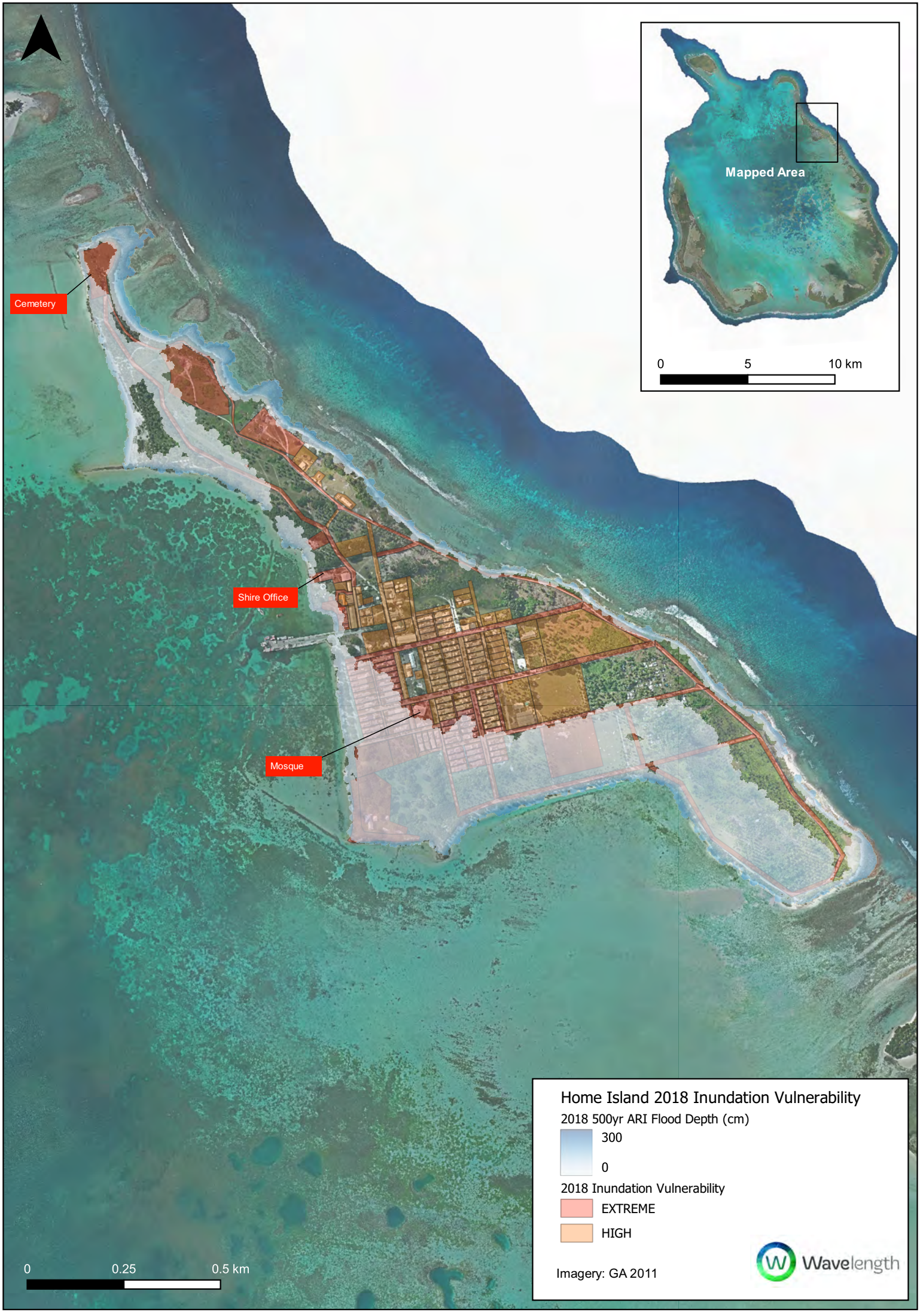
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2018 500yr ARI Flood Depth (cm)
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2018 Inundation Vulnerability
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Imagery: GA 2011
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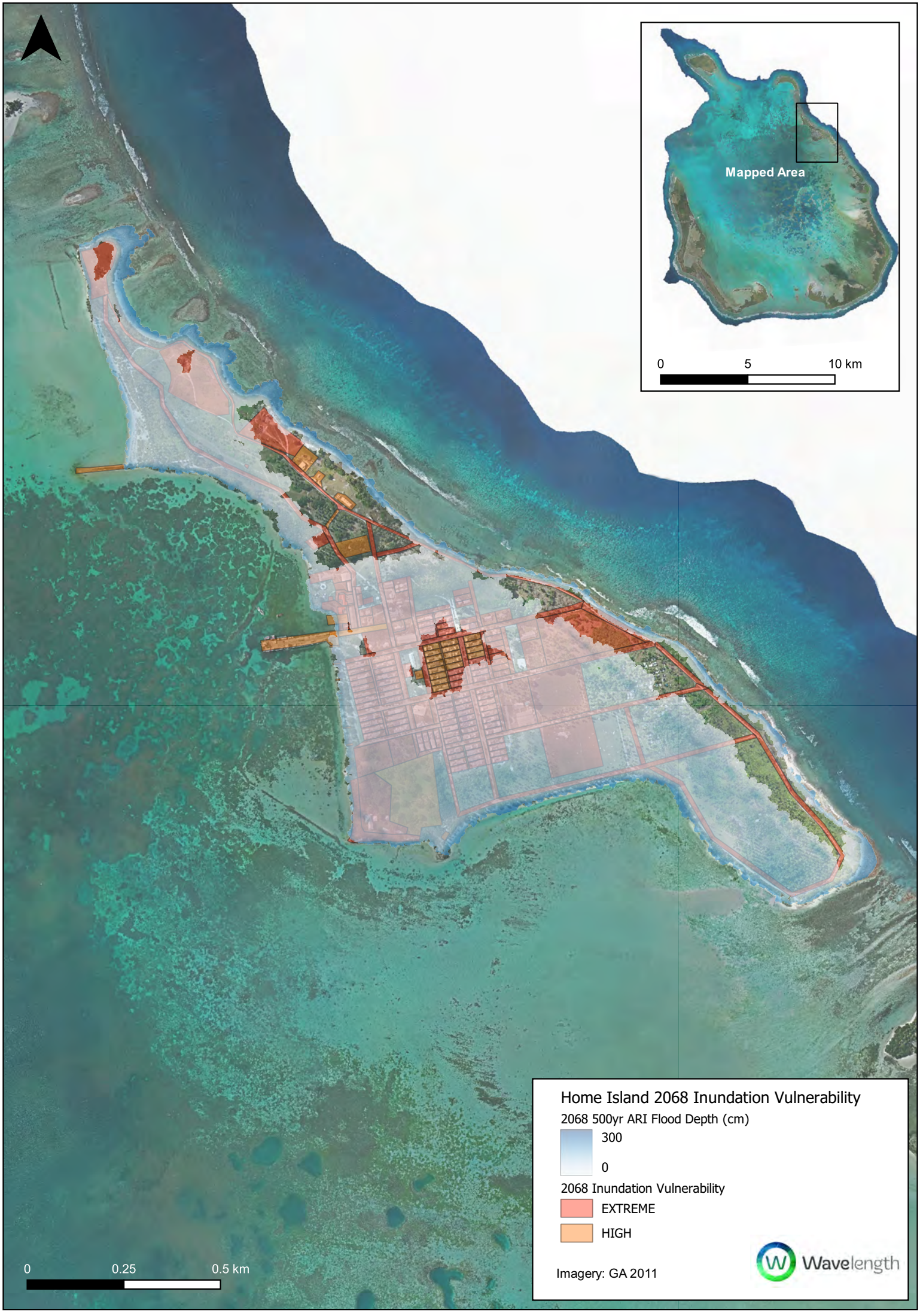
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Imagery: GA 2011
Wavelength


Mapped Area
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Home Island 2118 Inundation Vulnerability
2118 500yr ARI Flood Depth (cm)
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2118 Inundation Vulnerability
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Imagery: GA 2011
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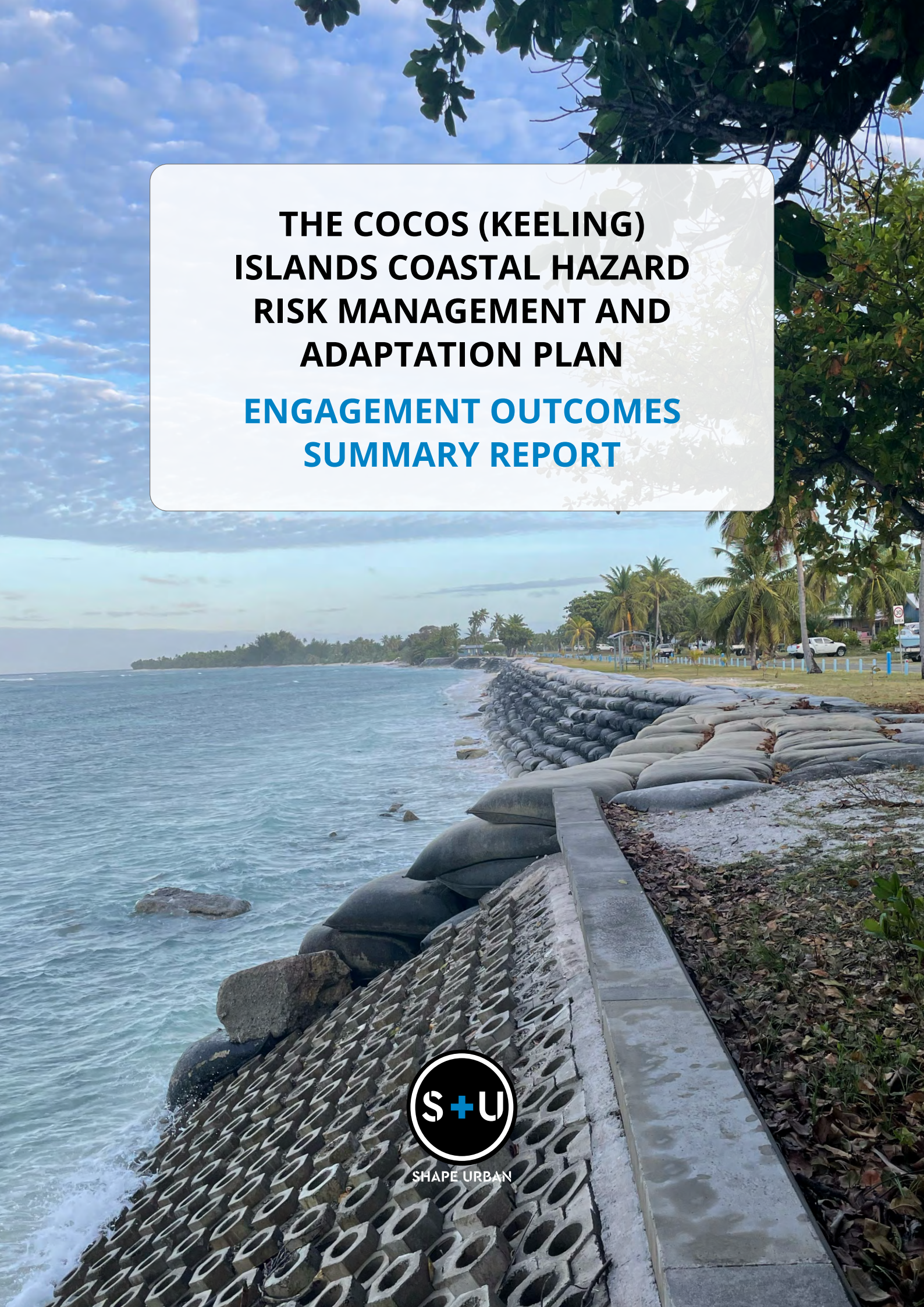
Appendix C

Appendix C The Cocos (Keeling) Islands Coastal Hazard Risk Management and Adaptation Plan Engagement Outcomes Summary Report



THE COCOS (KEELING) ISLANDS COASTAL HAZARD RISK MANAGEMENT AND ADAPTATION PLAN

ENGAGEMENT OUTCOMES SUMMARY REPORT

SHAPE URBAN

ACKNOWLEDGEMENT

This document has been prepared with the support of many people. Shape Urban and Wavelength wish to acknowledge the contributions of the CKI community and the support of the Australian Government and Department of Planning, Lands and Heritage in preparing this document.

The project in the Indian Ocean Territories has been funded by the Australian Government through the Department of Infrastructure, Transport, Regional Development, Communications and the Arts, in partnership with the Western Australian Department of Planning, Lands and Heritage and the Shire of Cocos (Keeling) Islands.

Shape Urban acknowledges the Cocos Malay people who inhabit the land on which we have worked for this project. We recognise their cultural heritage, beliefs and relationship to the islands, and the importance of the islands to the Cocos Malay people today and into the future.

DOCUMENT TITLE

The Cocos (Keeling) Islands Coastal Hazard Risk Management and Adaptation Plan Engagement Outcomes Summary Report

NO.	AUTHOR	REVIEWED BY	DATE	APPROVALS
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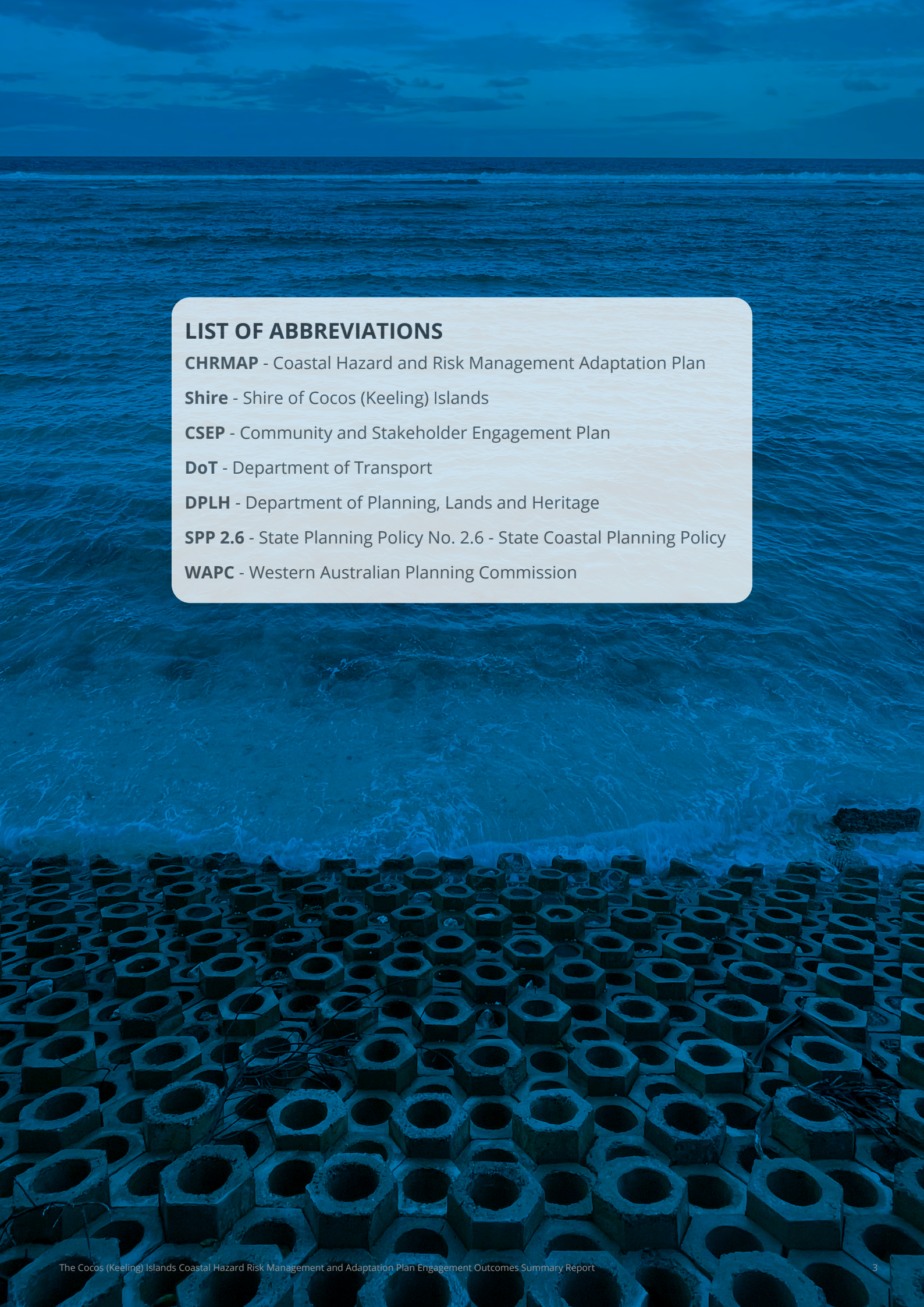


LIST OF ABBREVIATIONS

CHRMAP - Coastal Hazard and Risk Management Adaptation Plan

Shire - Shire of Cocos (Keeling) Islands

CSEP - Community and Stakeholder Engagement Plan

DoT - Department of Transport

DPLH - Department of Planning, Lands and Heritage

SPP 2.6 - State Planning Policy No. 2.6 - State Coastal Planning Policy

WAPC - Western Australian Planning Commission

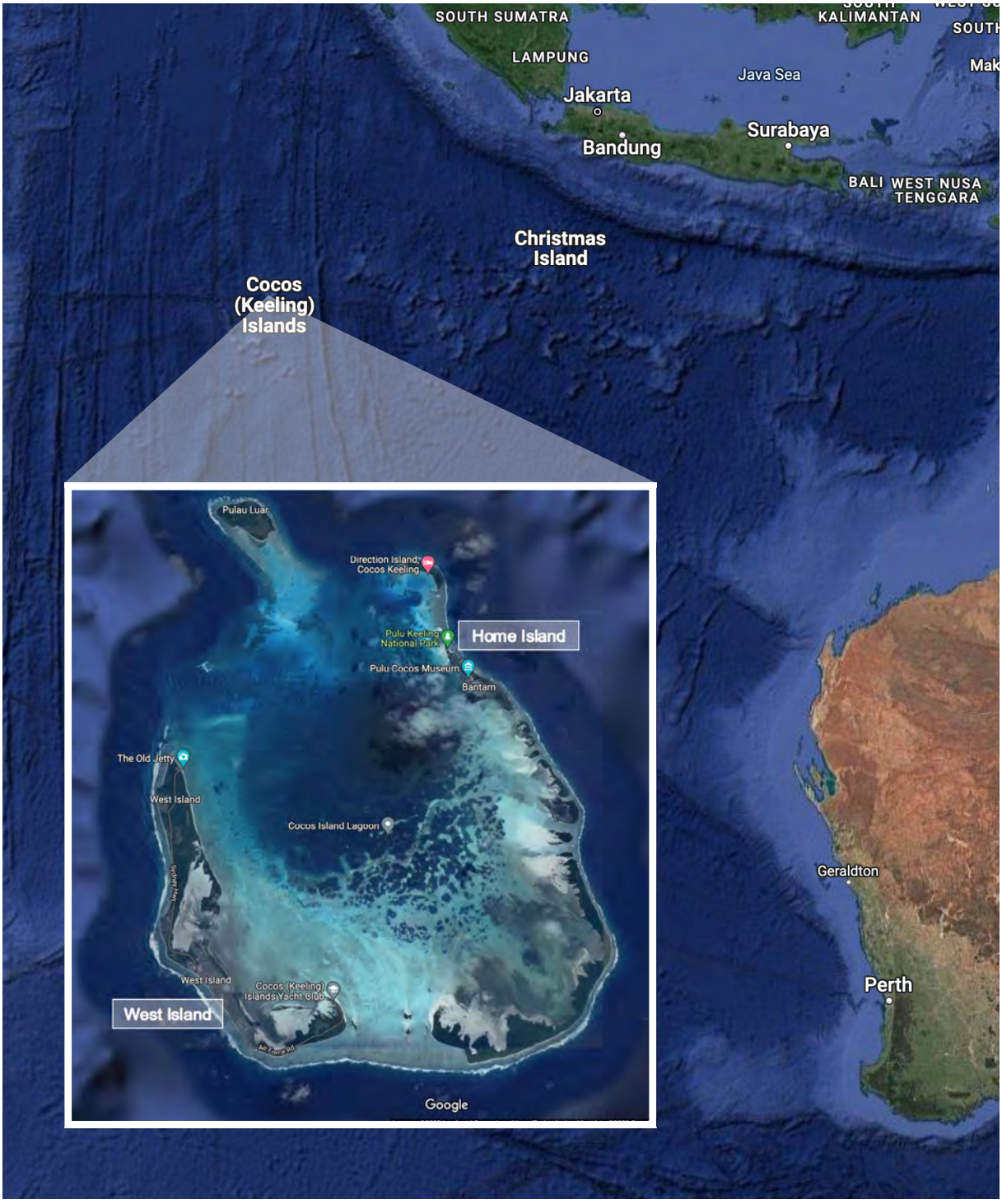


Figure 1 The Southern Keeling Islands showing West Island and Home Island (Google, 2022)

PROJECT BACKGROUND

The Cocos (Keeling) Islands (CKI) consists of two atolls made up of 27 coral islands. West Island and Home Island are in the South Keeling Islands and are inhabited by approximately 593 people (ABS, 2021). Figure 1 depicts a map of the CKI.

The Australian Government in collaboration with the Shire of CKI and the Western Australian Department of Planning, Lands and Heritage (DPLH) are undertaking coastal management planning for the CKI (refer Figure 2).

PHASE 1

The Australian Government commissioned the *Cocos (Keeling) Islands Coastal Vulnerability Study - Coastal Vulnerability Assessment Report* (Royal HaskoningDHV, 2021) (the CVA Report) which identifies the areas of West Island and Home Island at risk to the impacts of inundation and coastal erosion over a 100-year planning timeframe.

PHASE 2

This project progresses coastal planning; with the development of a *Coastal Hazard Risk Management Adaptation Plan* (**CHRMAP**) for CKI.

The CHRMAP for CKI will confirm that the consequence ratings of the CVA Report reflects community and stakeholder values. It will identify coastal erosion and inundation risks and challenges and proposed adaptation measures for Home Island and West Island.

The CHRMAP will also consider vulnerability and management for the other islands as part of the overall management response.

The CHRMAP will give decision makers, administrators and landowners on CKI a framework for sustainable coastal development into the future.

Figure 2 Project Phases for CKI Coastal Planning

CHRMAP STAGES & ENGAGEMENT APPROACH

A critical part of this project is the engagement with the local community and relevant stakeholders.

The engagement approach aligns with the framework of the Shire's strategic planning framework and the CHRMAP process in accordance with the Western Australian State Government's coastal planning policy framework - State Planning Policy No. 2.6 - State Coastal Planning Policy (SPP 2.6) and the CHRMAP Guidelines.

Engagement for the CHRMAP investigates the matters raised in previous engagement, and confirm or update risk assessments to reflect community and stakeholder values.

The project team has carried out stakeholder engagement throughout the CHRMAP stages. Figure 3 and Table 1 depict an overview of engagement approach in each of the CHRMAP stages to affirm the deliverables.

The outcomes of all engagement activities will inform the next steps of CHRMAP process.

The engagement activities and outcomes are detailed in the following reports:

- the *Provision Of Coastal Hazard Risk Management And Adaptation Planning In The Cocos (Keeling) Islands Engagement Outcomes Report* (Shape Urban, 2023a)
- *The Cocos (Keeling) Islands Coastal Hazard Risk Management and Adaptation Plan Stage 5 Engagement Outcomes Report* (Shape Urban, 2023b)

This report summarises the key outcomes of all the engagement activities undertaken in the CHRMAP stages to date.

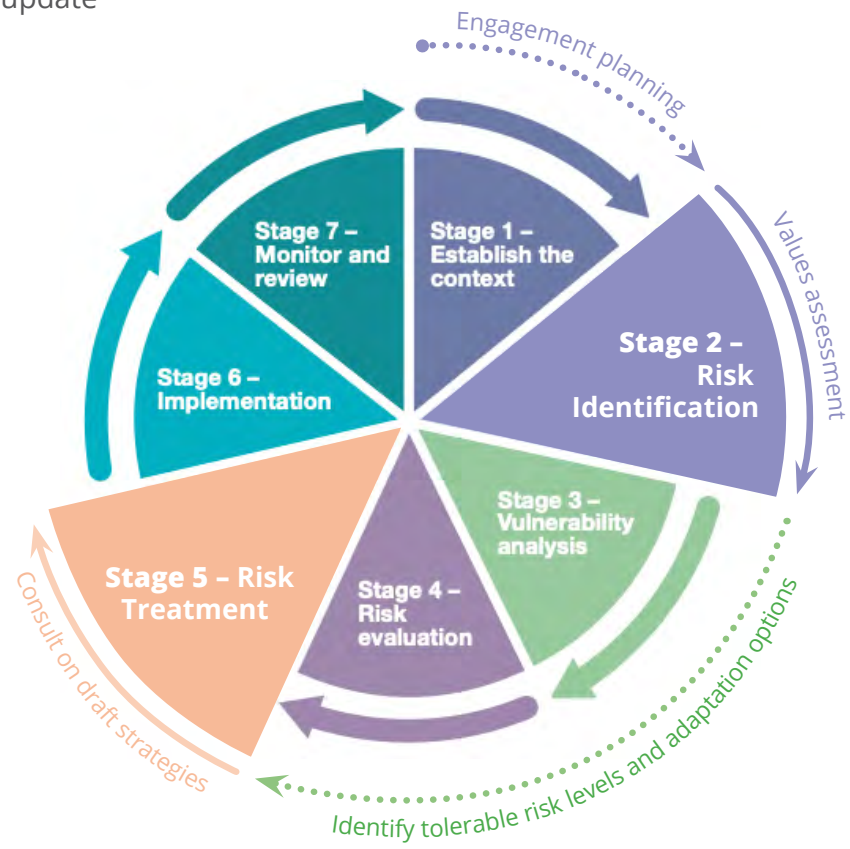


Figure 3 Engagement approaches in CHRMAP Stages adapted from the CHRMAP Guidelines (WAPC, 2019)

Table 1 Engagement in each of the CHRMAP stages

CHRMAP STAGE	DELIVERABLE	STAKEHOLDER/ AUDIENCE	ENGAGEMENT METHODS
Stage 1 – Establish the Context	• Develop Community & Stakeholders Engagement Plan	• Project Control Group • Australian Government	• Meetings
	• Build on information - informed values related to coastal assets	• Australian Government • State Government • Elected Members • Shire • CRG • Community groups incl Elders • Landowners • Businesses • General community • Schools • Service providers • Funding bodies • Other coastal stakeholders	• Shire webpage • Social Pinpoint (online platform - maps, asset points, surveys) • Introductory letter/ email • Preparation of supporting material (posters, infographics in English and Cocos Malay, reproduction of Coastal Vulnerability Assessment maps) • Social media - primarily Facebook • Stakeholder meetings in Perth and on-island • Workshops in Perth • On-island CRG workshops, information sessions and drop-in sessions • Meetings/ telephone calls - Perth • Open Day on-island • Elected Member briefings
Stage 2 – Risk Identification	• Updated list of coastal assets		
Stage 3 – Vulnerability Analysis	• Update risks, vulnerability and consequences		
Stage 4 – Risk Evaluation	• Consider tolerances and acceptance of risk in relation to values, assets and Australian Government needs		
Stage 5 – Risk Treatment	• Identify adaptation options and pathways for valued assets • Multicriteria analysis considering values, assets and needs • Cost benefit analysis of risk treatment options • Assess funding options		
Stage 6 – Implement-ation	• Prepare short term implementation plan • Identify long term pathways		
Stage 7 – Monitor and Review	• Develop monitoring plan	• Coastal managers (TBD)	• NA
CHRMAP Reporting and Adoption	• Integrate information into draft CHRMAP • Advertise draft CHRMAP • Finalisation and adoption of CHRMAP		

ENGAGEMENT OBJECTIVES

The engagement process was tailored to the unique local community needs on CKI, and to the decision making requirements of the Australian Government and State Government agencies with service delivery agreements (SDAs) with the Australian Government.

The overall objective of the engagement process is to facilitate an understanding of coastal hazards and risks, and to select appropriate risk management and adaptation strategies to respond to the identified coastal risks.

Specific engagement objectives are to:

- **Inform** the community and stakeholders about the extent of potential coastal hazards and the adaptation strategies available to respond to those hazards;
- **Explain** Australian, state and local governments' responsibilities and capacity to respond to potential coastal hazards, per the CKI governance framework;
- **Understand** community and stakeholder values along the coastlines; and
- Invite the community to bring their **local knowledge, expertise and lived experience** to the process and give them adequate opportunity to contribute in a way that suits their needs and circumstances.
- Ensure that the community and stakeholders' **advice and recommendations are incorporated into the decisions** to the maximum extent possible, and that this encourages a sense of community ownership for the CHRMAP
- The engagement will be **fair, equitable, transparent and honest**
- **Develop positive relationships** between all tiers of government and the community
- Gain an understanding of the community's preferred methods of **continued engagement** with local, state and Australian governments

COMMUNICATION METHODS

PROJECT WEBSITE

The Social Pinpoint engagement platform (Figure 4) was used as the primary location for all project information, including:

- background and links
- registrations of interest
- hazard maps
- an interactive mapping exercise,
- frequently asked questions (FAQs)
- common terms used

SOCIAL MEDIA

Social media, specifically the Shire's Facebook page and the Buy, Swap and Sell page, were used to promote the project and opportunities to be involved.

PUBLIC NOTICES

The Shire posted project launch posters/ information at the supermarket and other key locations on Home Island, at the ferry terminal and on the blackboard on West Island, and at its offices on both islands.

NEWSLETTER

Articles were published in "The Atoll" newsletter in English and Cocos Malay throughout the engagement process. The articles encouraged community members to learn, engage and contribute by visiting the project website.

Figure 4 Project website and online interactive mapping tool

WORKSHOPS & SESSIONS

Project information and updates were communicated at the following workshops and sessions:

WORKSHOPS & SESSIONS	DATE	LOCATION
DITRDCA Workshop	23 Aug 2022	Perth
State Government & Key Stakeholders Workshop	24 Aug 2022	Perth
CRG Workshops	3 & 5 Sep 2022	CKI
Elders Workshops	11 & 14 Nov 2022	CKI
DITRDCA Meeting	14 Feb 2023	Perth
Home Island Sessions	22 & 27 Feb 2023	CKI
West Island Sessions	23 & 27 Feb 2023	CKI

DIRECT COMMUNICATION

The project team communicated directly with community members on-island to invite nominations for a community reference group (CRG), or to set up meetings.

The team also sent email invites to workshops for identified Australian and state government agency stakeholders.

MEETINGS

Individual meetings were undertaken on-island with community members and stakeholders as required or requested. The meetings provided the project team with the opportunity to share project information and get feedback on values and the viable potential risk treatment options.

OTHER

The manager of the Community Resource Centre on-island shared project communications materials provided by the project team with community members.

The Shire's project manager also engaged directly with community about the project and advised them of on-island engagement and how to register to be involved.

In addition to the workshops on-island, the project team also hosted 'drop in' information sessions on Home Island and West Island.

LANGUAGE

Translation services for both written and spoken content were tailored for engaging the culturally and linguistically diverse community effectively, including workshops and one-on-one meetings.

ENGAGEMENT ACTIVITIES

STAGE 2 - RISK IDENTIFICATION

The purpose of Stage 2 engagement was to raise awareness of the project, understand how assets are valued along the coastline, and introduce the viable potential risk treatment options to stakeholders.

BRIEFING

Participants were introduced to the CHRMAP project including:

- Vulnerability mapping in the CVA Report for assets of interest on both islands
- SPP2.6 and CHRMAP Guidelines and the coastal risk management
- Examples of adaption pathways, with trade offs for each
- Multi-criteria assessment (MCA) process
- the next steps, including on-island engagement and future updates

ENGAGEMENT TASKS

Participants were tasked to contribute to the identification of the following:

- Values and asset mapping (including missed or sacrificial assets)
- Asset prioritisation
- Open discussion on proposed solutions for the next 100 years

Full report: see Attachment A

Figure 5 Council staff and Youth Council participated in the value mapping activity.

STAGE 5 - RISK TREATMENT

The purpose of Stage 5 engagement is to discuss the proposed risk treatment options by the coastal engineer, including how the multi-criteria assessment were formulated and associated cost to each treatment options.

BRIEFING

Participants were provided updates to the CHRMAP project including:

- Community values and assets identified from the last engagement
- Whole-of-settlement approach
- Multi-criteria assessment (MCA) methodology and results
- Shortlisted adaptation options
- The indicative costing, funding and remit for each option
- the next steps, including the finalisation of CHRMAP

ENGAGEMENT TASKS

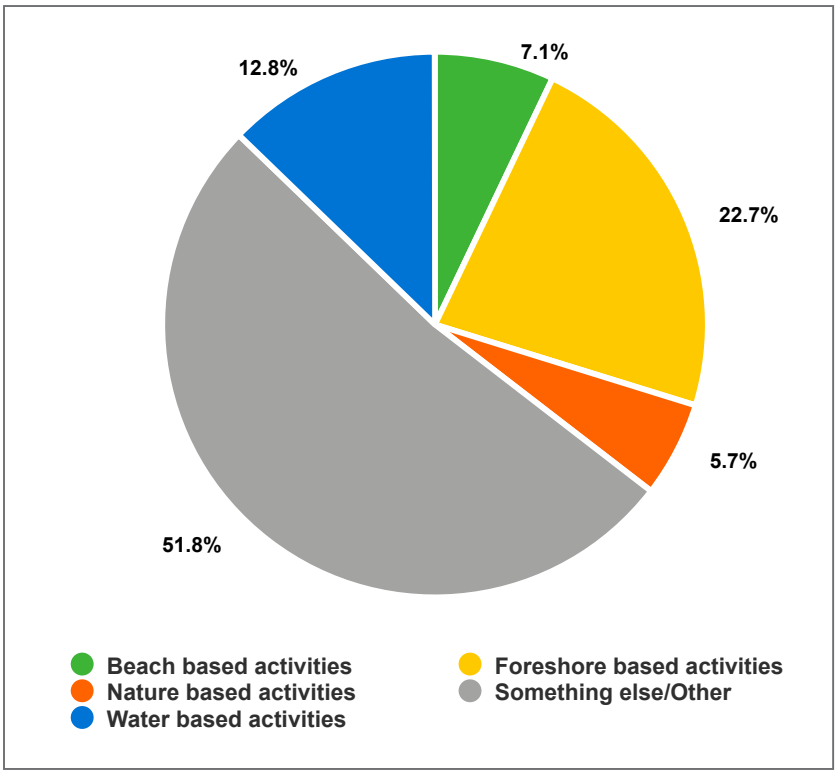
Participants were asked to contribute to the following:

- MCA criteria
- Preferred short and long-term adaptation options
- Open discussion

Full report: see Attachment B

Figure 6 Project team presented the MCA methodology and results

COMMENT CATEGORY BREAKDOWN



WORD CLOUD

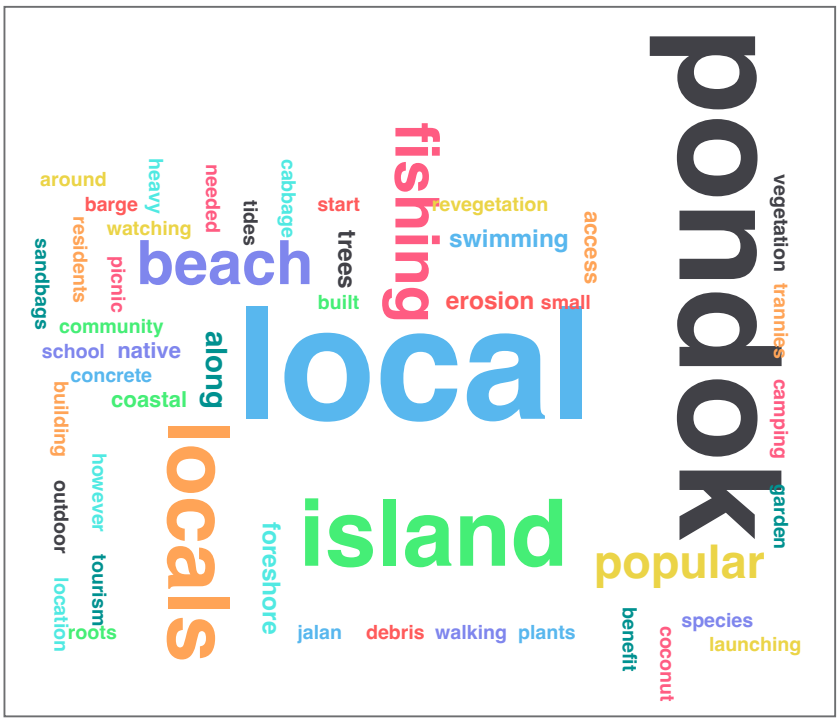


Figure 7 Result of the online engagement - value and asset mapping from 1 Jul 2022 to 28 Feb 2023

ENGAGEMENT KEY OUTCOMES

The following summarises key outcomes of all engagement activities under headings:

- Government and Key Stakeholders
- Prioritised Values and Assets
- Preferred Management Options
- Concerns

Detailed outcomes are available in the Attachment A and Attachment B in the end of this report.

GOVERNMENT AND KEY STAKEHOLDERS

Adaptation pathways will factor in the sustainability of the CKI community, with particular focus on the development of reasonable staged pathways.

Information gap regarding drainage and groundwater to be investigated, as this may impact on the suitability of adaptation options.

Assets at risk in the short term were also identified, such as the jetties and the medical clinic on West Island, which are assets of critical importance to living on the islands.

Full support for the development of a CHRMAP as a proactive Australian Government response to coastal risks and their management for the CKI community and stakeholders.

PRIORITISED VALUES & ASSETS

Recreation - The use of beach and foreshore areas for recreation, fishing, boat launching and recreational sporting activities are highly valued on both islands

Environment - The ocean, lagoon, views, landscapes, foreshore vegetation and protection of the natural environment and vegetation are highly valued

Amenities and infrastructure - The yacht, jukong and sailing clubs and other sporting/ recreation clubs are highly valued

Access - There is a strong desire for access along the coastal and lagoon foreshore areas, including for boat launching and access to other islands

Cultural and religious significance - the cemetery at Pulu Gangsa and the mosque on Home Island were raised as important assets, with comments raised by the Imam and Elders about the regular flooding experienced at the cemetery

Coastal process changes - The CKI community is concerned about the impacts of coastal change, with community members observing felled trees around the coastlines of the islands, sandbags that had been impacted and how much the coastlines on Home Island and West Island have changed over time.

Coastal management - The CKI community had a clear consensus on things being done to manage vulnerability risks (beyond making plans)

HOME ISLAND ASSETS & VALUE MAPPING

Figure 8 is the Home Island map collated all assets and values identified from the online mapping tool and engagement workshops. The map is also showing 2018, 2068 and 2118 erosion hazard lines and 2068 inundation hazard risk area.

PRIORITISED ASSETS

1. Pulu Gangsa Cemetery
2. Desalination pumps
3. Refuse stations
4. Potable water pump station
5. Waste water treatment plant
6. Fuel station
7. Power station
8. Oceania House
9. Mosque
10. Home Island Jetty

WATER BASED ACTIVITIES

1. Boogie boarding
2. Sandy Point picnic area
3. Swimming spot
4. Jukong and sailing club

BEACH BASED ACTIVITIES

1. Pondok Nek Jamil picnic spot
2. Pondok Abang viewing platform
3. Ujung Waru picnic area

FORESHORE BASED ACTIVITIES

1. Fishing/netting spot
2. Beach debris collection area
3. KampongBaru - Jukong launch area
4. Jalan Balok Mem - fitness use
5. Local boat ramp
6. Beach debris project - Pasir Nek Ayak

NATURE BASED ACTIVITIES

1. Bird watching area

SOMETHING ELSE/OTHER

1. Green waste and rubble site
2. Revegetation area
3. Tanah Tinggi - highest point on island
4. Large native calophyllum trees
5. Submerged breakwater
6. Reclaimed foreshore
7. Heritage listed area
8. Old Bungalow site - Copra Manager
9. Chicken and Garden Plots
10. Old Home Island School building
11. Local Pondok

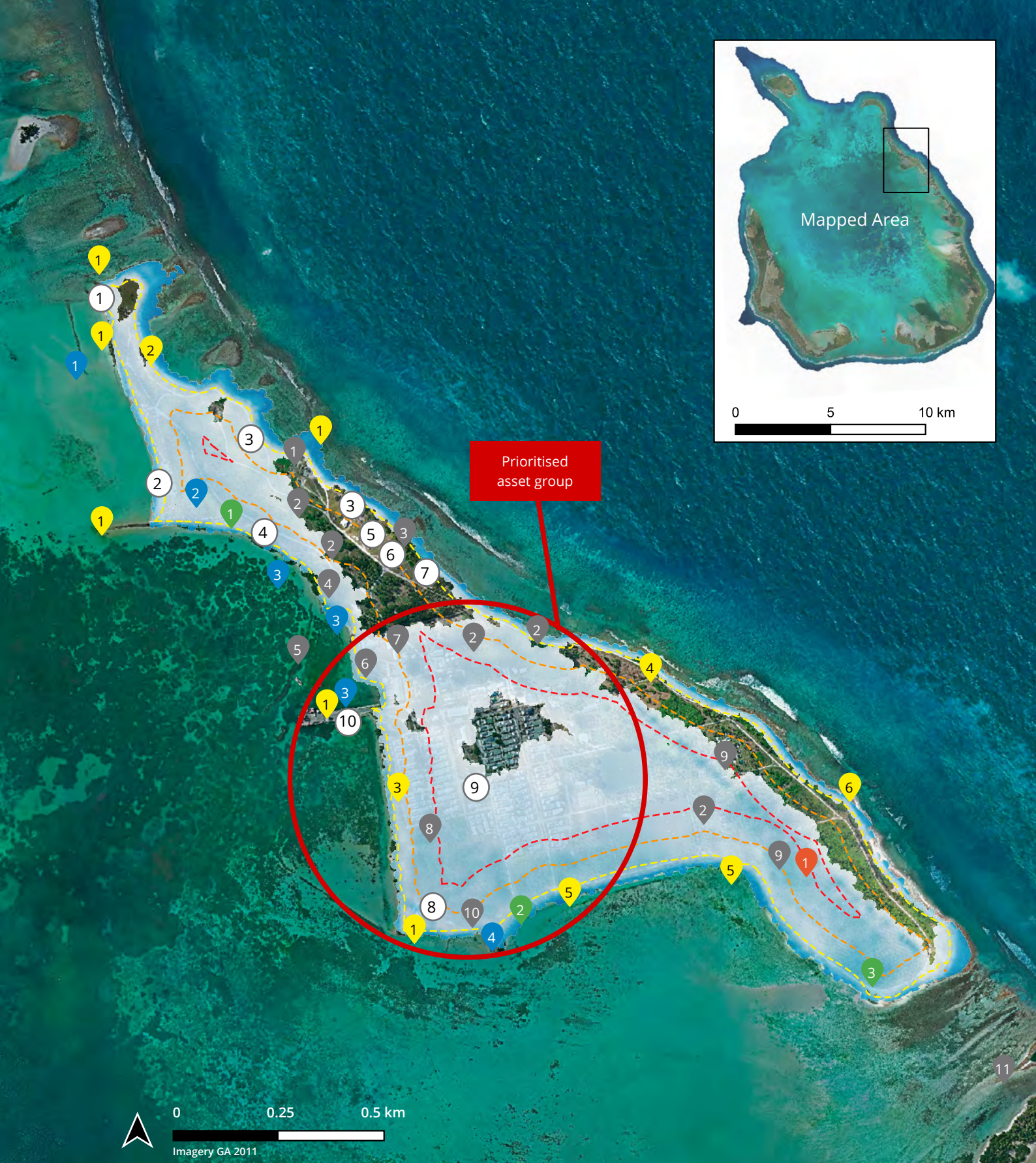


Figure 8 Asset and value mapping summary for Home Island

WEST ISLAND ASSETS & VALUE MAPPING

Figure 9 is the West Island map collated all assets and values identified from the online mapping tool and engagement workshops. The map is also showing 2018, 2068 and 2118 erosion hazard lines and 2068 inundation hazard risk area.

PRIORITISED ASSETS

1. Fuel station
2. Trannies beach reserve
3. Transmitter station
4. Rumah Baru jetty
5. Airfield storage
6. GA geomagnetic observatory
7. Bureau of Meteorology site
8. GA GNSS Mark
9. GA Seismic station
10. Communication array
11. Plaque
12. Substation
13. Access road
14. Scout Park reserve
15. Boat ramp
16. Yacht club
17. Pondok (shelter)
18. Runway

WATER BASED ACTIVITIES

1. Swimming spot
2. Local boat launch
3. Boat ramp
4. Surfing spot

BEACH BASED ACTIVITIES

1. Picnic area
2. Camping area
3. Cocos Islands Adventure Tours

FORESHORE BASED ACTIVITIES

1. Fishing/netting spot
2. Sunset viewing spot
3. Bicentennial track
4. Bob's Folly - old anchorage area
5. Shore walk
6. Small boat ramp

NATURE BASED ACTIVITIES

1. Bike and car track
2. Bird watching area
3. Massive fig tree
4. Beachcombing, turtle watching
5. Pulu Maria snorkeling spot

SOMETHING ELSE/OTHER

1. Big Barge Art Gallery
2. Red Claw Farm
3. Firewood collection (pemphis)
4. Iron wood trees

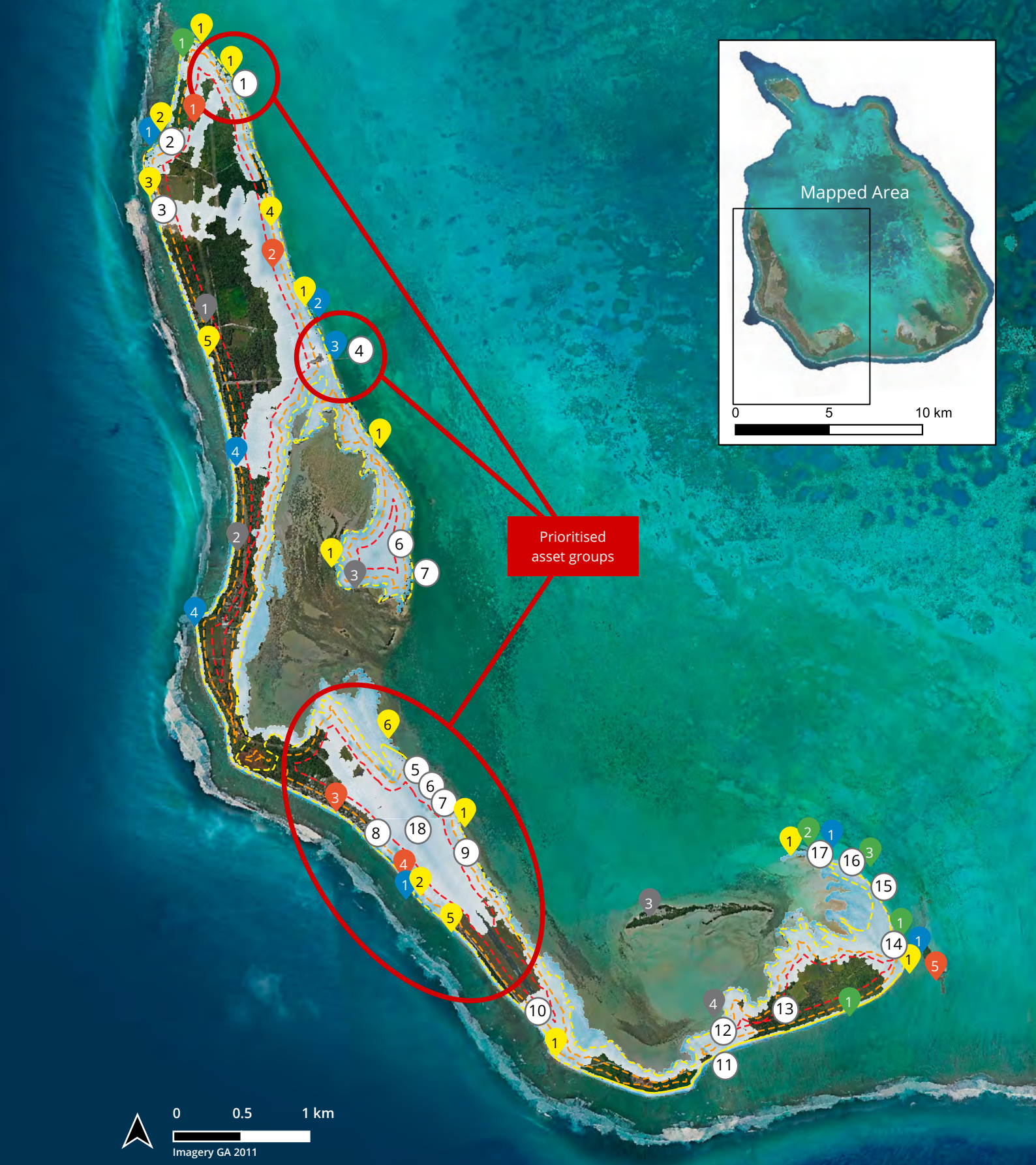


Figure 9 Asset and value mapping summary for West Island

PREFERRED MANAGEMENT OPTIONS

There was divergence of local preferences on management options for Home Island and West Island.

HOME ISLAND

Home Islanders prefer soft options including revegetation and education in the short-term, prioritising effective protection for the settlement area.

The community also continues to explore the retreat from islands options for the longer term.

There was an observation that people will adapt to the most applicable and safe options, for example, the community is adapting to the loss of pondoks (shelters) by camping instead.

WEST ISLAND

West Islanders prefer protection, adaptation and engineering options including sandbags and seawalls.

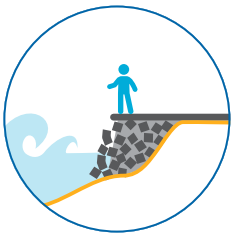
The community also wanted certainty and transparency to help them making long-term plans – whether to invest or retreat.

'PROTECTION' PREFERRED

Both island communities prioritised settlement protection, with keen interest for Seabee seawalls which are present on-island and which many long term locals helped to construct.

The CKI community has additional prioritisation of protection for the Yacht Club and Rumah Baru jetty areas on West Island.

PREFERRED SHORT-TERM OPTIONS



Seabee Sea wall

Monitor

CKI vulnerability to coastal inundation and erosion requires an unique timeframe of short term adaptation within next 5 to 10 years.

- "Avoid" and "Retreat" are not viable in the short term.
- "Protect" and "Accommodate" are possible for continued enjoyment until way of life substantially impacted

PREFERRED MEDIUM-TO-LONG TERM OPTIONS

With the accepted vulnerability modelling, it is challenging to maintain the short-term options of "Accommodate" and "Protect" due to the following factors:

- Groundwater impacts and regular flooding from rainfall events.
- High levees reduce visibility of the water, access to boat ramps, and doesn't stop land flooding.

Long-term options will be determined by the ongoing monitoring to decide the appropriate timing for "Reclaim and protect" or "Retreat from islands".

CONCERNS

GROUNDWATER & FLOODING

Increased frequency and severity of rainwater flooding, high ground water level and storm inundation has detrimentally affected the daily activities of the Home Island community.

FUNDING & OWNERSHIP

Funding for options are key consideration but the Home Island community thinks that they are not in the position to make the call as they do not own the houses or have a funding source.

The community is also likely to follow the lead of the Shire and the Commonwealth for retreat options as a collective.

INCREASED EROSION SEVERITY

Many changes along the coastlines have been observed by the community in both the short and long term periods, including the vegetation loss of Prison Island, and storm-exacerbated erosion near settlements.

RUNWAY UPGRADE

Both island communities are aware of the runway upgrade project and would like to have certainty about its ramification to the island's future, including its effect to local community and the change of coastal risks.

ENGAGEMENT EVALUATION

Increasing involvement of the community and their awareness of the project are observed over the engagement period from April 2022 to February 2023:

PROJECT WEBSITE	ENGAGEMENT PERIOD	VISITS	UNIQUE USERS
Cocos Strategic Community Plan	Apr - Jul 2022	185	57
CHRMAP Launch (Stage 2)	Jul - Nov 2022	844*	52
Post Visit 1 + 2	Nov - Dec 2022	256	95
CHRMAP Stage 5	Jan - Feb 2023	494	199
Total		**1,779**	**403**

IN PERSON ENGAGEMENT	PERSONS
Cocos Strategic Community Plan	57 (31 self-selected, 26 direct meetings)
CHRMAP **Launch** (Stage 2)	39 Stakeholders (including 2 Elders)
Post Visit 1 + 2	18-20* Elders
CHRMAP Stage 5	71 Stakeholders (including 7 Elders, 20 Seniors and 23 from schools)
Total	**~187**

The Community and Stakeholder Engagement Plan success measures:

MEASURE OF SUCCESS	TARGET	RESULTS
Number of people aware (impressions on social media, website visits, document downloads)	400	Achieved
Interested stakeholders (total number of people who contribute)	100	Achieved
Open rate on e-News / click throughs	30%	Achieved
Expressions of interest for workshops	>20	Achieved
Attendee diversity	Diversity of applicants allows at least three community profile ratios to be achieved (age, gender, land ownership, culture, geography categories)	Achieved

NEXT STEPS

The next phase of engagement will include formal public advertising of the Draft CHRMAP.

The Draft CHRMAP will include refinement of viable adaptation options, considering trade-offs resulting from each option.

Once finalised, the Shire will commence preparation of the Local Planning Strategy/ Scheme in conjunction with DPLH, which will duly be considered by the Assistant Minister for Regional Development and Territories, the Western Australian Planning Commission and the Minister for Regional Development and Territories.

ATTACHMENTS

ATTACHMENT A

Attachment A: The Cocos (Keeling) Islands Coastal Hazard Risk Management And Adaptation Plan Stage 2 Engagement Outcomes Report

Use Hyperlink Here

ATTACHMENT B

Attachment B: The Cocos (Keeling) Islands Coastal Hazard Risk Management and Adaptation Plan Stage 5 Engagement Outcomes Report

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