QCoast2100
COUNCILS LEADING COASTAL ADAPTATION

Council Showcase 3

Sea Level Rise – Complexities of Immediate Risk

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Torres Strait Island Regional Council
LGAQ
Queensland Government
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Acknowledgement of Country

The project team acknowledges all the Traditional Owners of the land, sea and waters where we live and work. We acknowledge their continuing connection to culture and Country and pay our respects to Elders past and present. We look forward to a reconciled and prosperous future for all.

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Torres Strait Island People, Culture and Environment

Traditional customs

Largest dugong and sea turtle population

Melanesian decent

Extensive seagrass meadows and marine environments

Connection to land and sea

The Torres Strait Islands

- 15 geomorphologically unique island communities spanning an area of 48,800 km^2
- Grouped into four main clusters:
  1. Eastern Islands (volcanic)
  2. Central Islands (sandy and coral cays)
  3. Western Islands (volcanic and granitic rock)
  4. Top Western Islands (muddy deltas)

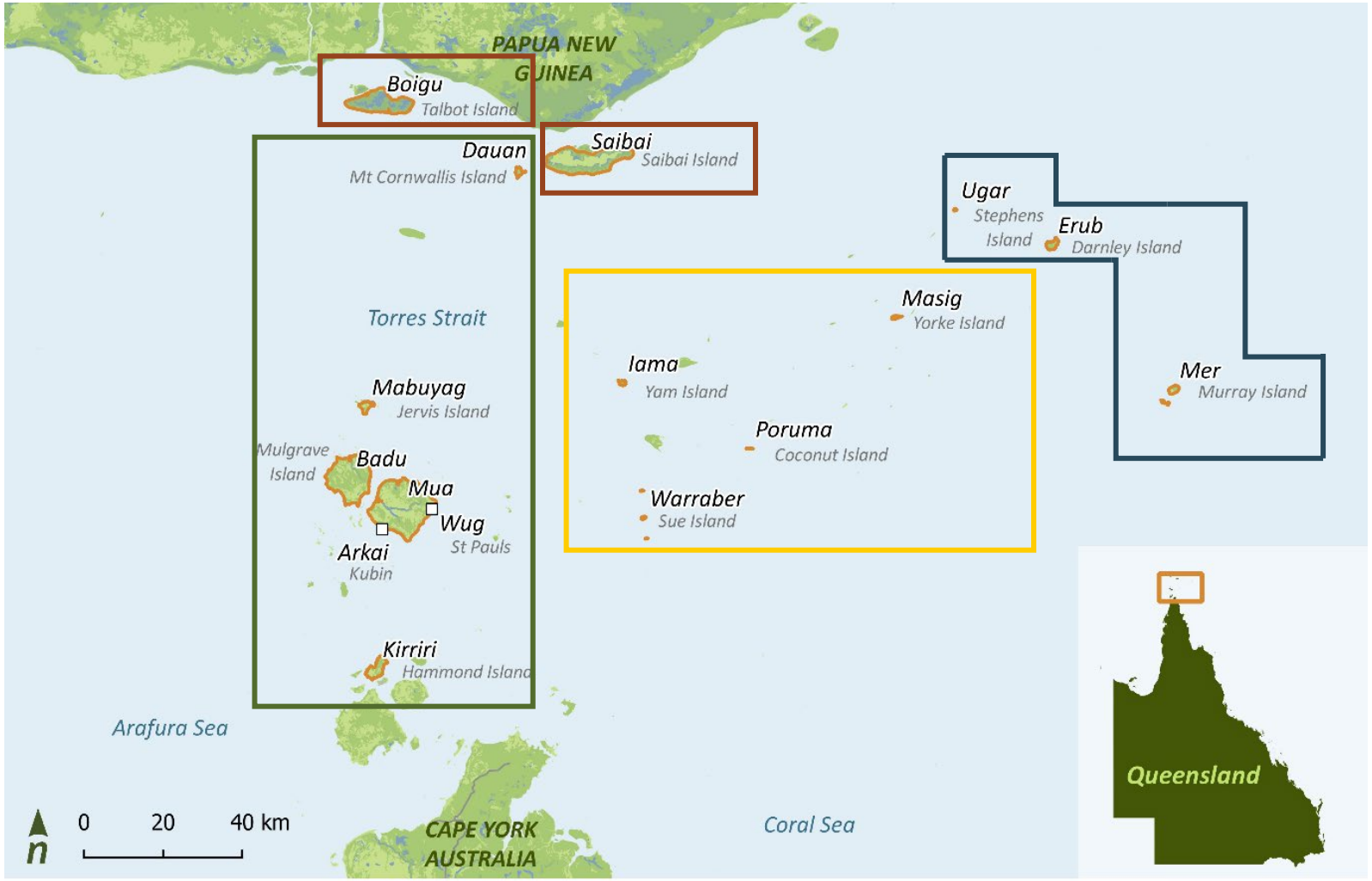


Figure 1. *Torres Strait Islands Study Area*

The role of the Torres Strait Island Regional Council

- Indigenous Council
- Largest employer in the region
- Manage border treaty between Papua New Guinea and Torres Strait

Manage a range of portfolios

- Water and wastewater
- Solid waste management
- Roads, seaports, airstrips, helipads
- Social housing
- Child & aged care
- Health and wellbeing
- Environmental health
- Climate/coastal adaptation

Overview of QCoast$_{2100}$

- $13 million funding has been provided to Queensland Coastal Councils to develop Coastal Hazard Adaptation Strategies
- Pro-active and strategic long-term approach to managing coastal hazards across Queensland's Coastline
- Funding awarded to the Torres Strait Island Regional Council (TSRIC) in 2020
- Developing the Zenadeth Kes, Coastal Hazard Adaptation Strategy as a critical management tool for the Torres Strait Islands

Torres Strait Island Regional Council

LGAQ

Queensland Government

QCoast2100 Councils leading coastal adaptation

Phases of a CHAS

- Plan and scope for the life of the project
- Identify coastal hazards and hazardous areas on each island
- Understand vulnerabilities and risks to a range of assets (including tangible and intangible assets)
- Engage with the community to understand their preferred approach to adaptation
- Determine the costs, priorities and timeframes for implementation.
- Iterative process with engagement throughout

Figure 2. *QCoast$_{2100}$ process for developing a Coastal Hazard Adaptation Strategy*

Phase 3: Mapping coastal hazards

- Coastal hazard areas (JBP)
  - Open coast erosion
  - Permanent inundation due to sea level rise (SLR)
  - Storm tide (temporary) inundation

The mapping considered all adaptation structures, such as sea walls and bunds as of the year 2020, but did not consider designed and planned structures.

Figure 3. *Mapped coastal hazards for Warraber*

Phase 4: Exposure assessment

- Built a comprehensive digital asset database

- Assets were grouped into the following categories to inform our analysis:
  - Beach and foreshore
  - Buildings and facilities
  - Infrastructure and Utilities
  - Roads
  - Land, environment and culture

- **Coastal hazards were overlaid with the features to determine the likelihood of each asset being exposed to coastal hazards**

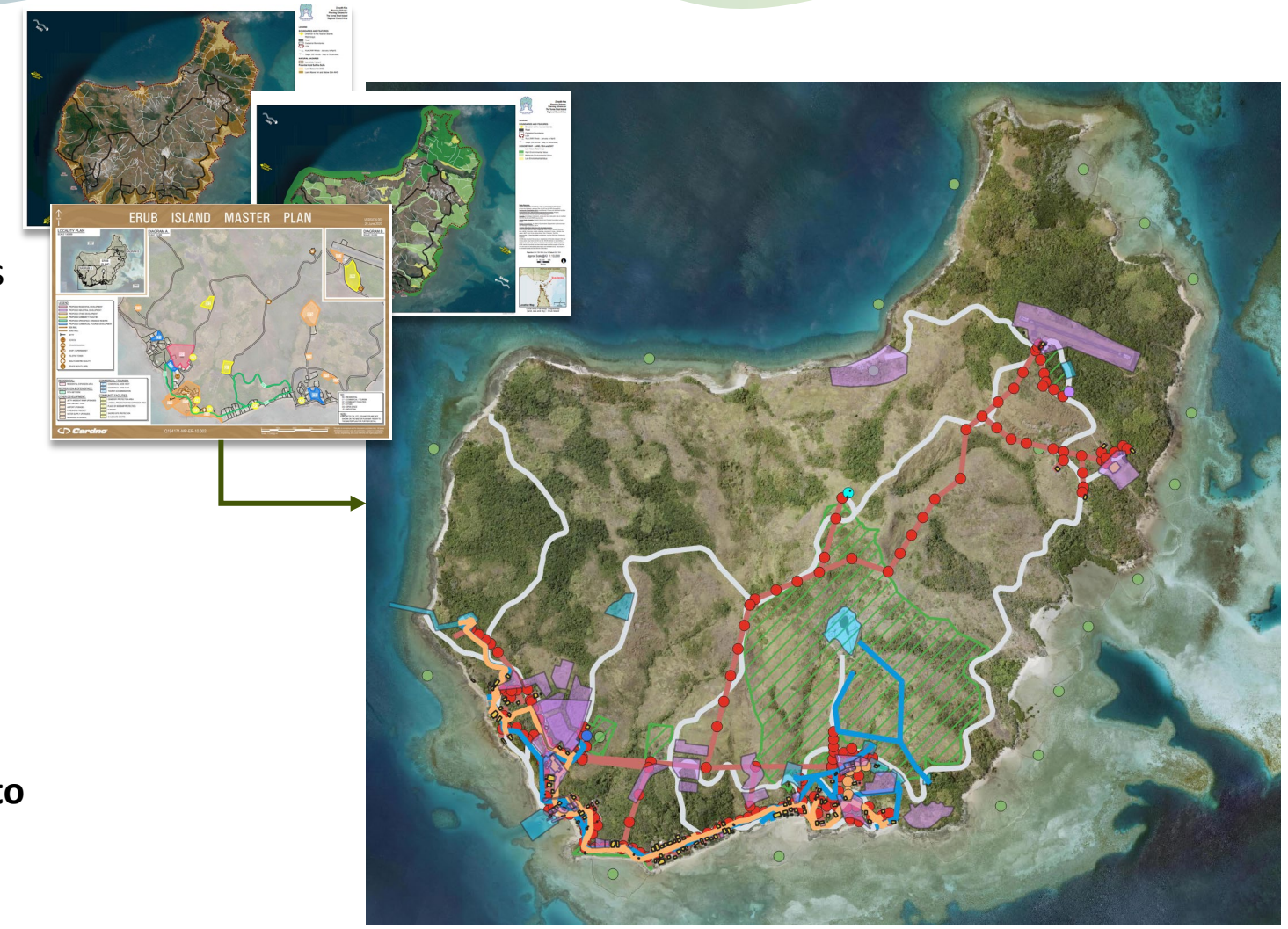


Figure 4. *Mapped assets on Erub Island.*

Phase 5: Risk assessment

- All assets were assigned a consequence
- Using the previous exposure assessment, risk was calculated by combining the likelihood and consequence.

Risk = Likelihood x Consequence

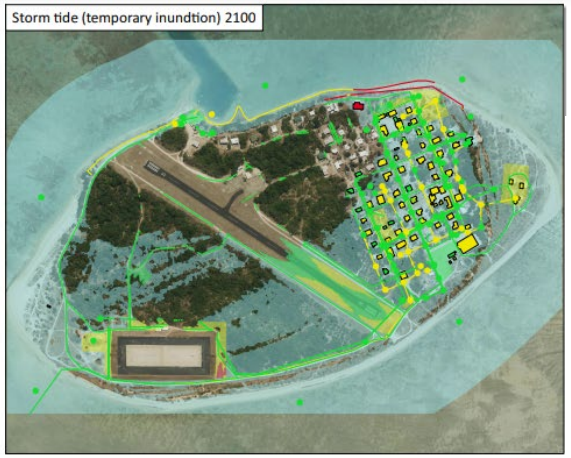
- Risk was mapped for each island
  - Over 130 maps created
- Risk profiles were developed

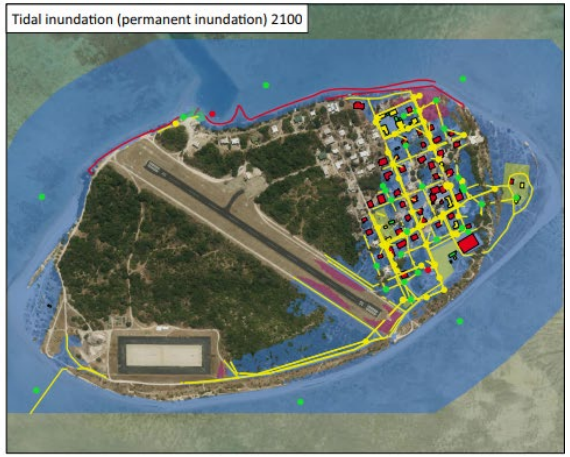
Table 1. *Asset consequence table*

Asset Category	Asset Type	Feature Type	Erosion Consequence	Storm Tide Consequence
Beach and Foreshore	Boating Facility	Barge Ramp	Major	Moderate
Beach and Foreshore	Boating Facility	Boat ramp	Major	Moderate
Beach and Foreshore	Coastal protection	Sea Wall	Major	Moderate
Beach and Foreshore	Master Plan	Future Flood Mitigation Bund	Major	Moderate
Beach and Foreshore	Master Plan	Future Sea Wall	Major	Moderate
Beach and Foreshore	Proposed coastal protection	Indicative Future Location for Bund Wall	Major	Moderate
Beach and Foreshore	Master Plan	Proposed Other Development	Major	Moderate
Beach and Foreshore	Commercial Building	Ferry Facility (finger wharf)	Moderate	Moderate
Buildings/Facilities	Amenities Block	Camps / outstations	Minor	Minor
Buildings/Facilities	Amenities Block	Toilets	Minor	Minor
Buildings/Facilities	Amenities Block	Transportable Toilets	Minor	Minor
Buildings/Facilities	Aviation	Airstrip	Major	Moderate
Buildings/Facilities	Aviation	Helipad	Major	Moderate
Buildings/Facilities	Aviation	Airport Terminal Building	Moderate	Moderate
Buildings/Facilities	Church	Outreach Church	Major	Moderate
Buildings/Facilities	Church	Church	Major	Moderate

Table 2. *Risk Matrix for the Torres Strait Islands*

			Consequence				
			Insignificant	Minor	Moderate	Major	Catastrophic
Likelihood	≥10%	Likely	Low	Medium	High	Very high	Very high
	1% AEP	Possible	Low	Medium	Medium	High	Very high
	≤0.2%	Rare	Low	Low	Medium	Medium	High





Warraber

Coastal hazards

- Storm tide area extent
- Tidal area extent
- Erosion extent

Risk rating

Point assets
- Low
- Medium
- High
- Very high

Line assets
- Low
- Medium
- High
- Very high
- Unclassified

Building assets
- Low
- Medium
- High
- Very high
- Unclassified

Polygon assets
- Low
- Medium
- High
- Very high
- Unclassified

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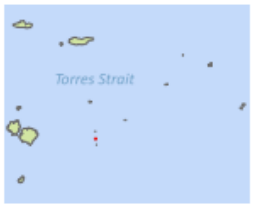
Torres Strait Islands



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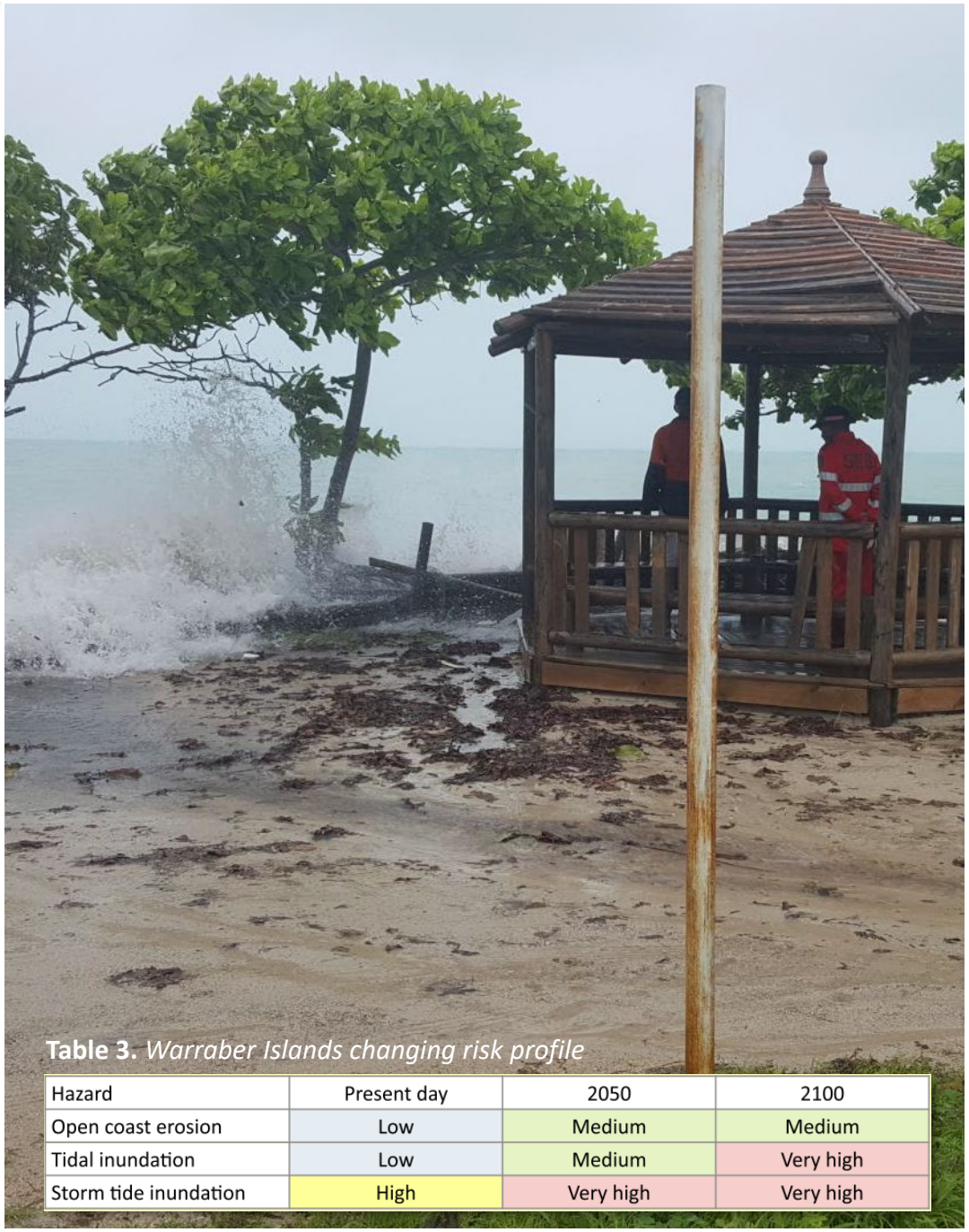


Table 3. *Warraber Islands changing risk profile*

Hazard	Present day	2050	2100
Open coast erosion	Low	Medium	Medium
Tidal inundation	Low	Medium	Very high
Storm tide inundation	High	Very high	Very high

Phase 6 and 7: Adaptation framework

Table 4. *Adaptation framework*

	Increasing risks as a result of coastal hazards →			
Adaptation response – How do we respond and adapt to coastal hazards?	**Avoid (and maintain)**	**Monitor (look and learn)**	**Actively manage**	**Transition and change**
	Prevent new risks from occurring and avoid placing new development or assets in coastal hazard areas.	Monitor the risk of coastal hazards. Monitor until local trigger levels are reached to initiate mitigation.	Proactively manage or mitigate the risk of coastal hazards through a range of adaptation options. Mitigate until management options are no longer socially, culturally or economically feasible or local trigger levels are reached to initiate transition.	A strategic decision to transition or change a specific land use (or location) to an alternative land use. Active management or mitigation may be part of the transition process.
Adaptation options – What can we do?	• Aply land use and development planning controls • Protect natural landscape and beaches from harm • Maintain assets in good condition	• Watch for any changes to the coast that might indicate a change in risk • Collect and record information • Plan for possible natural disasters	• Use nature-based solutions to create healthy shorelines • Upgrade infrastructure and sites to be more resilient • Coastal protection structures	• Relocate or rebuild infrastructure and assets in safer locations • Change how we use the land

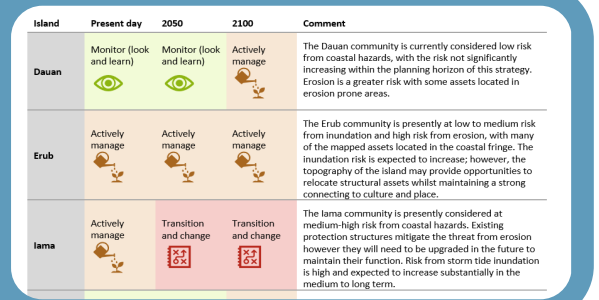
Table 5. *Warraber Islands risk profile*

Hazard	Present day	2050	2100
Open coast erosion	Low	Medium	Medium
Tidal inundation	Low	Medium	Very high
Storm tide inundation	High	Very high	Very high

Table 6. *Warraber Islands adaptation response for each planning horizon*

	Present day	2050	2100
Warraber	Actively manage	Transition and change	Transition and change

An adaption response was defined for each island community



Island	Present day	2050	2100	Comment
Dauan	Monitor (look and learn)	Monitor (look and learn)	Actively manage	The Dauan community is currently considered low risk from coastal hazards, with the risk not significantly increasing within the planning horizon of this strategy. Erosion is a greater risk with some assets located in erosion prone areas.
Erub	Actively manage	Actively manage	Actively manage	The Erub community is presently at low to medium risk from inundation and high risk from erosion, with many of the mapped assets located in the coastal fringe. The inundation risk is expected to increase; however, the topography of the island may provide opportunities to relocate structural assets whilst maintaining a strong connecting to culture and place.
Iama	Actively manage	Transition and change	Transition and change	The Iama community is presently considered at medium-high risk from coastal hazards. Existing protection structures mitigate the threat from erosion however they will need to be upgraded in the future to maintain their function. Risk from storm tide inundation is high and expected to increase substantially in the medium to long term.

Phase 6 and 7: Adaptation options

- Screened a range of specific adaptation options
  - Considering each island's unique geomorphology and past management activities
  - Building on existing work and discussions with Councillors and council staff
- Social, cultural and economic analysis of each adaptation option

Theme	Adaptation option	Descriptions	Arkai	Badu	Boigu	Dauan	Erub	Iama	Kirriri	Mabuiag	Masig	Mer	Poruma	Saibai	Ugar	Warraber	Wug
Council-wide initiatives to enhance custodianship	Community custodianship	Programs and partnerships to enhance stewardship of the coastline															
		Dune and foreshore protection, maintenance and monitoring															
	Education and knowledge sharing	Facilitating knowledge sharing and education on hazards and adaptation															
	Monitoring	Monitoring changes in coastal hazard risk and effectiveness of adaptation															
		Photo point monitoring															
Planning updates	Land use planning	Statutory planning / planning scheme updates															
		Other strategic planning – including land purchase / swap / relocation															
	Disaster planning	Update emergency response planning															
Resilient built environment	Maintaining and improving infrastructure	Upgrading infrastructure															
		Improving drainage networks															
		Resilient homes															
		Relocating infrastructure															
Nature based coastal management	Dune, mangrove and reef protection and enhancement	Dune management															
		Mangrove protection															
		Natural reef enhancement															
	Living shorelines	Mangrove protection and enhancement															
		Shoreline vegetation															
		Artificial reef															
	Beach nourishment	Sand scraping															
		Import sand to nourish the beach															
		Sand bypassing															
Coastal engineering	Structures to assist with sand retention	Rock groynes															
		Geo-bag groynes															
	Structures to dissipate energy offshore	Offshore breakwater															
		Floating breakwater															
		Submerged breakwater															
	Last line of defence structures	Exposed seawall (with living sea wall panels)															
		Buried seawall															
	Structures to minimise flooding	Dykes															
		Levees															
		Storm surge barriers															

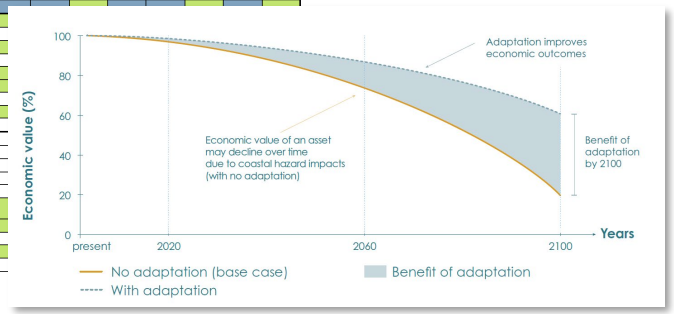


Figure 5. *Example adaptation options being considered.*

Key Management Areas

- Key Management Areas (KMAs) were identified for priority management based on the risk assessment and feedback from community leaders
- Adaptation options were selected for each KMA
- Built tailored adaptation pathways for each KMA on each Island

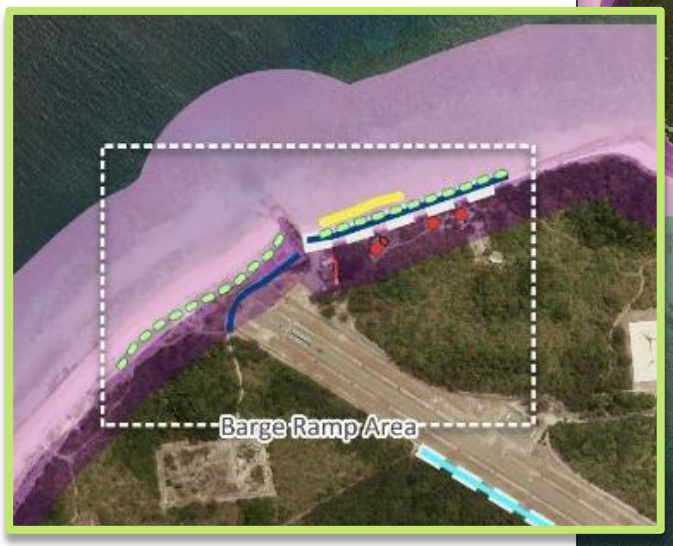


Figure 6. *Key Management Areas and priority adaptation options identified for Masig Island.*

Adaption pathways

Adaptation pathways are a valuable tool that can help land managers and scientists to better prepare and manage for changing coastal hazard risks through time

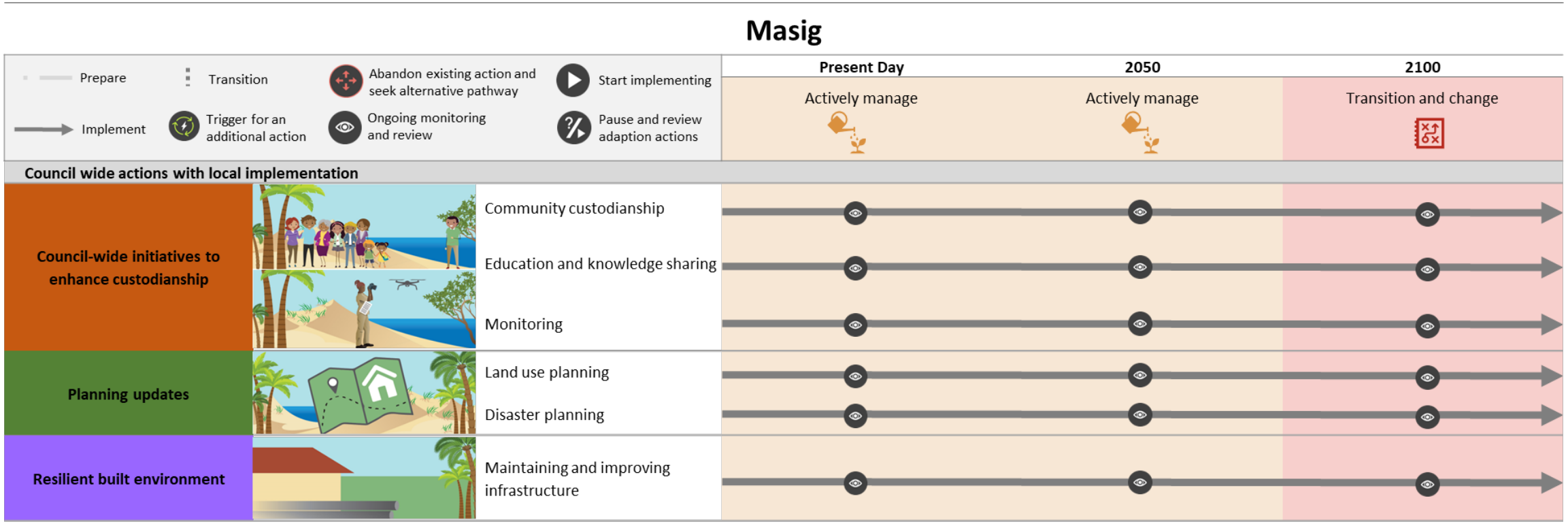


Figure 7. *Island-wide adaptation pathway for Masig Island.*

Masig – Barge Ramp Area

Prepare
Transition
Abandon existing action and seek alternative pathway
Start implementing
Implement
Trigger for an additional action
Ongoing monitoring and review
Pause and review adaption actions

Present Day	2050	2100
Actively manage	Actively manage	Transition and change

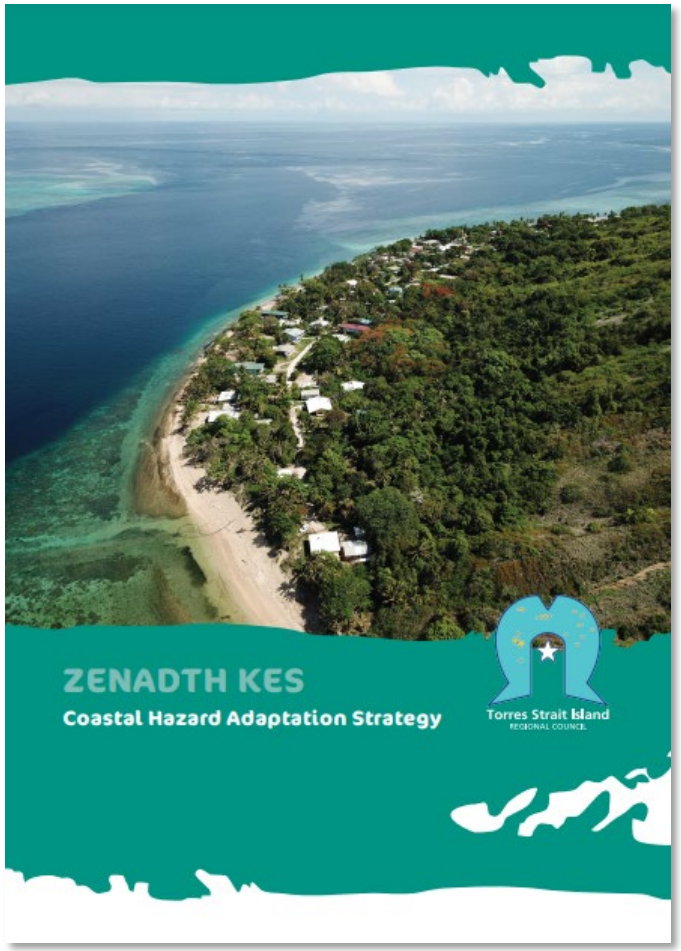
Key management area adaptation actions and pathway

Nature based coastal management	Dune management	
	Sand bypassing	
Coastal engineering	New seawall or revetment	
Transition	Relocate assets	
	Redesign for resilience	

Figure 8. *Masig Island Barge Ramp Key Management Area adaptation pathway.*

Engagement

Zenadeth Kes CHAS



Final Zenadeth Kes Coastal Hazard Adaptation Strategy

Zenadeth Kes Coastal Hazard Adaptation Strategy Arkai island summary

Complexities in managing immediate risks in the Torres Strait

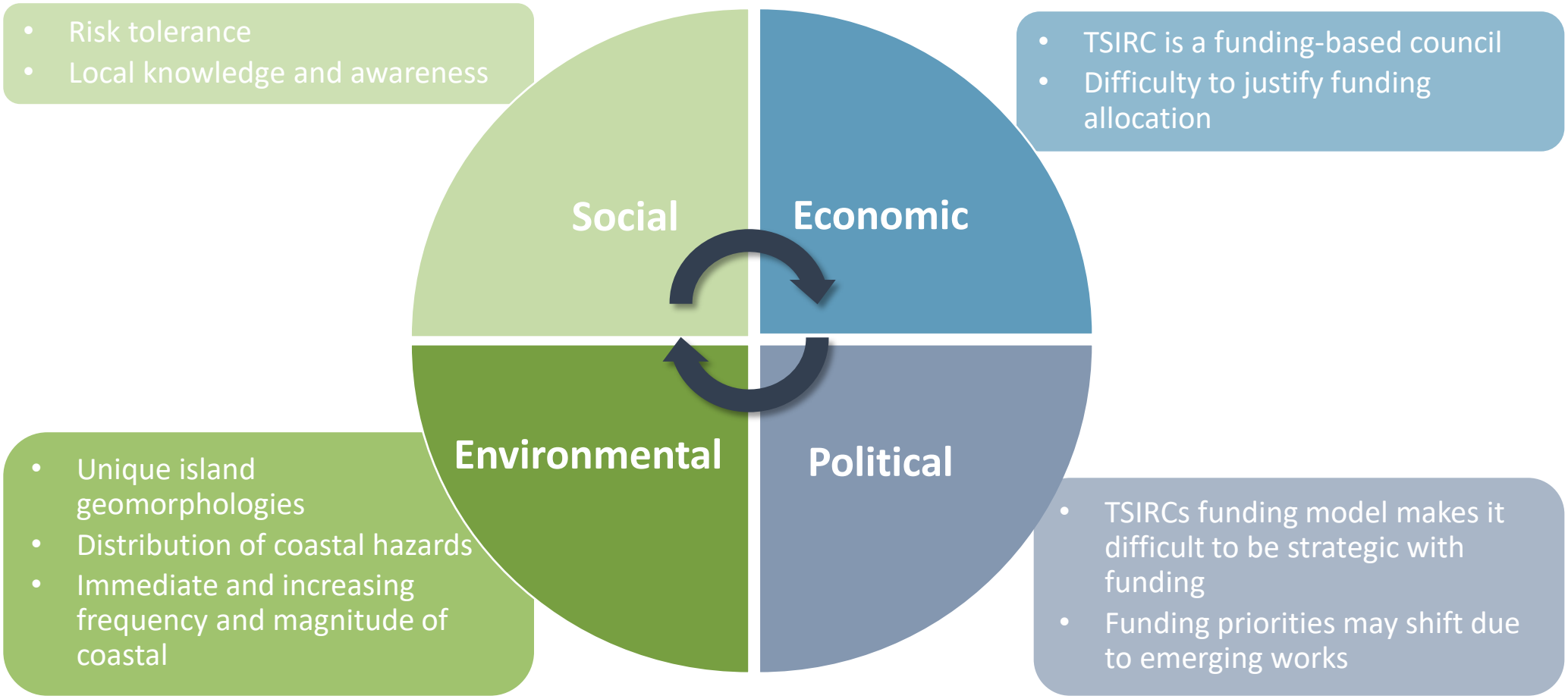


Figure 9. *Key factors influencing coastal hazard management in the Torres Strait*

Environmental factors

Unique Geomorphology
- 15 island with diverse geological features

Geographical Isolation
- Distance between islands and mainland services

Immediate Coastal Hazard Risks
- Coastal erosion
- Storm tide
- Tidal inundation

Distribution of Coastal Hazards
- Inundation on deltaic islands (e.g. Saibai and Boigu) and continental island (e.g. Iama)
- Erosion on coral cay island (e.g. Masig, Poruma, and Warraber)


Storm tide inundation at Saibai


Erosion at Poruma


Storms at Warraber


Flooding at Saibai

Boigu – Seawall repairs

Iama – Seawall (in construction) and flood protection works

Masig – TSIRC Civil Crew currently constructing sandbag seawall to stop erosion

Saibai – upgrading roads to improve accessibility and drainage

Poruma – recently completed sandbag seawall

Warraber – seawall planning underway

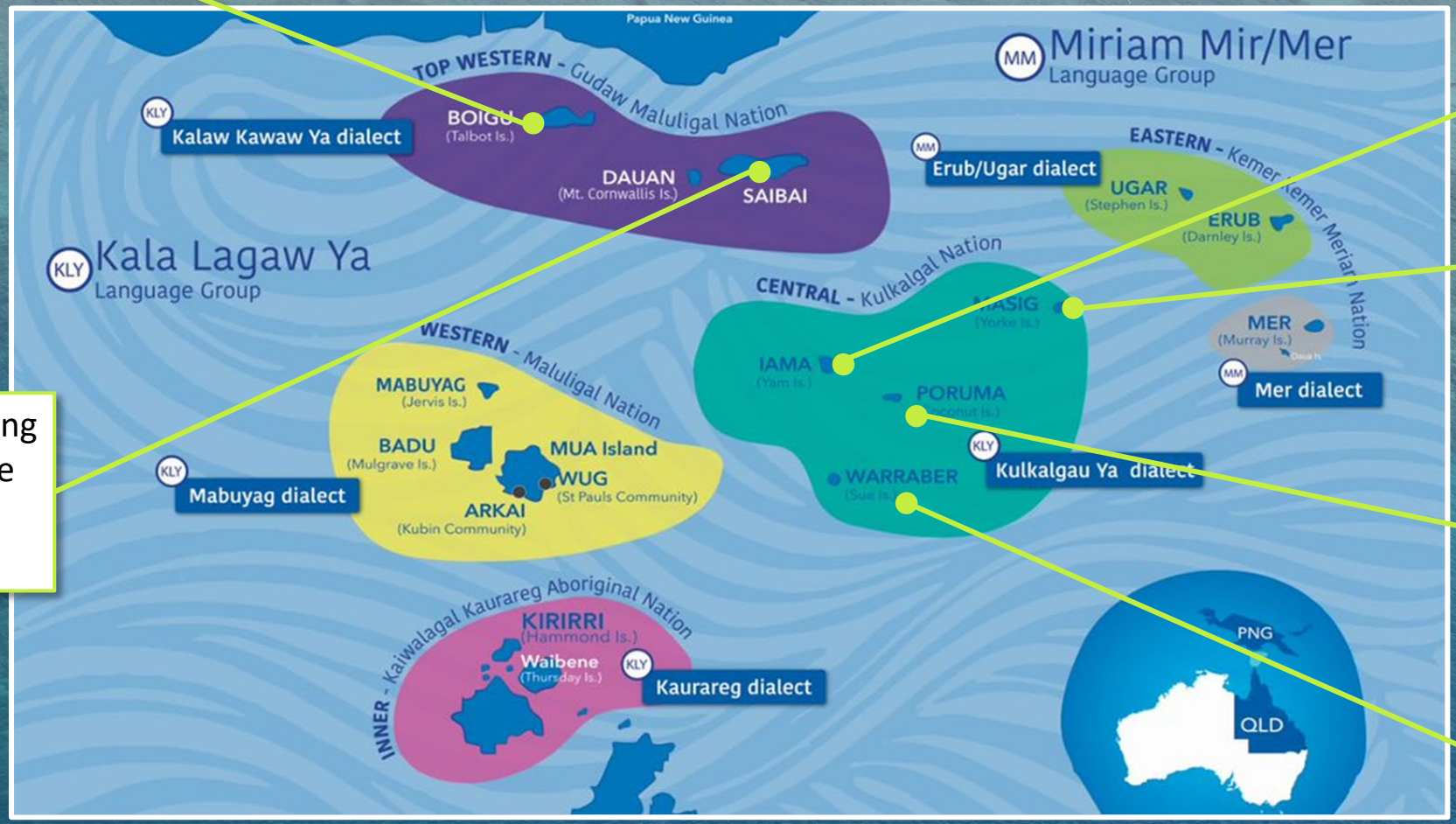


Figure 10. *Distribution of recently completed and current engineering management activities across the Torres Strait Islands*

Case Study: Iama Landfill flooding

- Inundation is an immediate coastal hazard currently impacting the Iama community
- Building a sea wall within budget means only the township gets protection works
- At the same time the landfill is experiencing flooding
- Need to see the seawall but also need to manage current hazards in other areas

Social factors

Navigating Native Title

- Constructing coastal protection works while respecting cultural values
- Prioritising works in accordance with the wants and needs of the communities while also doing what we can within legal rights

Different unique cultures/risk tolerance levels

- Risk tolerance is greater than a lot of other regions therefor voices not as pronounced
- Need for community upskilling and empowerment to improve understanding of coastal hazard risks

Economic factors

Funding Limitations

- Heavy reliance on external grants (e.g., QCoast2100)
- High competition for limited funding resources
- Difficult to justify benefit when asset values often prioritised over cultural values (intrinsic values) though crucial for preserving the Torres Strait heritage
- Limited discretionary funds in situation where emergent works require priority

Cost Discrepancies

- Higher costs for hazard mitigation (e.g., seawall construction) in the Torres Strait compared to Southeast Queensland

Boigu seawall

Political factors

Changes in decision making

- Shifts in priorities with new leadership

Advocacy and representation

- The Torres Strait has a smaller voice in policy discussion due to smaller population
- Challenges in highlighting and justifying unique community needs

Quantum of funds required

- Justification of high costs due to logistics

Limited discretionary funds

- Difficult to strategically assign/prioritise funding within the Councils funding model – funding-based Council
- Funds often redirected to urgent needs, hindering planned projects

Reflections

- Prioritisation is integral to the planning process, especially in the Torres Strait
- Building TSIRCs spatial asset data base as a tool for future use
- One-on-one collaboration and engagement with the Councillors
  - Empowering Councillors
  - Listening and incorporating Councillors learnings
  - Councillors becoming involved in the planning processes
- Building the capacity of council staff, councillors and community leaders
  - Council staff now have a spatial asset database to use and build upon
  - Councillors are more aware of the opportunities the CHAS provides as a tool

Thank you to everyone involved in providing feedback and funding in helping to develop the Zenadeth Kes Coastal Hazard Adaptation Strategy

Questions

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