Mettams & Watermans Coastal Adaptation Options

Workshop 3

Disclaimer: *The content herein is part of an ongoing coastal engineering process and should not be considered final or exhaustive. For the latest information, please refer to the project page on the City of Stirling's website https://www.stirling.wa.gov.au/your-city/shaping-our-city/search-all-projects/coastal-environment-and-management or contact the City on (08) 9205 8555.*

m p rogers & associates pl

Welcome and Introductions

Outline / Agenda

- Group Introductions and Governance
- Summary of recent Stakeholder Engagement
- Benefits Distribution Analysis
- Recap Works to Date, Conditions & Objectives
- Adaptation Options
  - Mettams Pool
  - Watermans Bay
- Multi Criteria Analysis
- Next Steps

Community Engagement Update

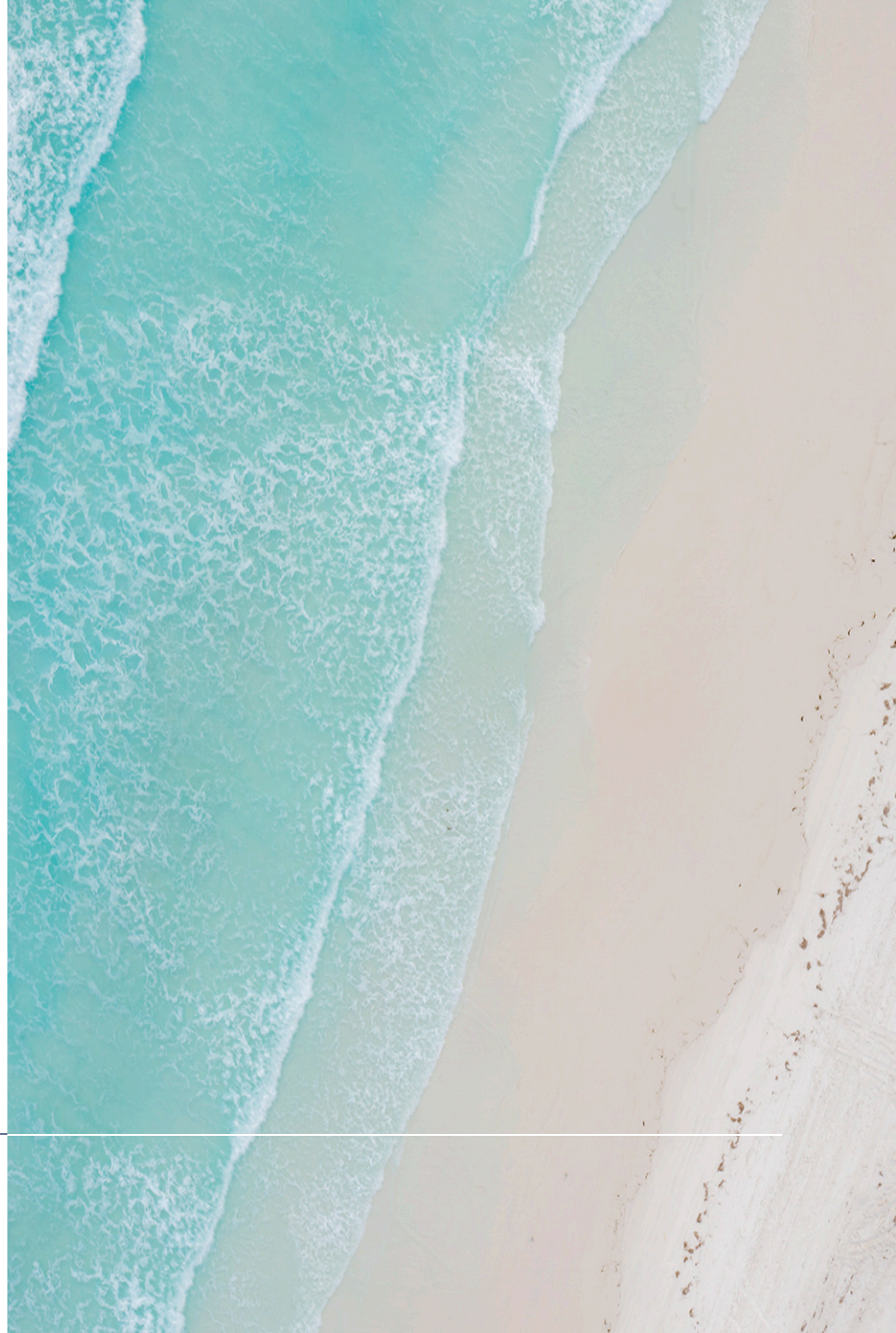
- Recruitment of community Representatives – Aug 24
- Introductory meetings and Project Overview – Sep 24
- Coastal Conversations:
  - Watermans – 10 Sep 24 – 7 participants
  - Trigg - 26 Sep 24 – 40 attendees (10 engaged after walk)
  - Feedback inc:
    - High level of interest in coastal adaption
    - Need for inclusive consultation, clear presentation communications
    - Specific concerns from surfers

Benefit Distribution Analysis

City of Stirling

Aither (a Ricardo Company)

Sarah Leck



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What is BDA and why do we use it

Who benefits from a proposed investment

WA State Coastal Planning Policy Guidelines requires a BDA to be undertaken before implementing any proposed coastal protection works.

Identify which groups are receiving the most benefits from adaptation actions

Identify the magnitude and timing of overall benefits resulting from adaptation actions

Useful for ensuring equitable cost recovery (beneficiary pays principal)

Inform funding and financing models for adaptation actions

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What does the BDA include?

Project overview

BDA approach

- Assess the benefits from coastal protection works at Watermans Bay Beach and Mettams Pool Beach
- Identify the stakeholders who benefit from coastal protection works
- Attribute benefits resulting from coastal protection works to relevant groups

Purpose of the BDA

- Determine potential equitable funding contributions
- Identify appropriate future funding arrangements for coastal protection
- Ensure that the BPP is met where appropriate

Questions for today

- Unpack some of the community values associated with Mettams Pool and Watermans Bay and how these values might change due to coastal hazards

Challenges in BDA

Determining benefits

A key challenge for BDA of coastal protection measures is access to reliable data.

Some key adaptation benefits are particularly challenging to value such as:

- Recreational beach use
- Tourism benefits and the loss of tourism income or value
- Disruption to communities and local businesses as a result of specific flood or erosion events




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Recreational benefits

Testing some assumptions

- How many people use each of these beaches daily?
- What would people's response be to erosion affecting these beaches?

Watermans Bay

Popular beach amongst mainly locals

Tourism visits/day: 227

Recreation visits/day: 670

Mettams Pool

Popular beach amongst both tourists and locals

Tourism visits/day: 202

Recreation visits/day: 596

- Are these quantity estimates reasonable?

Sources: TRA LGA and region profiles, Abbie A. Rogers and Michael P. Burton, 2019, *Non-market valuation instruments for measuring community values affected by coastal hazards guidance and an application*

Thank you

Sarah Leck

Principal

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Workshops 1 & 2 - Recap

Recap

- Assets at risk
- History of erosion over several decades
  - Reduction in sediment feed
  - Sea level rise
- Number of previous technical assessments and investigations
- Discussed project objectives
- Discussed coastal processes

Do Nothing – Erosion Hazard Areas

WATERMANS BAY

METTAMS POOL

- Require action – doing nothing is not an option

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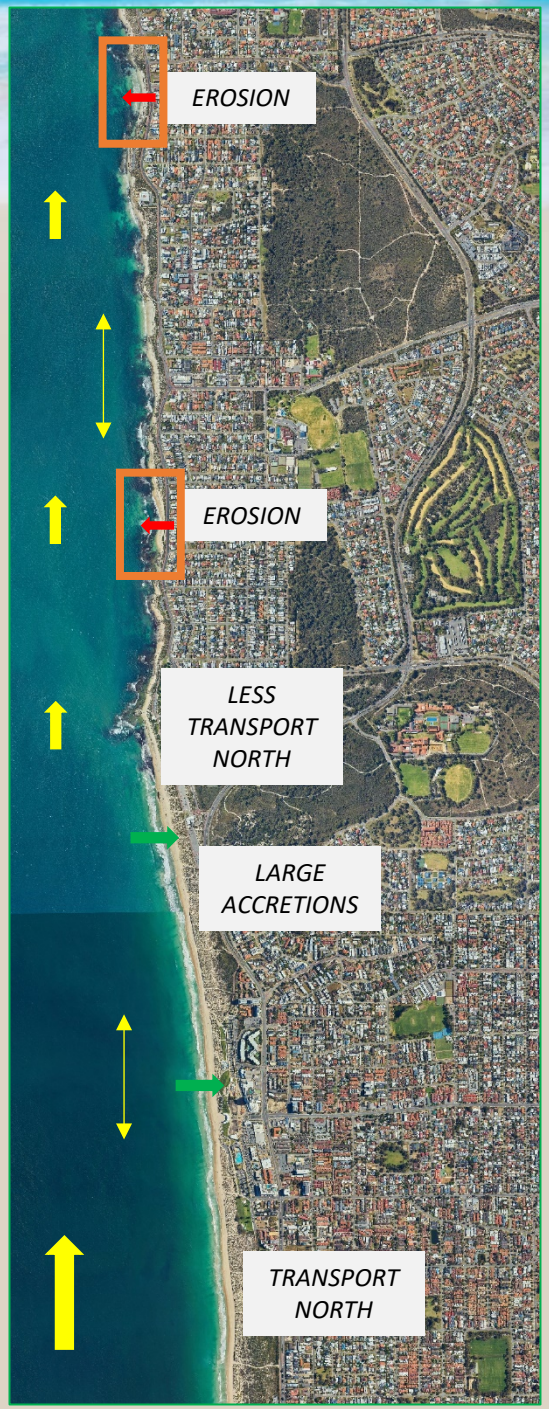
Success Criteria & Project Objectives

- Consistent success criteria and objectives from the CHRMAP
- Community value 'recreation' and 'natural environment' most about their coastline

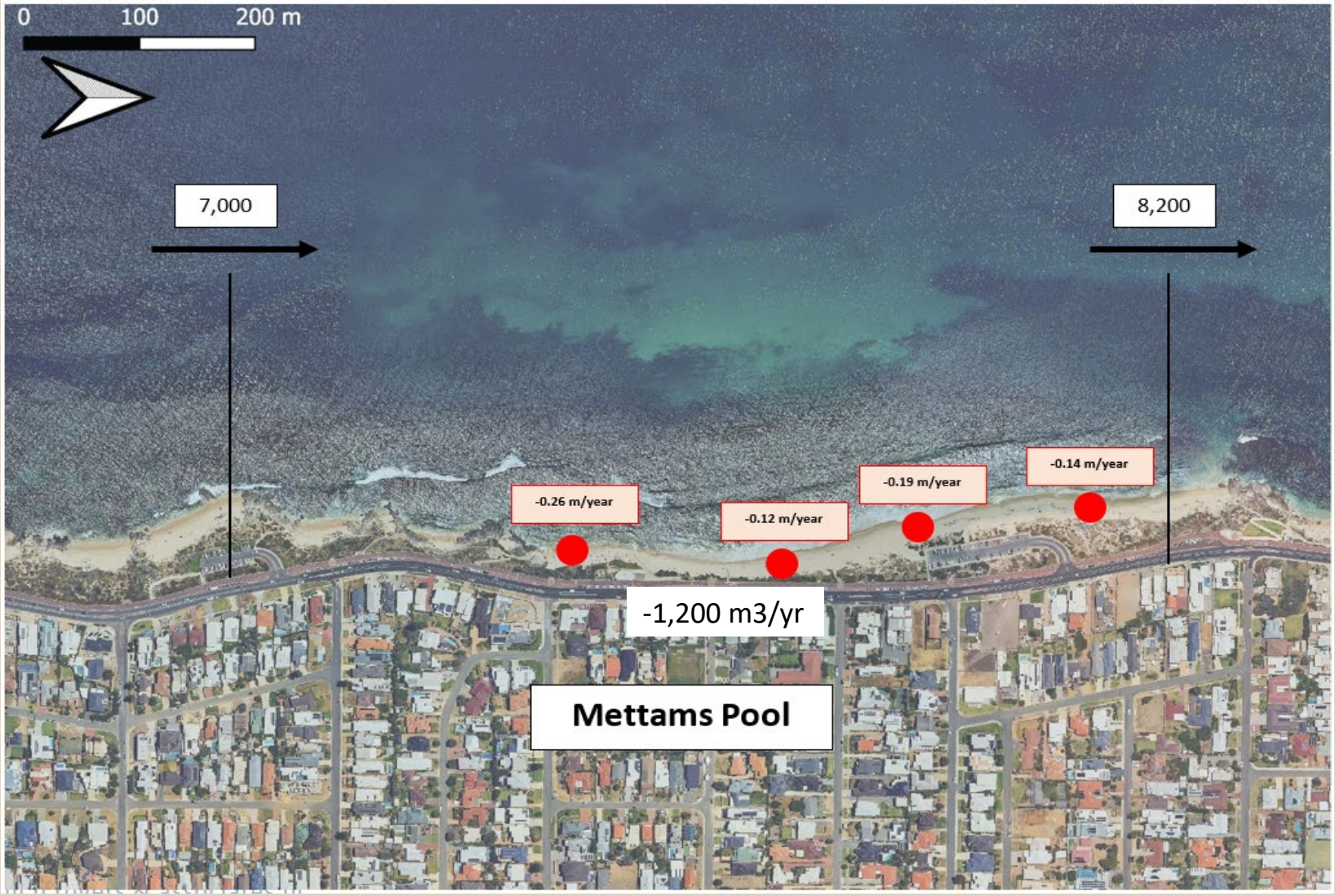
	Success Criteria / Project Objectives
1	Preserve the function and opportunity for recreation activities along the coastline (such as walking/running, swimming and surfing).
2	Preserve the existing hospitality venues along the coastline and access to them.
3	Ensure the natural environment is protected and sustained in its current condition or an improved condition (concerning the dunes and flora and fauna).
4	Develop solutions to coastal processes that are sustainable (financially, socially and built form) and locally responsive.
5	Revisit regularly with community and key stakeholders their values in relation to development adjacent the coastline.
6	Maintain services that maximise community benefit for all.
7	Ensure the coastline is safe and accessible to all.
8	Achieve a balance between access needs and environmental sensitivities.

Coastal Processes - Recap

- Based on previous assessments
- Seasonal transport and changes
  - Transport north in sea breezes
  - Transport south in storms
- Net northerly transport
- Erosion at Mettams & Watermans
- Required updating



Conceptual Sediment Movement Models – Mettams Pool



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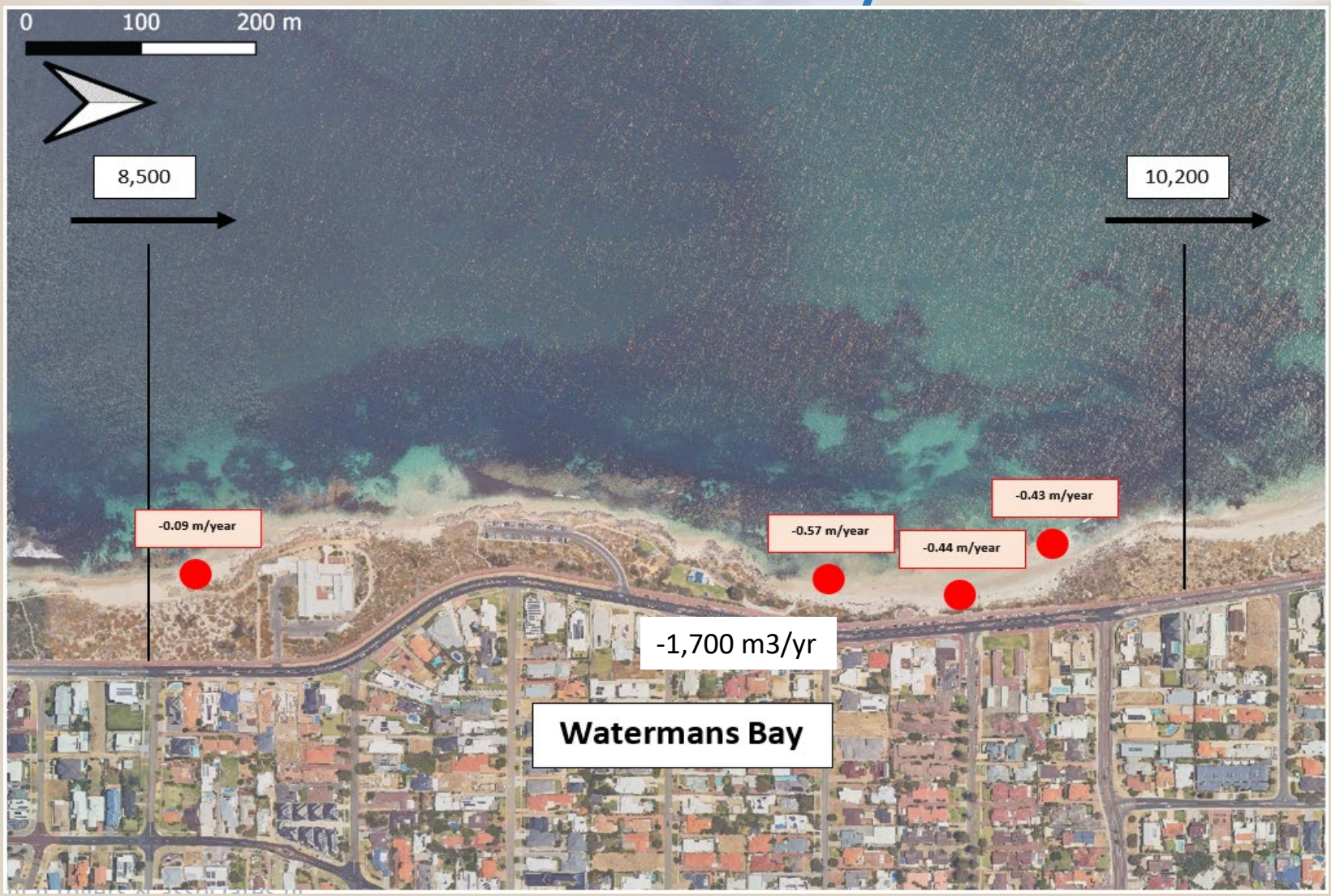
Conceptual Sediment Movement Models – Watermans Bay



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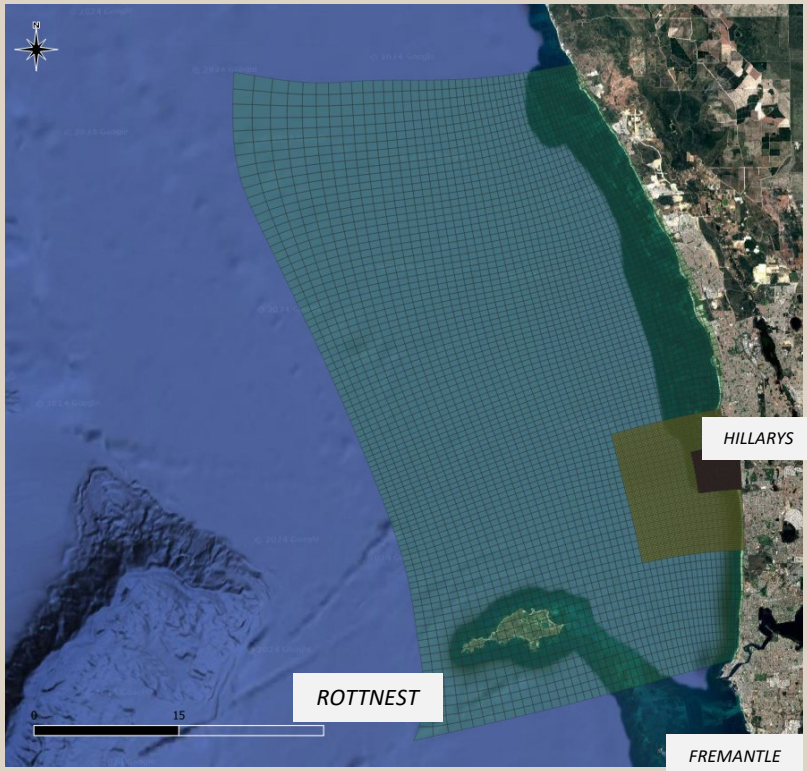
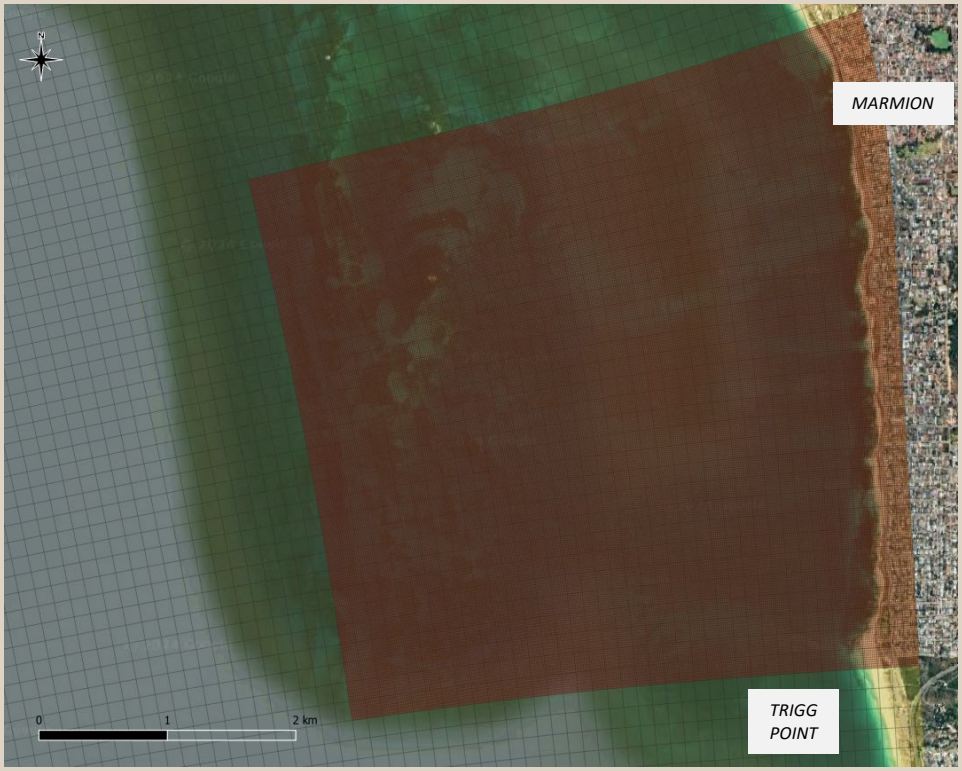
Wave Modelling

Wave Modelling & Design Conditions

- Delft3D wave model set up to simulate design wave conditions near sites
- Nested grid format





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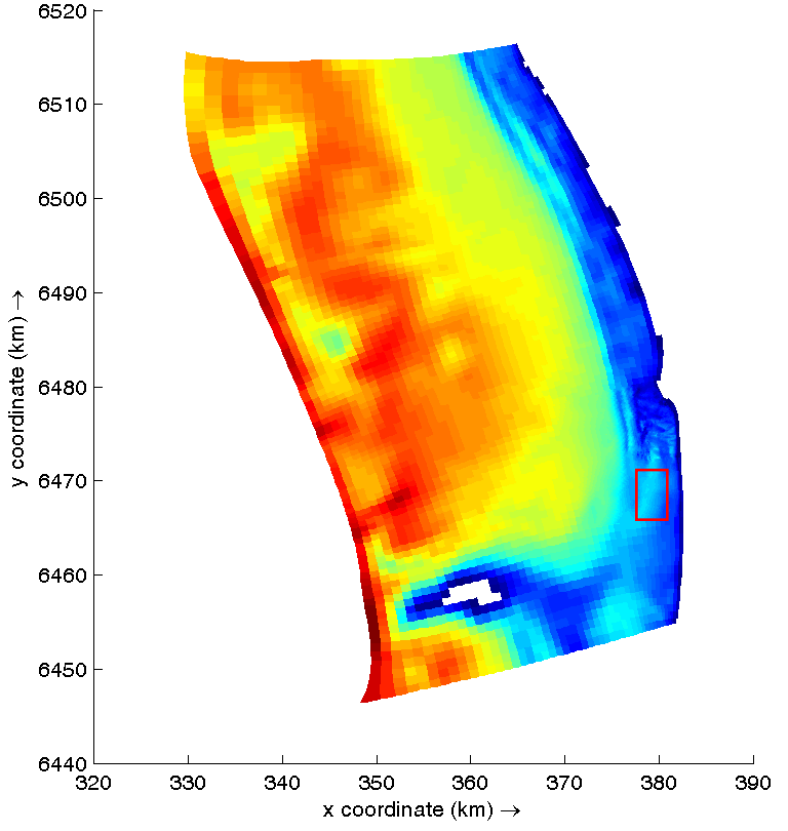
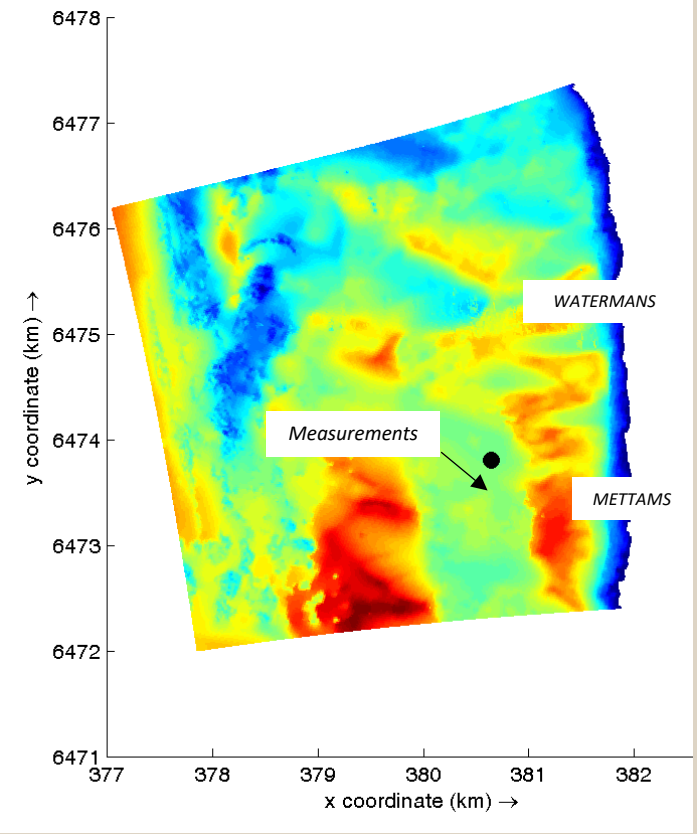
Wave Modelling & Design Conditions

- Grids updated from previous work to suit project
- Updated bathymetry with survey where available





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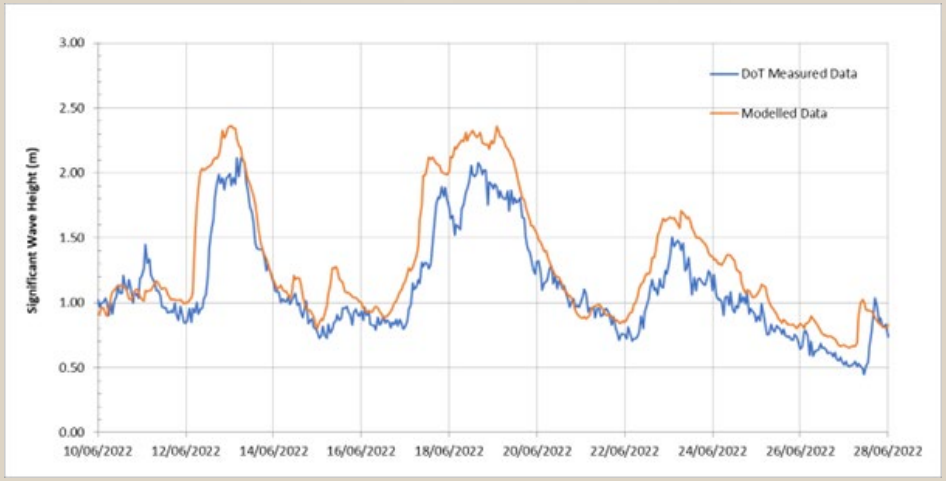
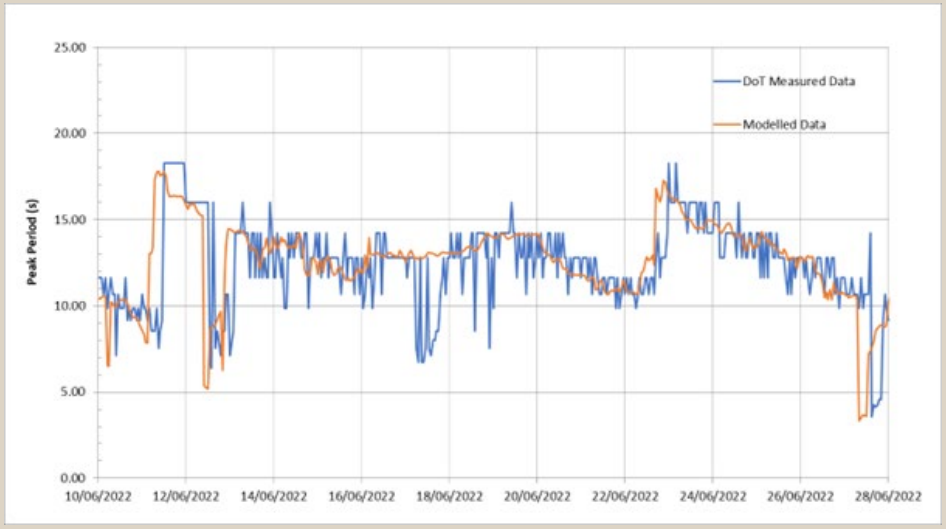
Wave Modelling & Design Conditions

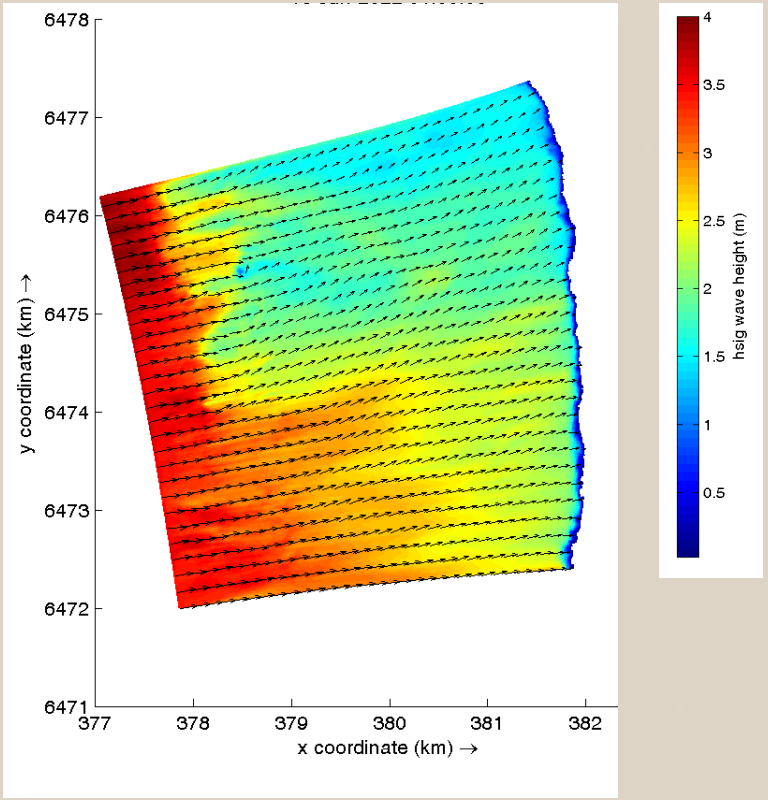
- Calibrated against measurements





Wave Modelling & Design Conditions

- Model performing well, slightly conservative
- Modelled 50 year ARI event
- Design waves near sites
  - Watermans Hs = 2.4 m
  - Mettams Hs = 2.0 m
- Used in development of design



Concept Coastal Adaptation Options

Concept Coastal Adaptation Options

- Develop coastal adaptation concepts to manage impacts and meet objectives
- The primary objective is coastal adaptation
- Estimate details and impacts of the concepts from:
  - Conceptual sediment models
  - Wave modelling
  - Engineering experience
  - Background information
- Concepts include:
  - Sand Nourishment
  - Seawall
  - Groynes
  - Offshore structures (emergent and submerged)

Success Criteria & Project Objectives

- Reminder

	Success Criteria / Project Objectives
1	Preserve the function and opportunity for recreation activities along the coastline (such as walking/running, swimming and surfing).
2	Preserve the existing hospitality venues along the coastline and access to them.
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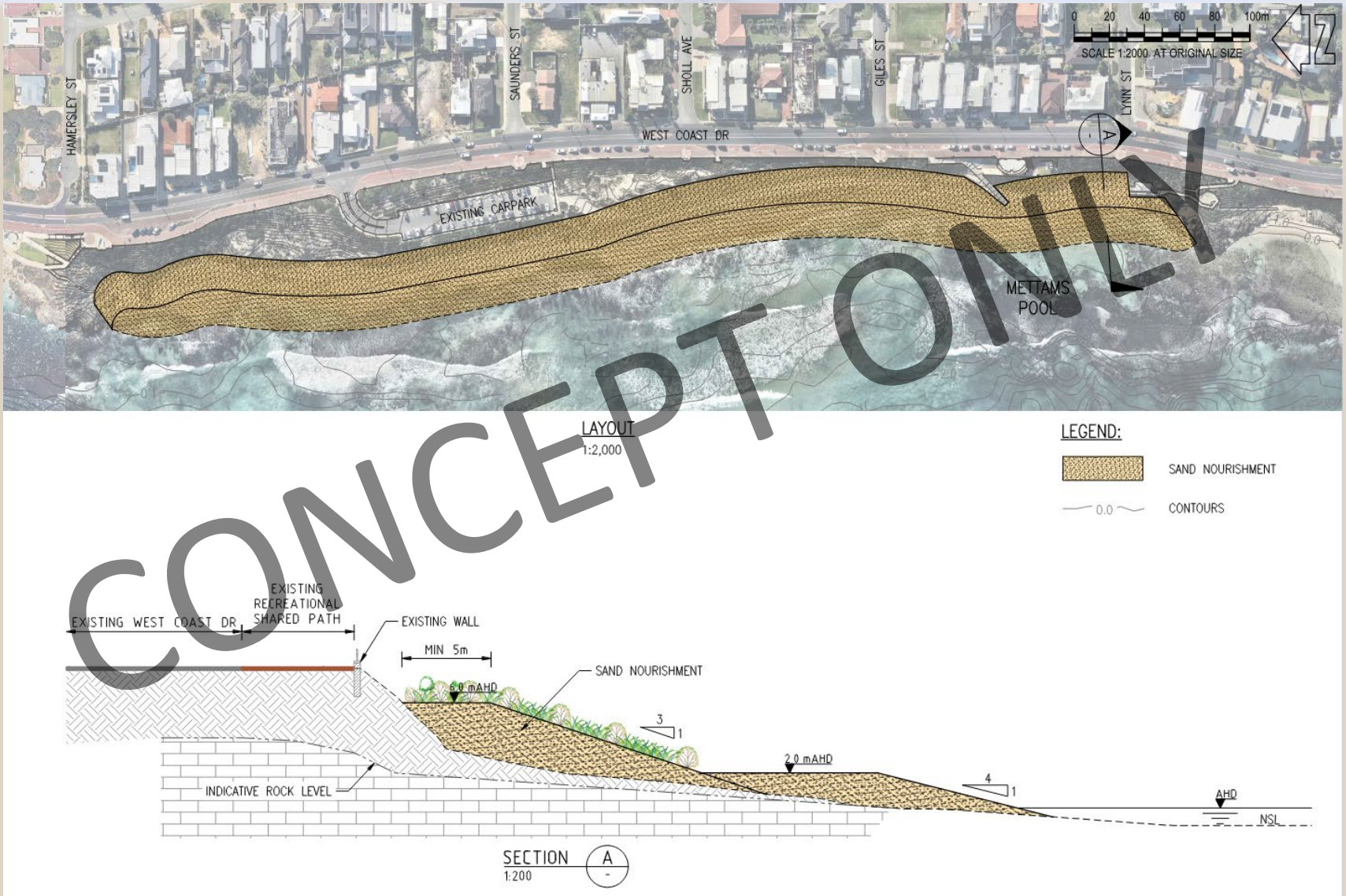
Mettams Pool – Concept Option 1 of 5
Sand Nourishment



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Mettams Pool – Concept Option 1 of 5
Sand Nourishment

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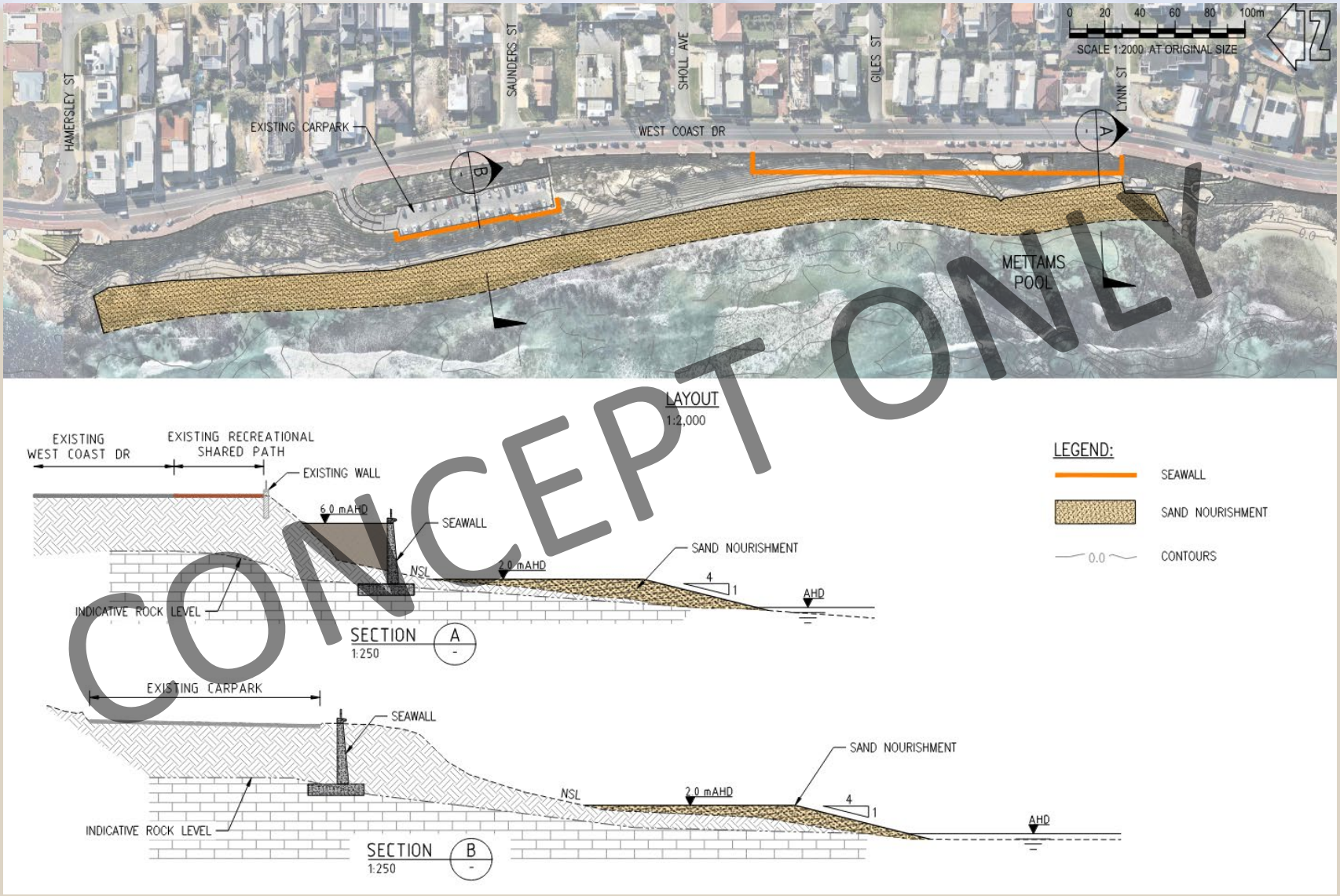
Mettams Pool – Concept Option 1 of 5 Sand Nourishment

Pros	Cons	Considerations
Protects infrastructure through nourishment of dune and providing storm buffer	Large volumes of borrowed sand required for nourishment	Require an ongoing source of sand
Maintains continuity of the beach space	Beach nourishment causes beach disturbance	Consideration of sediment movements
No encroachment into Marmion Marine Park	High capital and maintenance costs	
Minimal visual impact	Risk of nearshore reef smothering	
Proven accessibility as sand has been placed at both sites before	Potential loss of buffer during severe or consecutive storm events, requiring additional nourishment – less guarantee	
Increases public safety by reducing exposure of the nearshore reef	Logistical challenges with beach access during construction	
Nourishment can be adjusted based on shoreline response		
Dune stabilisation improves back beach ecology and vegetation		

Mettams Pool – Concept Option 2 of 5 Seawall



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Mettams Pool – Concept Option 2 of 5 Seawall

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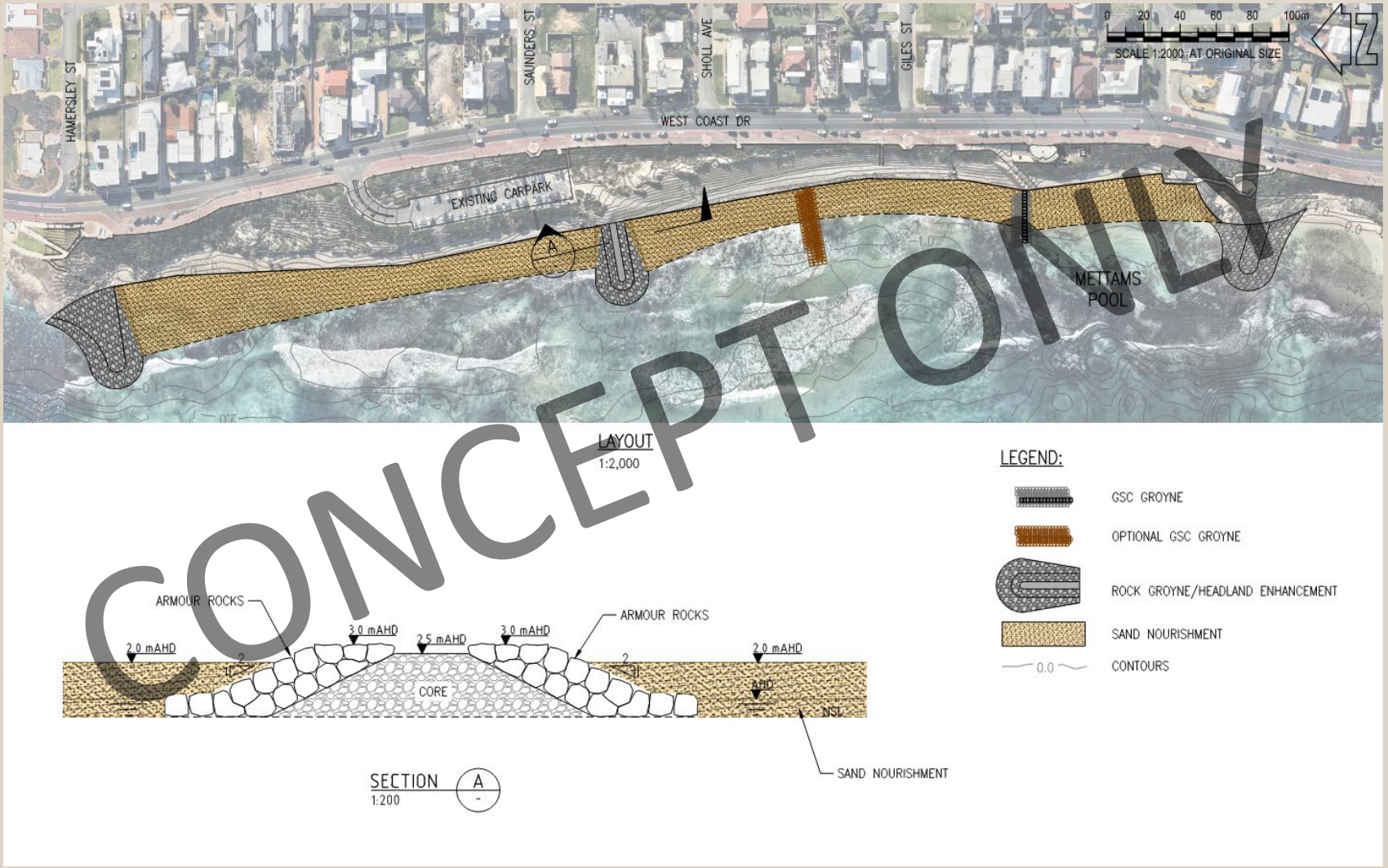
Mettams Pool – Concept Option 2 of 5 Seawall

Pros	Cons	Considerations
Seawall protects infrastructure, sand provides beach	Reduces usable beach width and profile	Clearing permit required
Maintains continuity of the beach space	Significant visual impact of seawall	Require an ongoing source of sand
No encroachment into Marmion Marine Park	Significant volume of clearing to allow construction	Requires additional design of space to make functional
Improves beach	Large volumes of borrowed sand required for nourishment	Consideration of sediment movements
Increases public safety by reducing exposure of the nearshore reef	Beach nourishment causes beach disturbance	
Nourishment can be adjusted based on shoreline response	High capital and maintenance costs	
Proven technique	Risk of nearshore reef smothering as sand moves offshore	
Land-based construction	Logistical challenges with beach access during construction	
	Seawall is inflexible and may require replacement if damaged	

Mettams Pool – Concept Option 3 of 5 Groynes



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Mettams Pool – Concept Option 3 of 5 Groynes

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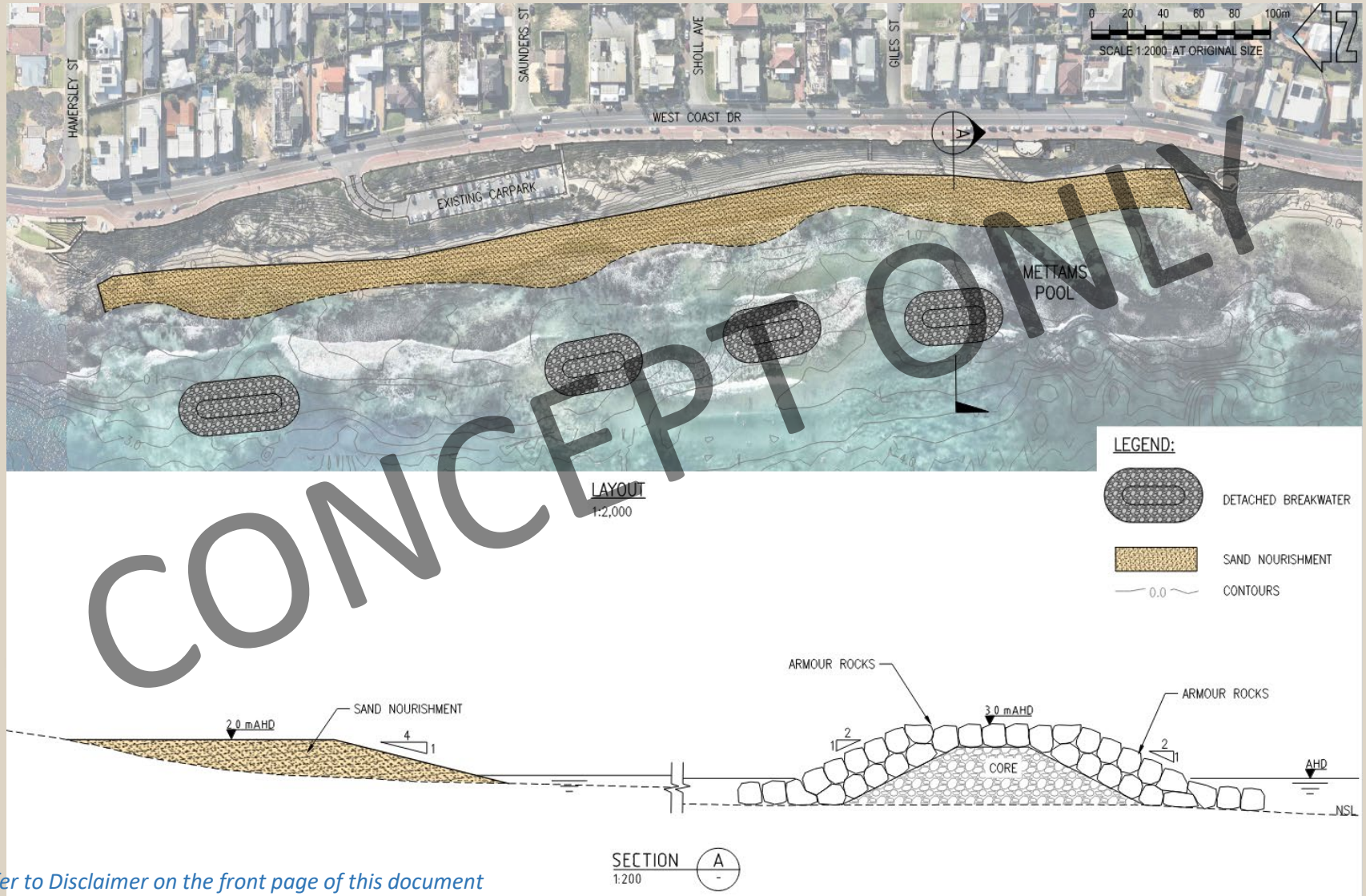
Mettams Pool – Concept Option 3 of 5 Groynes

Pros	Cons	Considerations
Protects assets by increasing beach width, creating an erosional buffer	Reduces beach continuity due to shore-perpendicular structures	Clearing permit required
Maintains / increases current beach width and slope	Groynes and headlands may be visually unappealing	Require an ongoing source of sand
Lower capital and maintenance costs	Significant visual impact from the headland/groynes	Requires additional design of space to make functional
Dune stabilisation enhances back beach ecology, with minimal impact on flora and fauna	Interrupts longshore sediment transport, potentially impacting downdrift coast	Consideration of sediment movements
Improves public safety by reducing nearshore reef exposure	Encroaches into Marmion Marine Park, requiring additional environmental approvals	Require Marine and Coastal Approval through DBCA
Nourishment can be adjusted as needed	Structures may affect nearshore seastate and inhibit water-based such as surfing and wind surfing	
Construction is largely land-based	Logistical challenges with beach access during construction	
	Increased relative maintenance and operational costs due to access restrictions	

Mettams Pool – Concept Option 4 of 5 Offshore Headlands



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Mettams Pool – Concept Option 4 of 5
Offshore Headlands

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Mettams Pool – Concept Option 4 of 5 Offshore Headlands

Pros	Cons	Considerations
Allows continuity of beach	Headlands may be visually unappealing	Require Marine and Coastal Approval through DBCA
Protects assets by increasing beach width, creating an erosional buffer	Logistical challenges with in-water construction	Require an ongoing source of sand
Maintains / increases current beach width and slope	Encroaches into Marmion Marine Park, requiring additional environmental approvals	Consideration of sediment movements
Lower capital and maintenance costs	Structures may impact water-based activities such as surfing and wind surfing	
Dune stabilisation enhances back beach ecology, with minimal impact on flora and fauna	Interrupts longshore sediment transport, potentially impacting downdrift coast	
Improves public safety by reducing nearshore reef exposure	Increased relative maintenance and operational costs due to access restrictions	
Nourishment can be adjusted as needed	Structures may damage nearshore reef	
May increase habitat around structures		

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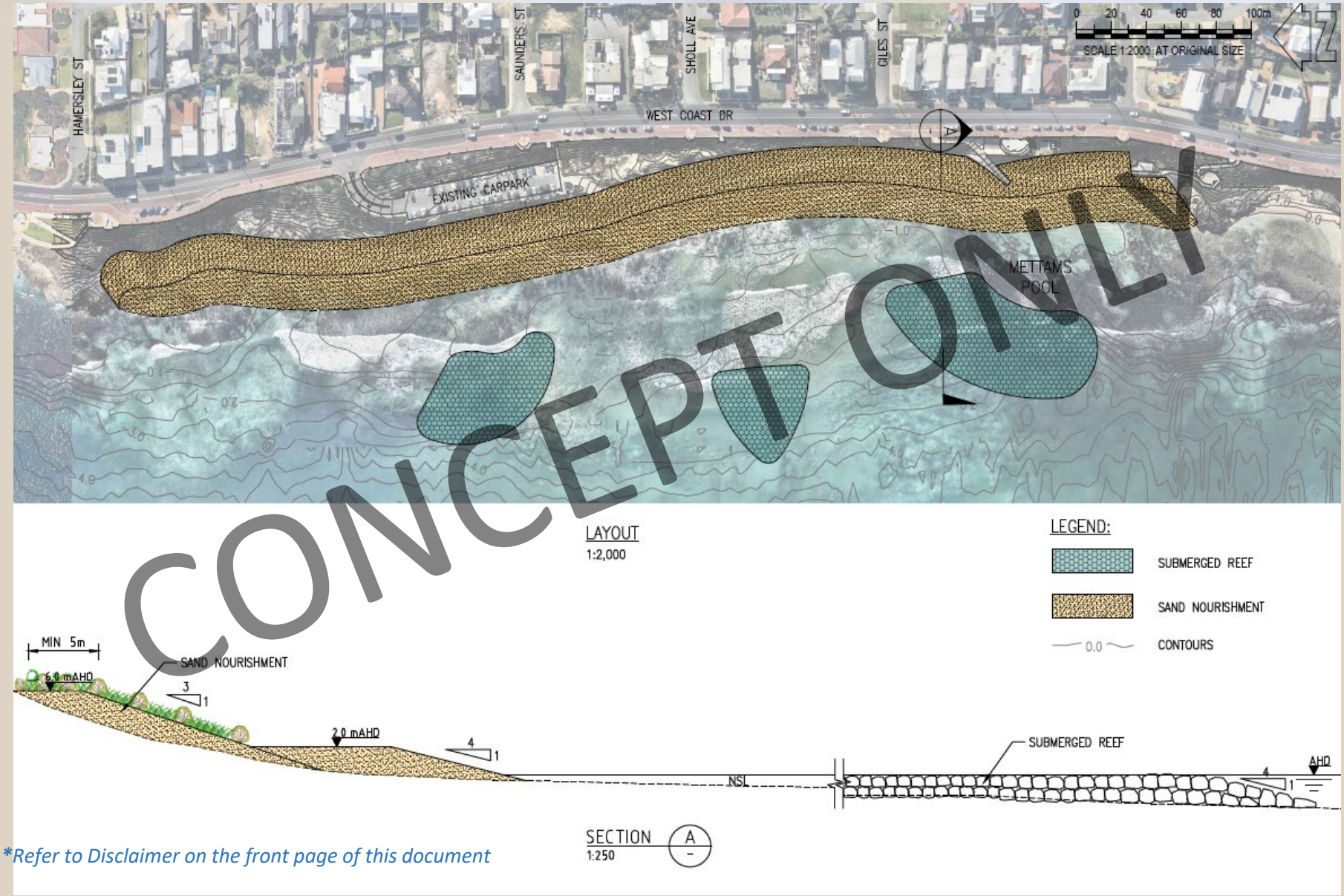
Mettams Pool – Concept Option 5 of 5
Reef Enhancement



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Mettams Pool – Concept Option 5 of 5
Reef Enhancement

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Mettams Pool – Concept Option 5 of 5 Reef Enhancement

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Maintains continuity of the beach space	Beach nourishment causes beach disturbance	Consideration of sediment movements
Structures can be designed to improve water based activities such as surfing and snorkelling	High capital and maintenance costs	Require Marine and Coastal Approval through DBCA
Minimal visual impact	Risk of nearshore reef smothering	Consider safety of reef if surfable
Increases public safety by reducing exposure of the nearshore reef	Potential loss of buffer during severe or consecutive storm events, requiring additional nourishment – less guarantee	
Nourishment can be adjusted based on shoreline response	Logistical challenges with in-water construction	
	Interrupts longshore sediment transport as it reduces the wave energy reaching the coastline	
	Structures may damage nearshore reef	

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Mettams Pool – Concept Options Indicative Upfront Capital Costs

Option	Capital Cost	Comment
Sand Nourishment	$2.5M	Large ongoing costs
Seawall	$7M	Moderate ongoing costs
Groynes / Headlands	$4M	Moderate ongoing costs
Offshore Headlands	$7M	Moderate ongoing costs
Reef Enhancement	$9M	Large ongoing costs

Watermans Bay – Concept Option 1 of 5
Sand Nourishment

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Watermans Bay – Concept Option 1 of 5
Sand Nourishment

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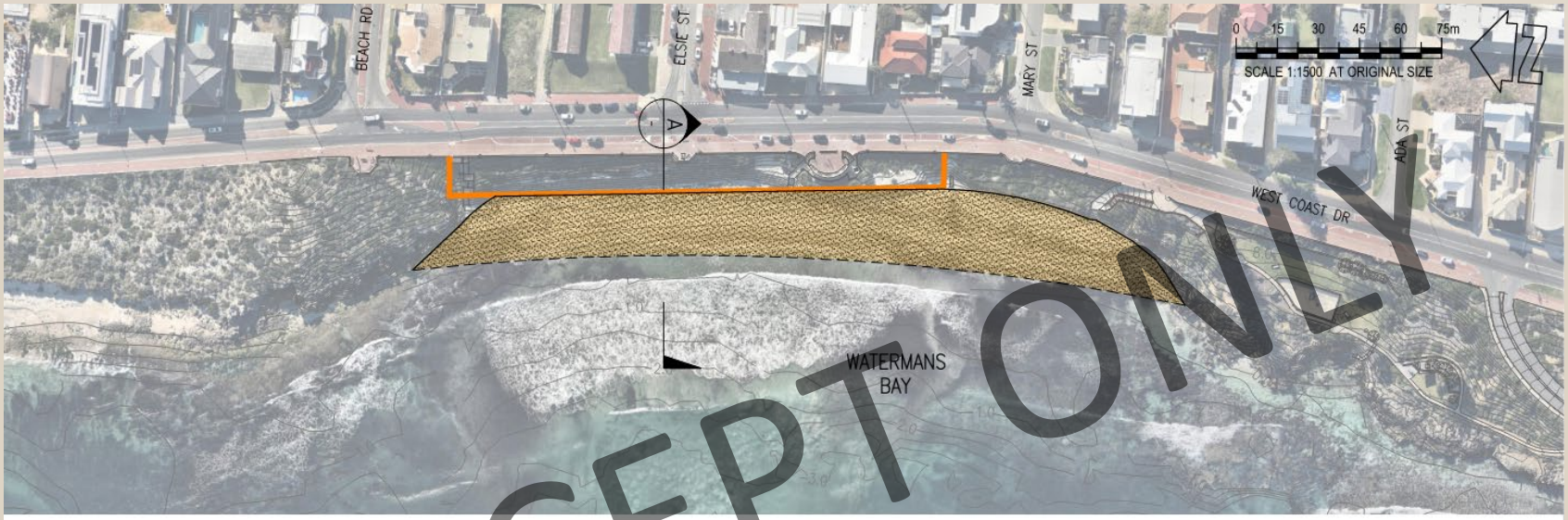
Watermans Bay – Concept Option 2 of 5 Seawall



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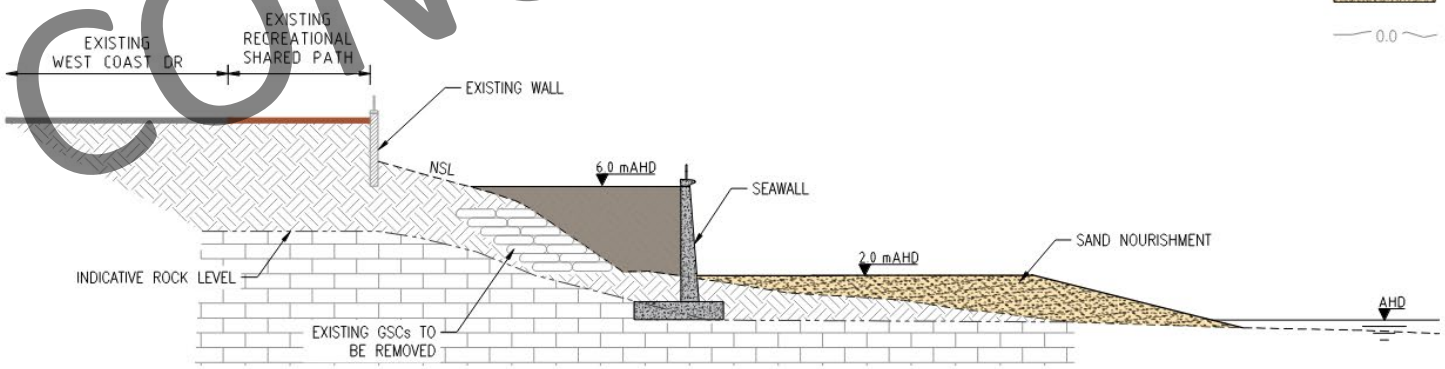
LEGEND:
- SEAWALL
- SAND NOURISHMENT
- 0.0 CONTOURS



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Watermans Bay – Concept Option 2 of 5 Seawall

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Watermans Bay – Concept Option 2 of 5 Seawall

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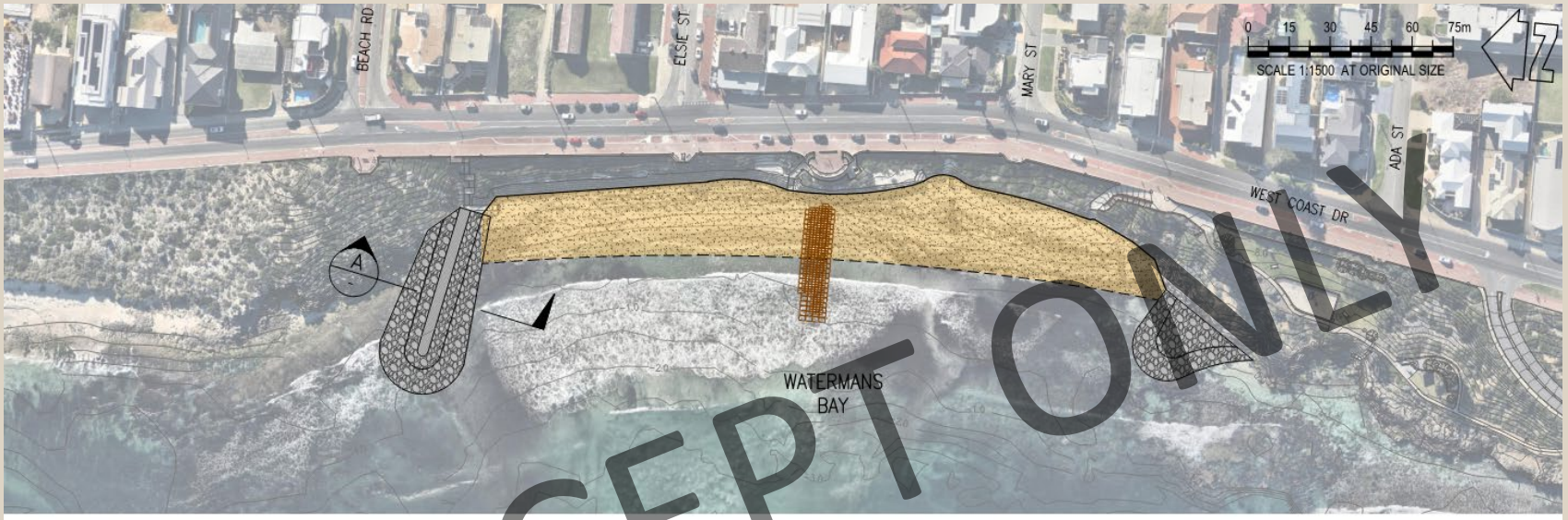
Watermans Bay – Concept Option 3 of 5 Groynes



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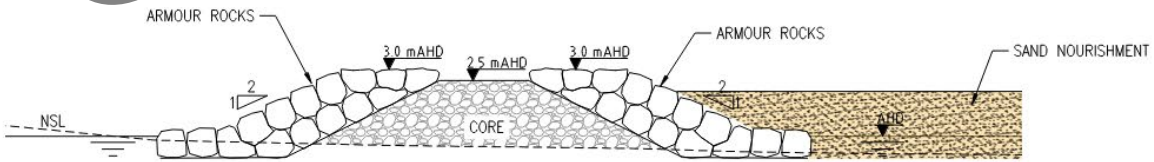
LEGEND:

- OPTIONAL GSC GROYNE
- ROCK GROYNE/HEADLAND ENHANCEMENT
- SAND NOURISHMENT
- 0.0 CONTOURS



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Watermans Bay – Concept Option 3 of 5 Groynes

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Watermans Bay – Concept Option 3 of 5 Groynes

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Nourishment can be adjusted as needed	Structures may affect nearshore seastate and inhibit water-based such as surfing and wind surfing	
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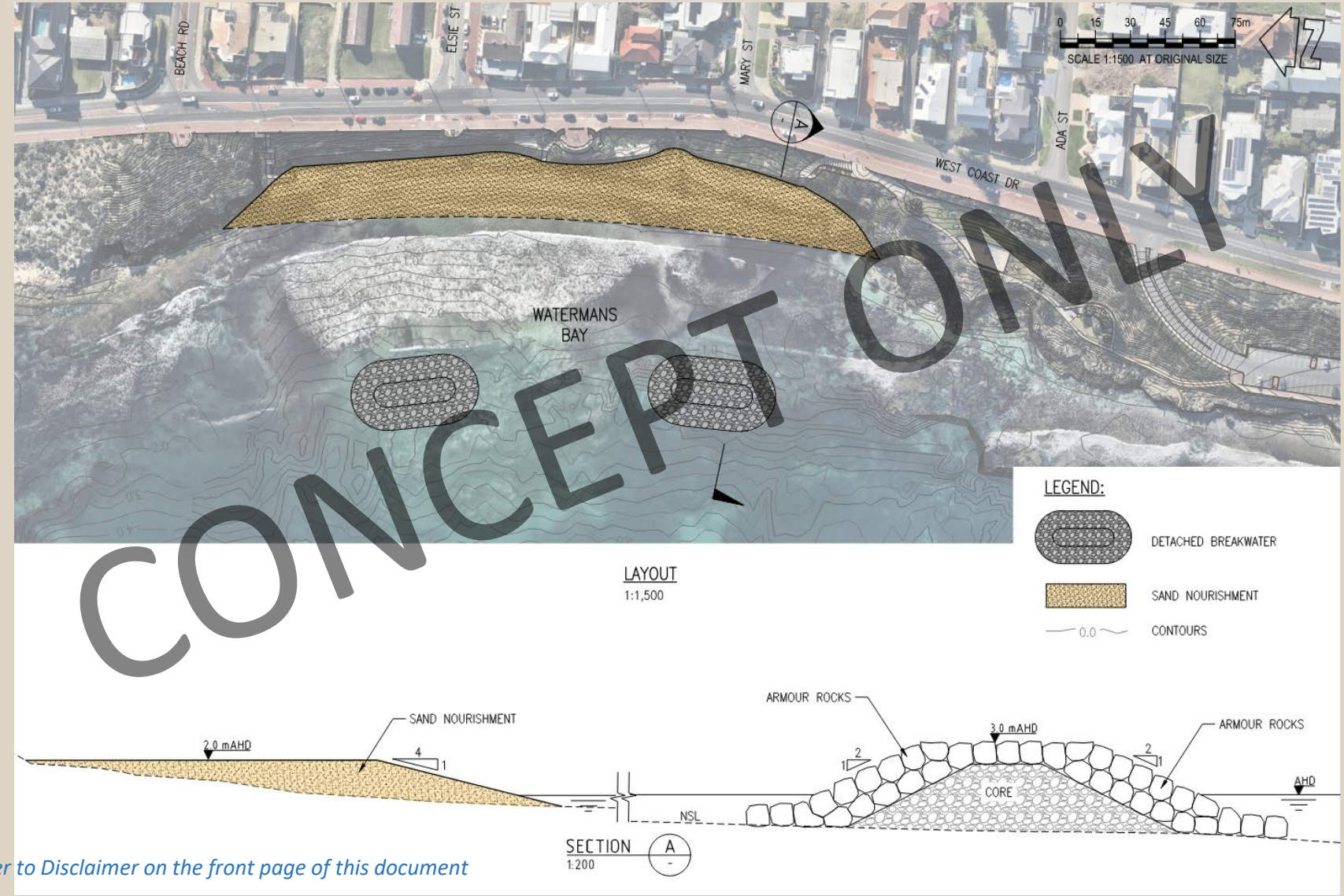
	Increased relative maintenance and operational costs due to access restrictions	

Watermans Bay – Concept Option 4 of 5 Offshore Headlands



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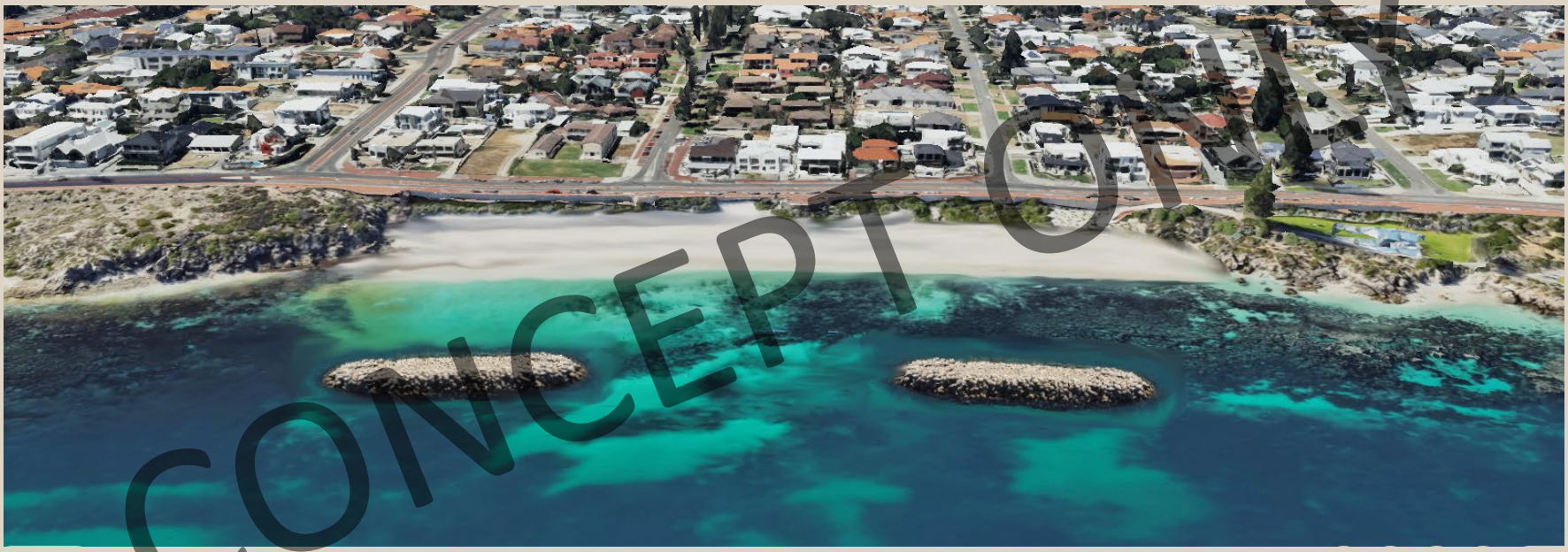
Watermans Bay – Concept Option 4 of 5
Offshore Headlands



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Watermans Bay – Concept Option 4 of 5 Offshore Headlands

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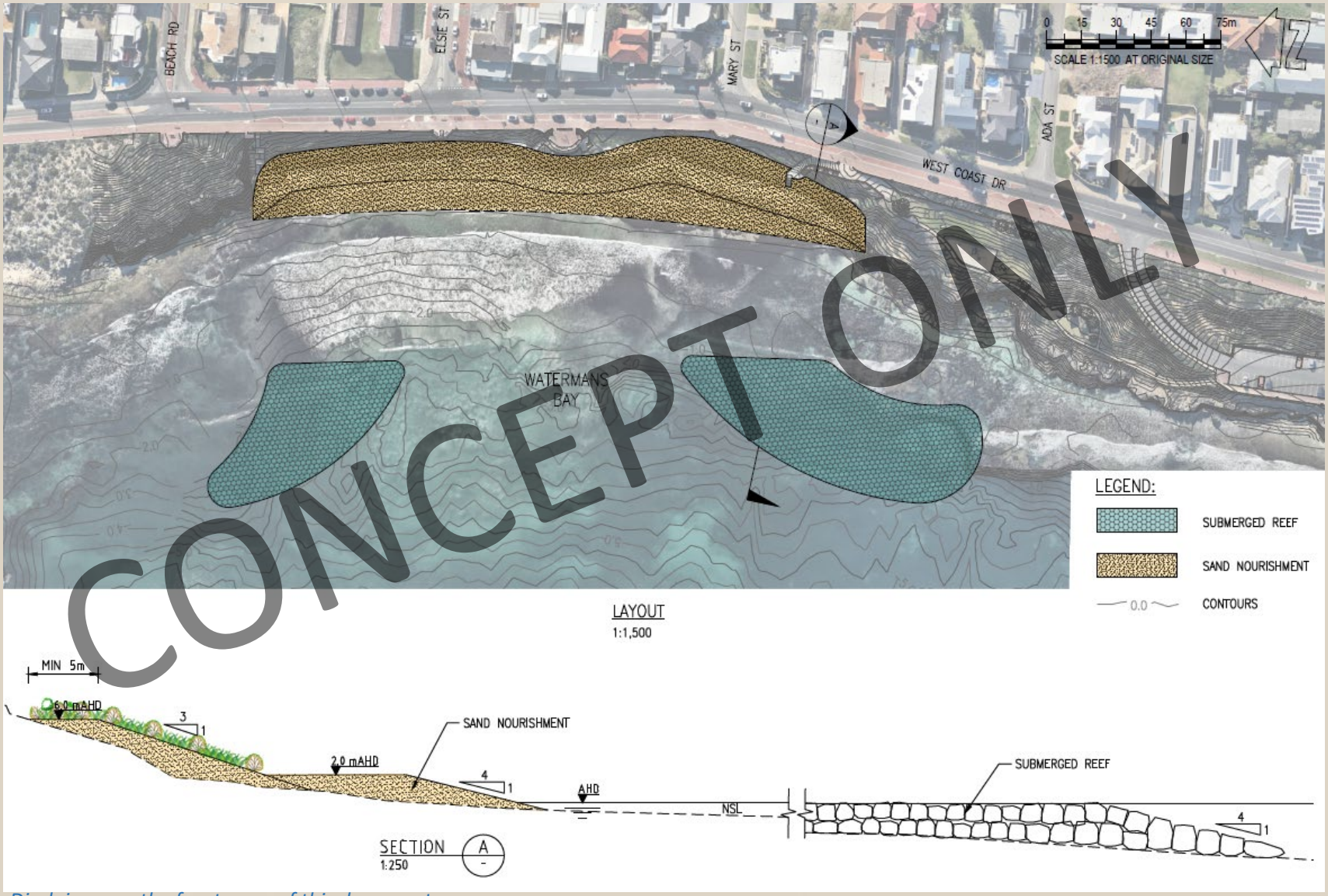
Watermans Bay – Concept Option 5 of 5 Reef Enhancement



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Watermans Bay – Concept Option 5 of 5
Reef Enhancement

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Watermans Bay – Concept Option 5 of 5 Reef Enhancement

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Structures can be designed to improve water based activities such as surfing and snorkelling	High capital and maintenance costs	Require Marine and Coastal Approval through DBCA
Minimal visual impact	Risk of nearshore reef smothering	Consider function of reef – solely protection, or surfing, MPR
Increases public safety by reducing exposure of the nearshore reef	Potential loss of buffer during severe or consecutive storm events, requiring additional nourishment – less guarantee	Consider safety of reef if surfable
Nourishment can be adjusted based on shoreline response	Logistical challenges with in-water construction	
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	Structures may damage nearshore reef	

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Watermans Bay – Concept Options Indicative Upfront Capital Costs

Option	Capital Cost	Comment
Sand Nourishment	$2M	Large ongoing costs
Seawall	$6M	Moderate ongoing costs
Groynes / Headlands	$3M	Moderate ongoing costs
Offshore Headlands	$4M	Moderate ongoing costs
Reef Enhancement	$7M	Large ongoing costs

Multi Criteria Analysis

Multi-Criteria Analysis

- MCA is used to assess options
- Considers a range of criteria

Table 3-2 Multi-Criteria Assessment criteria

Preliminary feasibility	Preliminary acceptability	Preliminary financial implication
Effectiveness	Environmental and social impact	Financial gain / avoidance of cost
Governance, legal implications and approval risk	Community acceptability	Capital cost
Reversibility / adaptability	-	Ongoing cost

Performance Criteria & Weightings

- General broad categories
- Can be weighted

Technical Criteria – Draft Weightings

		TECHNICAL		
	Description	Effectiveness	Adaptability	Legal / approval requirements
		Weighting 60%	Weighting 30%	Weighting 10%
	Rating Description	Expected effectiveness of the scheme at achieving the key objectives without ongoing modifications or risks of failure/poor outsomes.	Ease with which option can be modified to account for changes in conditions, etc in the future	Extent of effort and time required to receive approval for option
Rating Scale	1	Not expected to be effective	Modification not possible	Extreme effort required - >12 month timeframe for approvals
	2	Slightly effective	Only slight modifications possible with large effort	Significant effort required to achieve approvals 6 to 12 month period
	3	Effective	Reasonable potential for modification with some effort	Some issues with approvals, but addressed over 3 to 6 month period
	4	Very effective	Modifications readily possible with moderate level of effort	Minor issues with approvals, but easily addressed
	5	Completely effective	Complete modification of option easily achieved	No issues with approvals

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Social Criteria – Draft Weightings

		SOCIAL			
	Description	Provide beach and active recreation opportunities	Provide coastal amenity	Ensure the coastline is accessible for all	Provide recreational facilities including ablutions and changerooms, shade and shelter
		Weighting 30%	Weighting 30%	Weighting 20%	Weighting 20%
	Rating Description	Extent that the option provides useable beach area and active recreation opportunities	Extent that the option provides opportunities for passive recreation and amenity, such as provision of dual use path, areas to sit and view the water, etc.	Ranking based on provision and likely functionality of access to the beach.	Ranking based on provision and likely functionality of the ablutions, changerooms, shade and shelter.
Rating Scale	1	Significant loss in beach area and active recreation opportunities	Significant loss of amenity and passive recreation opportunities	Access not provided	Ablutions, changerooms, shade and shelter not provided
	2	Slight decrease in beach area and active recreation opportunities	Slight decrease in amenity and passive recreation opportunities	Access provided but with potential loss of functionality due to change in beach or areas of beach usage	Ablutions, changerooms, shade and shelter provided but with potential loss of functionality due to change in beach or areas of beach usage
	3	No net change in beach area and active recreation opportunities	No net change to amenity and passive recreation opportunities	Access provided within scheme with minimal potential for loss of functionality	Ablutions, changerooms, shade and shelter provided within scheme with minimal potential for loss of functionality
	4	Slight increase in beach area and active recreation opportunities	Slight increase in amenity and passive recreation opportunities	Access provided with for all most of the time	Ablutions, changerooms, shade and shelter provided with improved functionality
	5	Significant increase in beach area and active recreation opportunities	Significant increase in amenity and passive recreation opportunities	Access provided for all at all times	Ablutions, changerooms, shade and shelter ideally situated

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Environmental Criteria – Draft Weightings

		ENVIRONMENTAL	
	Description	Preservation of beach environment (beach and vegetated dunes)	Preservation of Marine Park
		Weighting 50%	Weighting 50%
	Rating Description	How well the option protects or provides for preservation of the beach environment, including dunes	How well the option protects or provides for preservation of the marine park environment
Rating Scale	1	Significant loss of beach environment	Significant loss of marine park environment
	2	Slight loss of beach environment	Slight loss of marine park environment
	3	No net change in beach environment	No net change in marine park environment
	4	Slight increase in beach environment	Slight increase in marine park environment
	5	Significant increase in beach environment	Significant increase in marine park environment

**Refer to Disclaimer on the front page of this document*

Economic Criteria – Draft Weightings

		ECONOMIC	
	Description	Capital cost	Operating/ maintenance cost
		Weighting 50%	Weighting 50%
	Rating Description	Capital cost to construct	Ongoing operating and maintenance costs to maintain
Rating Scale	1		
	2		
	3		
	4		
	5		

Weightings

- How should they be weighted?

Criteria	Technical	Social	Environmental	Economic
Weighting	25%	25%	25%	25%

Any other business

Next Steps

Workshop 4:
Wednesday 11 December
1:00pm – 3:00pm