# Redlands Coast CHAS Implementation: Living Shorelines


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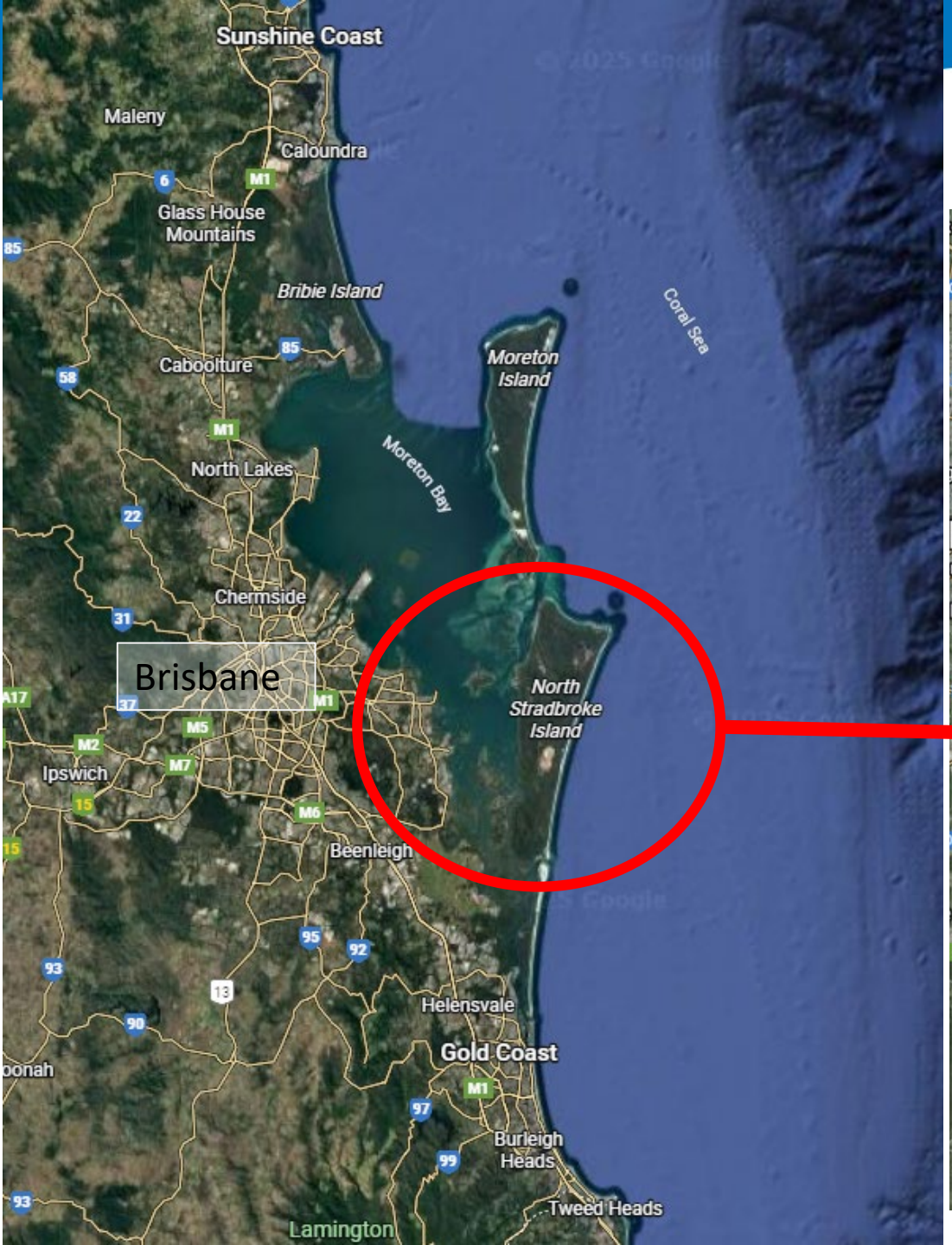
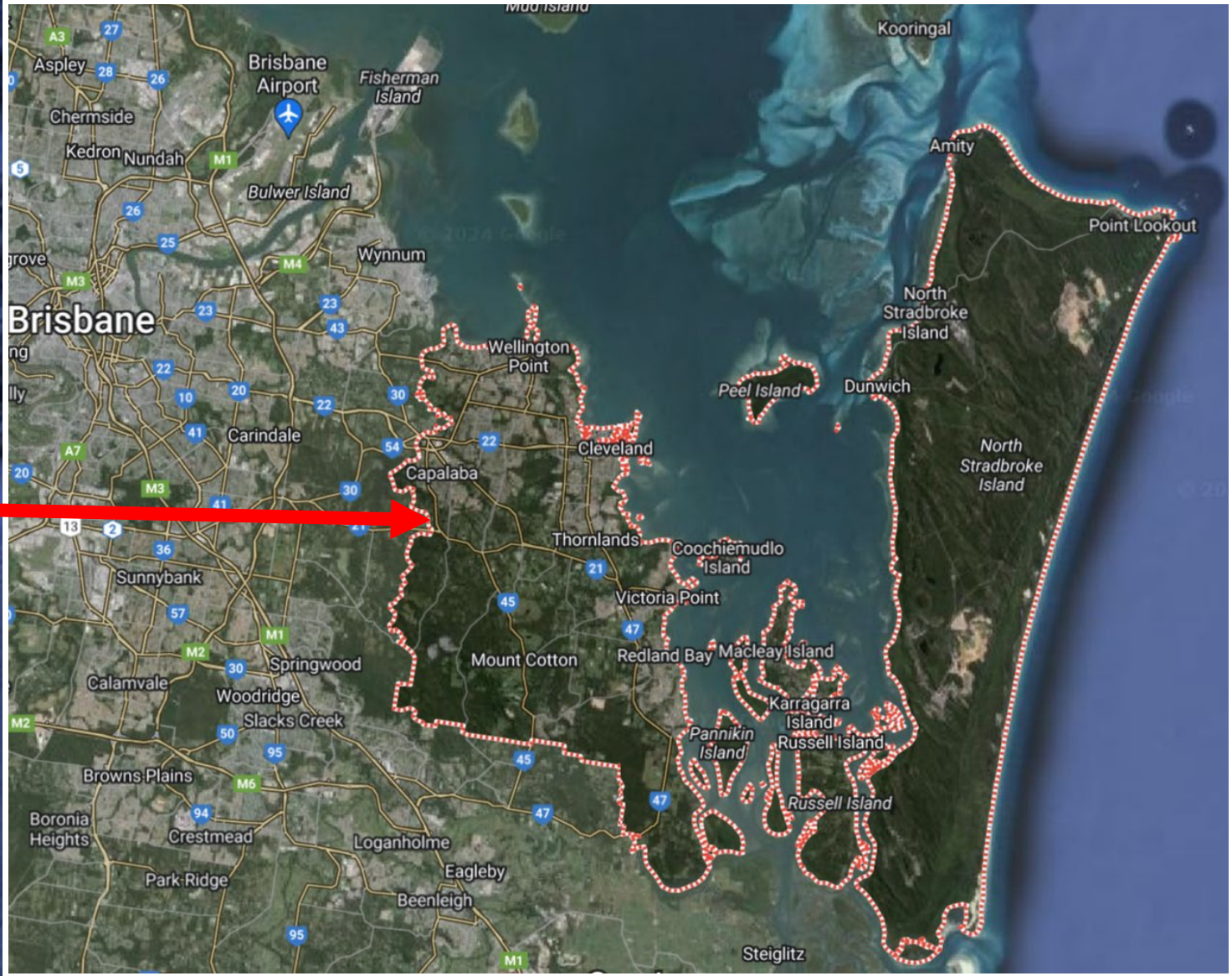
Redland City Council

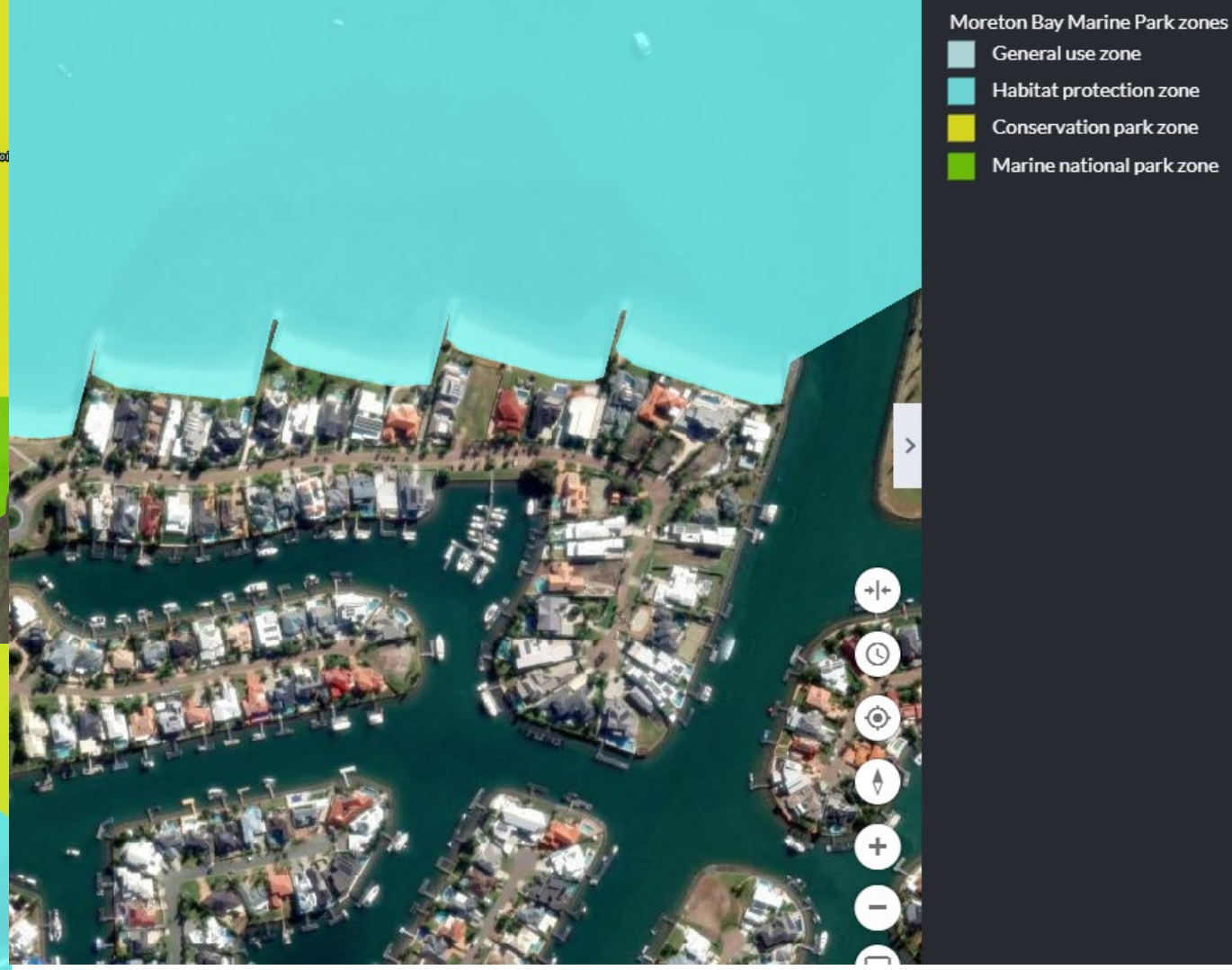
# Redland LGA

Redland CITY COUNCIL








# Moreton Bay Marine Park

# CHAS Development

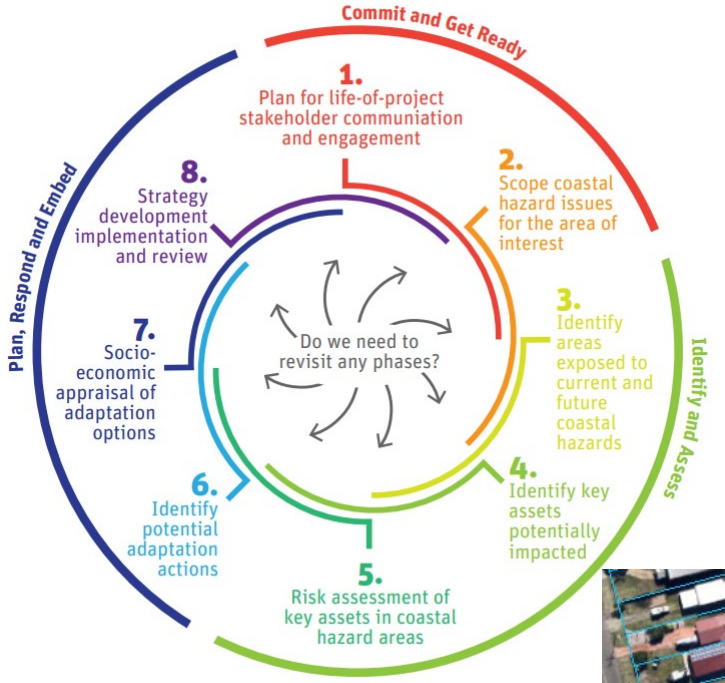
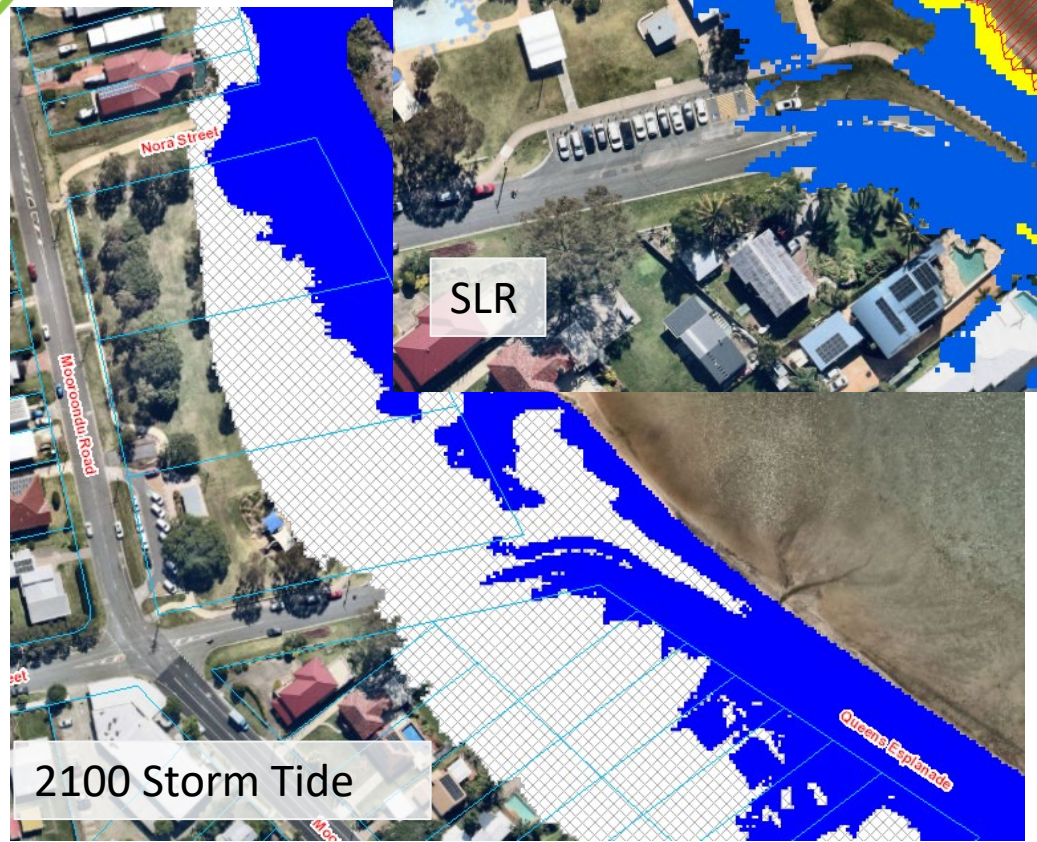



Figure 2. QCoast2100 eight-phase process


# CHAS Community Feedback

The top three values of the coast identified during the consultation activities were:

- Natural ecosystem values
- Unique landscape and natural beauty
- Recreation and access.

There is a strong preference for nature-based options as the primary/initial pathway for coastal hazard adaptation. The community values coastal and island lifestyle and wishes to see this preserved.

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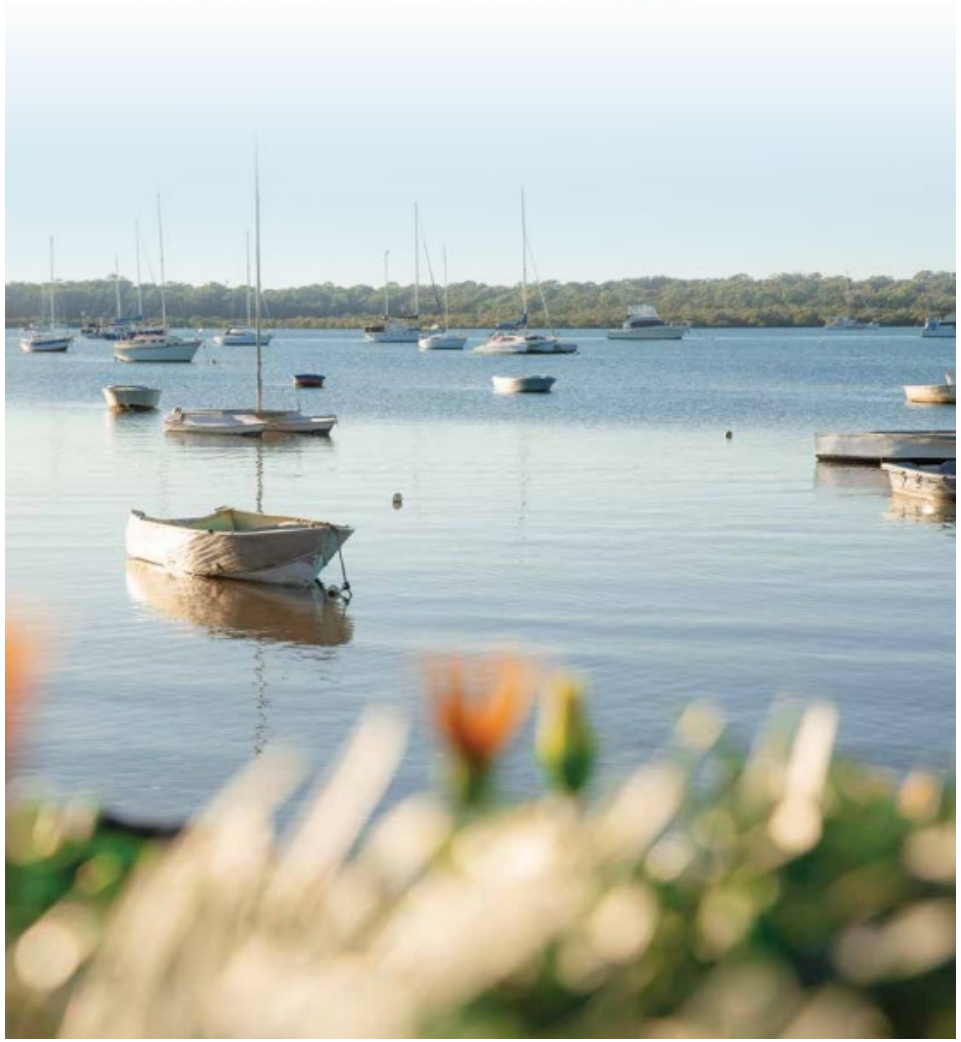
# Coastal Hazard Adaptation Strategy



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| | Present-day | By 2040 | By 2070 | By 2100 |
|---|---|---|---|---|
| **BIRKDALE** | Monitor, maintain, and prepare | Mitigate | | |
| **Enhance adaptive capacity** | As per city-wide actions as applicable, including:<br>• Establish Aquatic Paradise Park (east) or Three Paddocks Park as a focus site for action 1.2.5 - enhance signage on hazards and role of vegetation<br>• Establish Aquatic Paradise Park (east) or Three Paddocks Park as a key site for action 1.3.1 - a photo monitoring station (Coast snap to similar) to monitor potential living shoreline site, and potential research collaboration – action 1.4.1 | | | |
| **Planning** | As per city-wide actions as applicable | | | |
| **Modifying infrastructure** | As per city-wide actions as applicable, including:<br>Promote resilient homes program – linked to action 3.1.3 | | | |
| **Coastal engineering and management** | Maintain existing shoreline protection works and integrate into living shoreline design<br>Develop concept design and monitoring plan for living shoreline at Aquatic Paradise Park (east) or Three Paddocks Park (link to action 4.1.2 and 1.3.3) | Implement living shoreline design | Review of effectiveness of living shoreline design<br>Review pathway options<br>Concept planning for additional structural protection or upgrades (if applicable) | Review of effectiveness of living shoreline design<br>Review pathway options<br>Implement additional structural protection or upgrades (if applicable)<br>Undertake feasibility study for potential tidal barrier for canal estate |
| **Other considerations** | Establish indicators (with concept designs) to monitor level of acceptable service and trigger change of pathway<br>Examples include:<br>• Living shoreline does not achieve expected level of service → Pathway is reviewed and planning for additional works may commence<br>• Water levels at canal estate are too high too often by 2100 → Feasibility is reviewed for a tidal barrier for canal estate | | | |

Table 9. Birkdale adaptation pathway

QCoast2100 LGAQ Every Queensland community deserves to be a liveable one Queensland Government

# Traditional Coastal Protection Structures

- Do a great job at protecting land behind the structure, controlling erosion and protecting from overtopping and inundation,
- Removes or alters foreshore environment and the associated ecological benefits,
- Costly to build and maintain,
- Permitting and approval requirements.

# What is a Living Shoreline?

- Natural ecosystems contribute to coastal hazard risk reduction, via increased bed friction, local shallowing of water, sediment deposition and building of vertical biomass.

- Nature-based methods are adaptive to a changing climate, and can self-repair after storm events.

- In this instance our Living Shorelines pilots are our attempt to recreate, or hybrid engineer a natural solution to coastal erosion.

# Living Shoreline Pilot Objectives

- Develop potential options and designs relevant to our local coastline and context,
- Determine permit and approval requirements,
- Construct and trial different types of designs, materials, and construction techniques,
- Demonstrate the role they can play in coastal hazard mitigation,
- Facilitate a template for Council to implement further Living Shorelines.

# Pilot Locations

**PILOT SELECTION CRITERIA**

- Sites experiencing ongoing erosion,
- Sites representative of broader Redlands coastline,
- Sites to have community infrastructure nearby,
- Sites that do not have critical infrastructure nearby in case of living shoreline failure or pathway change,
- Sites to have community foot traffic for passive community engagement,
- Sites with minimal viewlines from private residences,
- Sites with nearby vegetation that can be tapered into.

# Site 1 - Three Paddocks Park, Birkdale


# Site 2 - Oyster Point Park, Cleveland


# Options - Vegetation

- Vegetation provides natural and cost-effective protection against shoreline erosion.  Whilst the species used will vary based on the local conditions, broad distinctions can be made between dune, saltmarsh and mangrove communities:
    - Dune vegetation – relevant to our higher energy more wave dominated and open
    - Mangrove forests occur within low energy, sedimentary shorelines between mean tide and high tide elevations - meaning that nature-based engineering approaches may be required to create calm areas for their establishment.
    - Coastal saltmarshes consists mainly of low growing, salt-tolerant vegetation.  Saltmarshes generally form at the high intertidal zone, at the landward edge of the mangroves, are submerged during high spring tides. Endangered ecological community.

# Options – Bank reprofiling

- Foreshores can be eroded through a variety of mechanisms including lateral retreat, slumping, undercutting, oversteepening, rear side erosion due to overtopping, etc.  In these areas, it is beneficial to reduce the slope of the bank back to a stable gradient prior to vegetation establishment.

- When reshaping the bank, batters of 1:2 (vertical: horizontal) is generally considered stable although recommendations range up to 1:4 for safe maintenance.

- The need for ongoing maintenance to the reprofiled bank will depend on the success of vegetation establishment and the occurrence of any storms immediately after construction, which is the period with the greatest risk of damage.

# Options - Log Jams

- Wooden debris and log jams to create sheltered areas is a growing approach in riverbank stability.
- Not suitable for an open sandy coastline, however have been used successfully in rivers, which have some parallels with the intertidal regions of Moreton Bay.
- The intention is to use a log jam to create a small, protected area along the shoreline which blocks wave energy and strong tidal currents. This protected area would allow silts to accumulate and mangrove propagules to establish, which would act as the primary shoreline defence. This is expected to have similar effect as a small pocket breakwater with lower material costs if the logs can be sourced locally.

# Options - Reefs and pocket breakwaters

- Reefs and breakwaters protect the shoreline by reducing wave energy
- Offshore submerged reefs are used to attract and sustain a wide diversity of marine life by providing protection from predators, shelter from ocean currents, breeding opportunities and a supply of rich food sources
- In a tide-dominated muddy shoreline like the two pilot sites, a pocket breakwater can be designed to provide protection from incoming wave energy, creating stable zones for mangrove and marine plant growth
- A range of emerging materials are being used to create reef habitats, including reefballs, artificial concrete units and oyster bags.

# Options - Rock Fillets

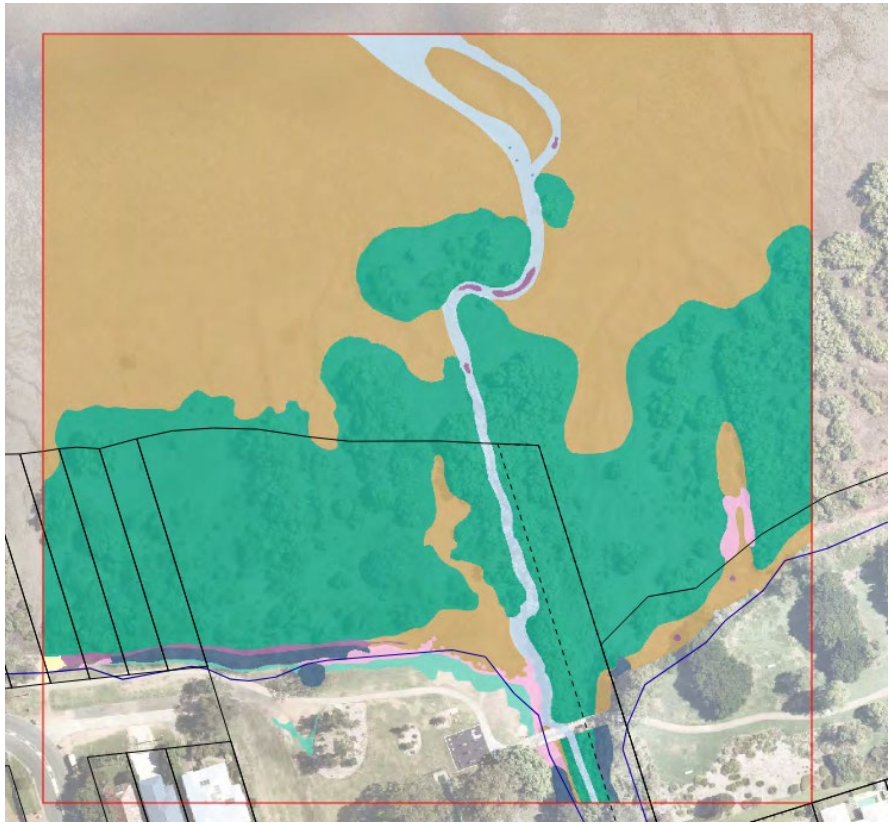
- Rock fillets are designed to dissipate energy from wave and currents and allow vegetation to re-establish adjacent to an eroding bank.
- They are typically oriented parallel to the shoreline, connected at one end where the dominant energy originates (either due to waves or currents), and constructed using loose placed rock.
- The crest level of the rock is relatively low level, e.g, positioned at mean sea level, and is not considered the primary long term shoreline defence - instead being designed to absorb wave action and create an area of calm water between the fillet and the eroding bank. This area encourages the accumulation of sediment and provides a habitat that is suitable for the natural regeneration of mangroves or reeds.

# Options - Planted Revetment

- A planted revetment uses a sloped rock or concrete honeycombed base with vegetation strategically planted onto the structure.
- Incorporating vegetation within the revetment can provide valuable ecological benefits and help to blend the revetment into the adjacent ecosystems.  These benefits will partially offset any additional costs required in its construction
- Where additional environmental benefit is desired however the primary defence requires engineering certification

# Options to Concepts

- Site Surveys,
- Marine Plant Survey,
- Coastal Process Studies,
- Environmental Impact Assessments
- *EPBC Act* Significant Impact Assessments
- Archeological surveys and Cultural Heritage Management Plan



220320 RCC Soft Engineering

Map 4: Distribution of Marine Plants and Other Marine Habitats: Three Paddocks Park, Birkdale

LEGEND

Study area

Cadastre
- Lot boundary
- Easement
- Highest astronomical tide (QLD Government 2021)

Marine plants
- Mangrove
- Seagrass
- Saltmarsh
- Saltmarsh dominated by *S. virginicus*
- Casuarina

Transitory marine plants
- Bare Mud
- Detritus

Other
- Outlet channel
- Rock wall
- Sand

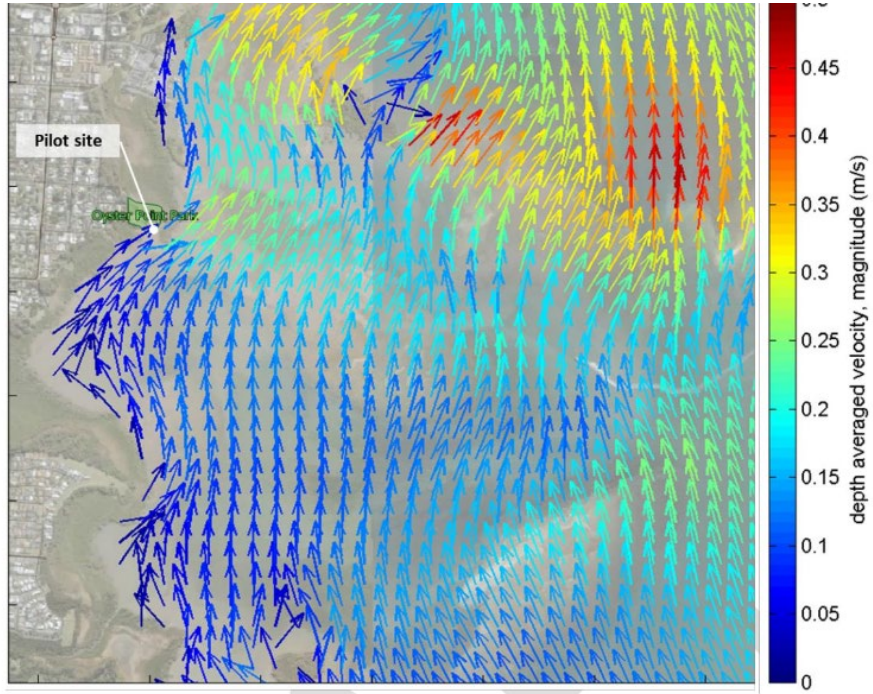
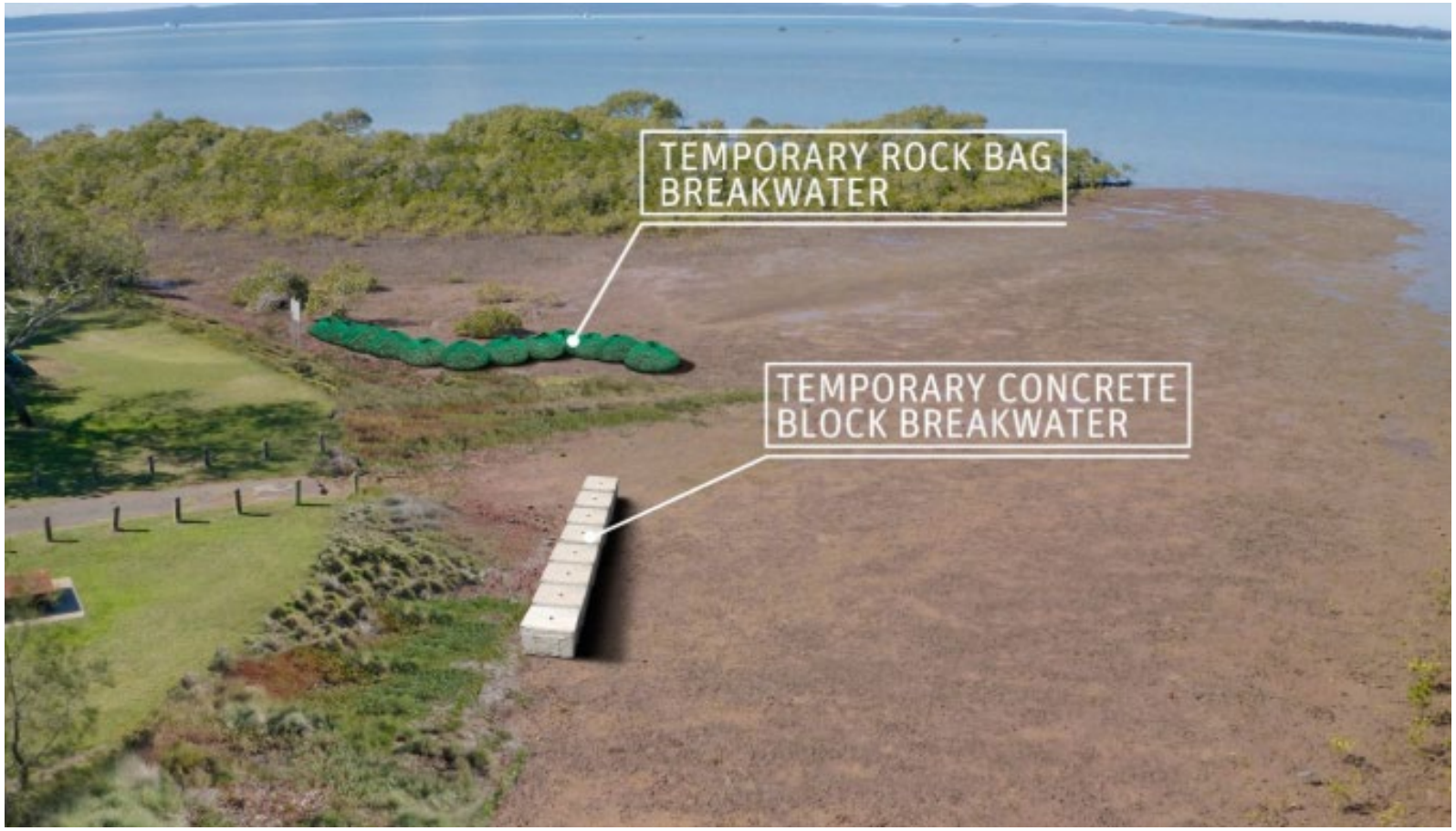



Figure 4-14: General tidal currents during ebb tide at Oyster Point Park

# Functional Design Requirements

- Measurable shoreline protection against erosion,
- Increased ecological and social benefits,
- Public access to foreshore,
- Design and specifications capable of engineering certification,
- Gain Government permits and approvals,
- Minimise capital costs and ongoing maintenance requirements,
- Minimise construction and disturbance areas,

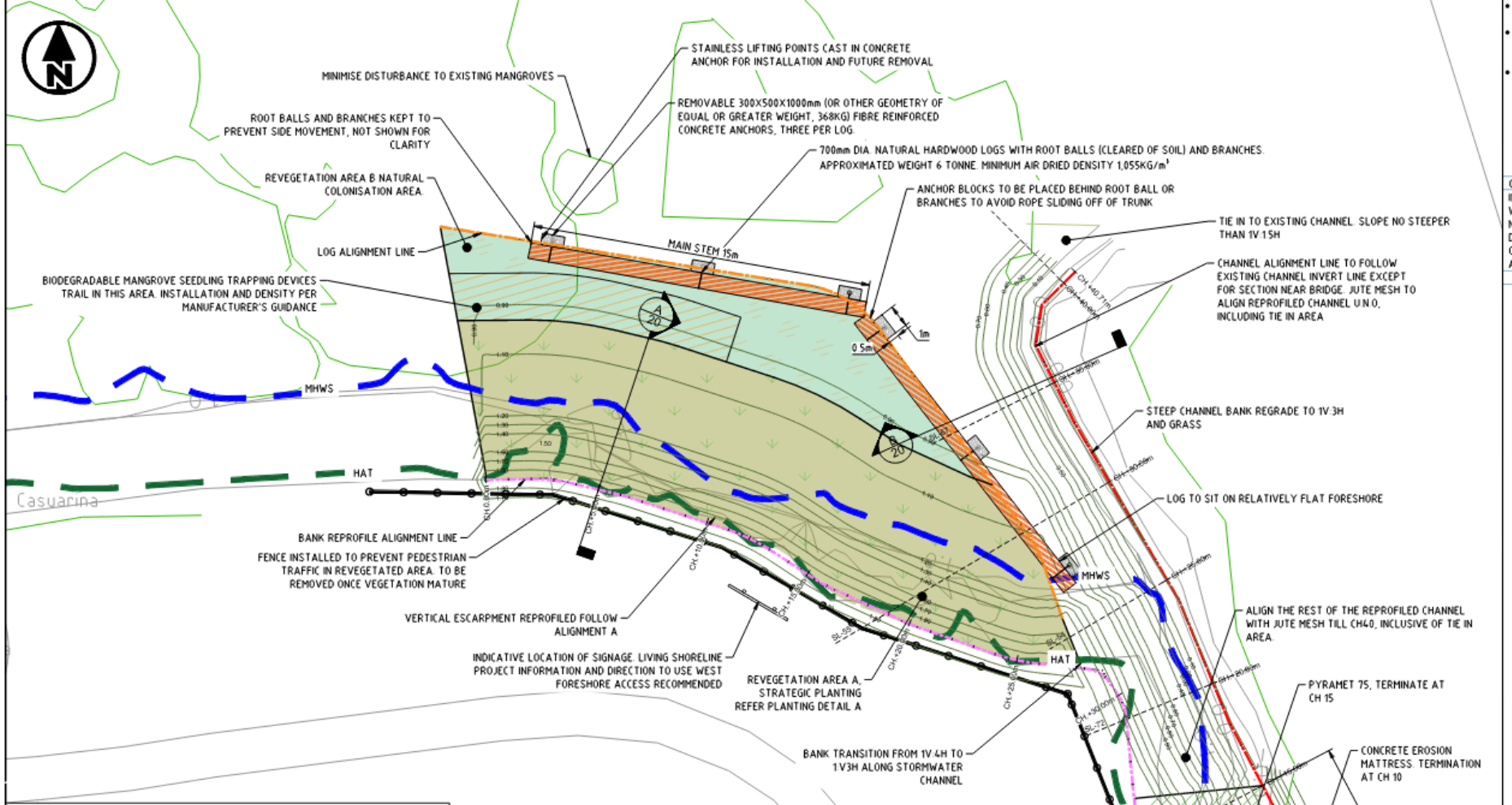


# Permits, Approvals and Legislative Requirements

- Marine Park Permit
- State tidal works approvals
- Cultural Heritage
- Native Title
- *Environment Protection and Biodiversity Conservation Act.*

# Site 1 - Three Paddocks Park, Birkdale


Three Paddocks Park




MANGROVE SEEDLING TRAPPING DEVICES

GENERAL ARRANGEMENT

SCALE 1:100

| | | |
|---|---|---|
| • WORKING IN A TIDAL ENVIRONMENT<br>• MOVEMENT OF PLANT IN AND AROUND WATER<br>• UNSTABLE FORESHORE BANK | • INTERACTION WITH RECREATIONAL VESSELS<br>• PUBLIC INTERACTION WITH SITE TRAFFIC<br>• UNAUTHORISED SITE ACCESS<br>• WORKING NEAR PRIVATE PROPERTIES | • POLLUTION HAZARDS ASSOCIATE WORKING N SEA<br>• RISK OF DA FLORA AND |

| CONSTRUCTION RISKS | PUBLIC RISKS | ENVIRONMEN |
|---|---|---|

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SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

GENERAL NOTES

1. ALL DIMENSIONS SHOWN ARE IN MILLIMETRES UNL OTHERWISE STATED AND LEVELS ARE IN METRES AUSTRALIAN HEIGHT DATUM.
2. DO NOT SCALE FROM THIS DRAWING. ALL DIMENSI MUST BE CHECKED/VERIFIED ON SITE.
3. ANY DISCREPANCIES SHALL BE NOTIFIED IMMEDIAT THE SUPERINTENDENT.
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8. ALL WORKS WILL BE CARRIED OUT ADHERING TO T CONTRACTORS SITE SPECIFIC ENVIRONMENTAL MANAGEMENT PLAN.
9. DETAILS OF REVEGETATION REFER TO DESIGN REP

LEGEND

- REVEGETATION AREA A 312.17m2
- REVEGETATION AREA B (NATURAL COLONISATION) 59.56m2
- MHWS
- HAT
- CHANNEL ALIGNMENT
- LOG ALIGNMENT
- BANK REPROFILE ALIGNMENT

JEREMY BENN PACIFIC ENGINEERS AND SCIENTISTS PTY LTD

| | |
|---|---|
| CERTIFIED BY: | D.W. RODGER |
| RPEQ NO: | 17794 |
| PROJECT NO: | 2023s0365 |
| DATE: | 22.03.2024 |

SIGNED:

JBP scientists and engineers

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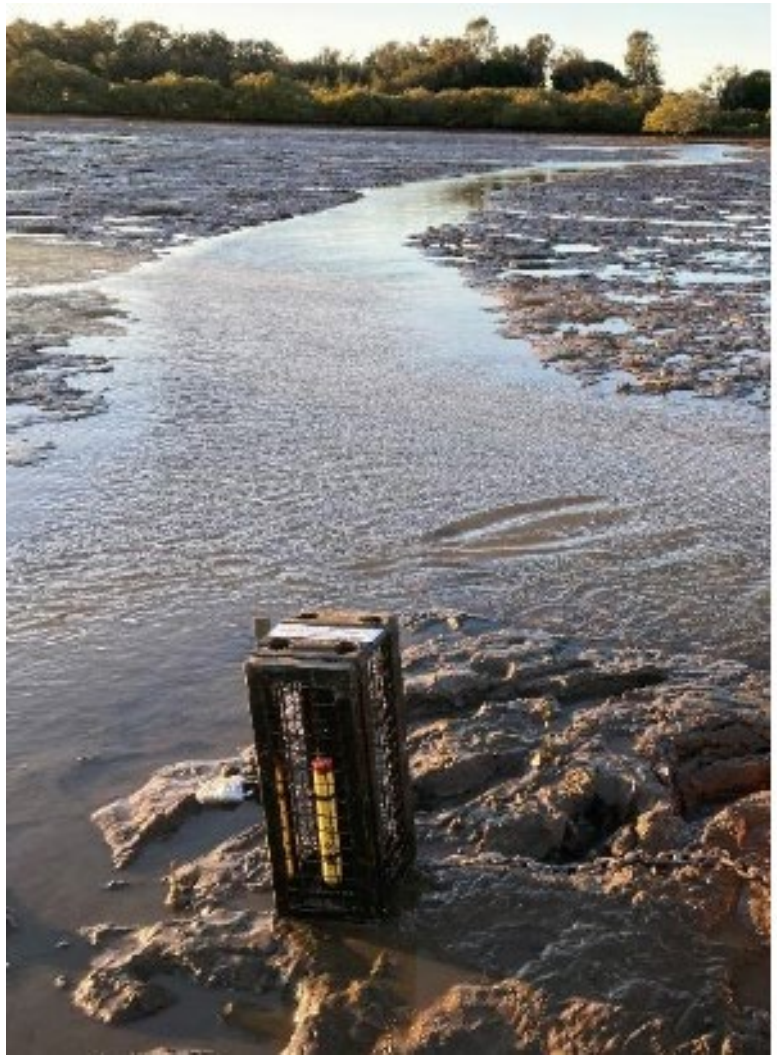
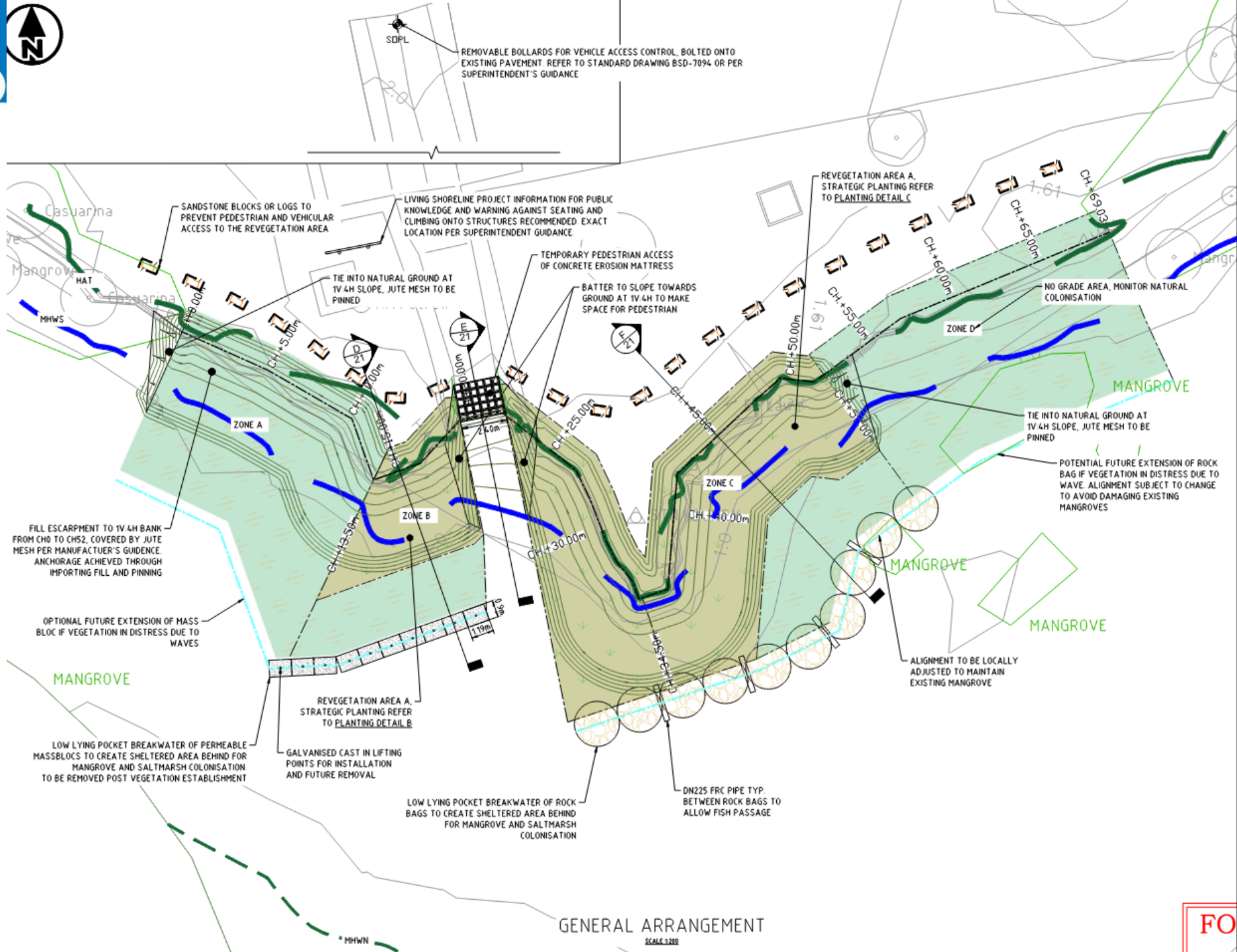
# University Research



# Site 2 - Oyster Point Park, Cleveland


Oyster Point Park




GENERAL ARRANGEMENT
SCALE 1:200

| CONSTRUCTION RISKS | PUBLIC RISKS | ENVIRONMENTAL |
|---|---|---|
| • WORKING IN A TIDAL ENVIRONMENT<br>• MOVEMENT OF PLANT IN AND AROUND WATER<br>• EXCAVATION<br>• UNSTABLE FORESHORE BANK<br>• LIFTING / CRANE ACTIVITY ON SOFT BANK | • INTERACTION WITH RECREATIONAL VESSELS<br>• PUBLIC INTERACTION WITH SITE TRAFFIC<br>• UNAUTHORISED SITE ACCESS<br>• WORKING NEAR PRIVATE PROPERTIES | • POLLUTION HAZARDS ASSOCIATED W WORKING NEAR SEA<br>• RISK OF DAMA FLORA AND FA |

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9. DETAILS OF REVEGETATION REFER TO DESIGN REPORT

LEGEND

- REVEGETATION AREA A 241m2
- REVEGETATION AREA B (NATURAL COLONISATION) 356m2
- MHWS
- HAT
- BANK REPROFILE ALIGNMENT
- ROCK BAG ALIGNMENT
- MASS BLOC ALIGNMENT


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Little fish gather over submerged coir netting at high tide

# Lessons Learned and Next Steps

- Construct around certain tide heights and construction windows when shorebirds were not on site.
- Establish plants through summer and storm season.
- Construction costs living shoreline approx. $3,700/m vs $6,000/m for traditional seawall.
- Monitor performance and ongoing costs. Quantify sedimentation and natural revegetation.
- Fauna and flora monitoring, impact and benefits.
- Other trial solutions to consider – oysters and reef breakwater, sandy beach dune pilot, log anchoring systems and different log configurations, coarser sand/soil profile mixtures, letting natural area settle before planting.
- Refine CHAS mapping of suitable locations that would be suitable for NbS.
- Projects that can work within view lines.
- Implement NbS into a foreshore preventative maintenance schedule to proactively manage future issues. Assets with sufficient time for NbS establishment.
- Failure in pilots is not a bad thing. We want to learn what not to do, to be able to deliver cheap and effective solutions.
- Reduce red tape - State Government site visit occurred post completion and discussions on State Code amendments to make aspects if not all items included into accepted development code to not require DA approval.
- **State Grant funding was imperative in fast tracking our CHAS and delivery of projects!!!**