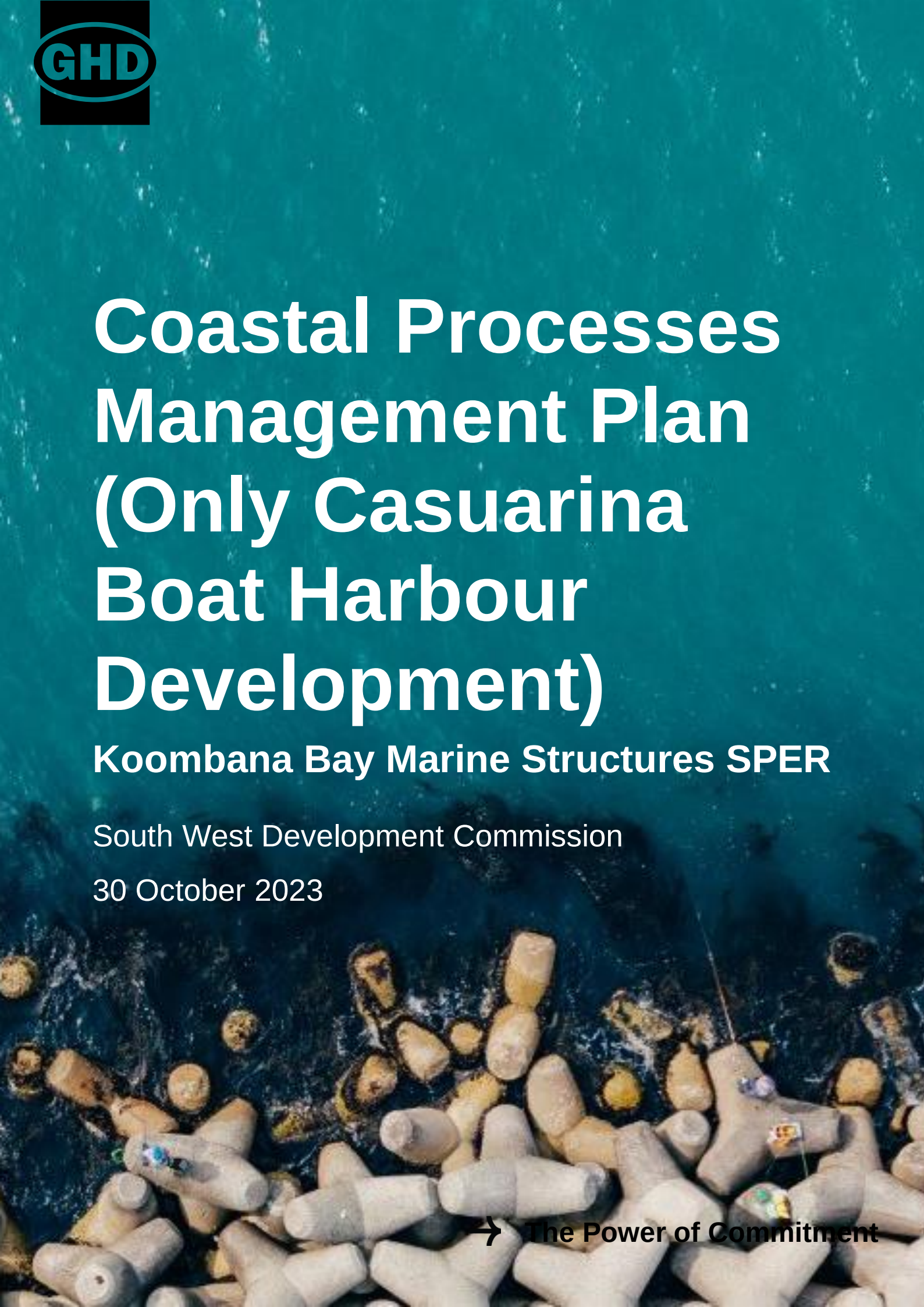
Coastal Processes Management Plan (Only Casuarina Boat Harbour Development)

Koombana Bay Marine Structures SPER

South West Development Commission

30 October 2023



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Document status

Status Code	Revision	Author	Reviewer		Approved for issue		
			Name	Signature	Name	Signature	Date
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Executive summary

This Coastal Processes Management Plan (CPMP) has been prepared in accordance with the Environmental Protection Authority's (EPA) instructions on the preparation of environmental management plans (EPA 2020) for only one of the future proposals of the Koombana Bay Marine Structures (KBMS) Strategic proposal (Assessment Number 2049), namely the Casuarina Boat Harbour (CBH) development. This CPMP was prepared in recognition that the CBH development future proposal will be implemented shortly after approval of the KBMS proposal, where the risks posed to coastal processes and seagrass wrack dynamics are much lower than those of the Koombana Bay Sailing Club (KBSC) marina future proposal. Upon construction of the KBMS marina this CPMP will be superseded by the approved KBMS SPER CPMP.

The purpose of this CPMP is to address relevant Environmental Scoping Document (ESD) requirements (items) in regards to the monitoring and management of coastal processes and seagrass wrack following approval of the KBMS strategic proposal, to reiterate only for the CBH development future proposal.

A summary of this CPMP as per EPA (2020) guidance is provided in the following table.

Item	Description
Proposal name	Koombana Bay Marine Structures
Proponent name	South West Development Commission
Ministerial Statement number	Not applicable
Purpose of the CPMP	Provide management and monitoring actions for coastal processes and seagrass wrack in accordance with ESD items 4, 5 and 6 (coastal processes) for only the CBH development future proposal.
CPMP environmental objectives and management triggers	This CPMP's environmental objectives and management triggers for coastal processes management (CPM) and seagrass wrack management (SWM) are: – **Coastal processes environmental objective**: Minimise the impact on the environment and coastal processes due to interruption and/or alteration of sediment movement by the CBH development future proposal. • **(Not Applicable) Management Trigger CPMT1**: Erosion causing greater than 5 m recession of the 0 m AHD contour of Koombana Beach or Ski Beach from the pre-development position. This management trigger is for the erosion risk to Koombana Beach and Ski Beach, which is only applicable to the KBSC marina future proposal, and not the CBH development future proposal. • **(Not Applicable) Management Trigger CPMT2**: Formation of a sill above the declared depth post development in the entrance of KBSC marina future proposal that impacts navigation and safety. DoT is already responsible for safe navigational depths across its facilities, so this management trigger is not applicable to the CBH development future proposal. • **Management Trigger CPMT3**: During implementation of coastal process management actions (e.g. dredging) the bottom DO does meet MEQMP (GHD 2023b) Environmental Quality Guideline Values of >80% and >90% for Moderate and High Ecological Protection Areas, respectively. – **Seagrass wrack environmental objective**: Minimise the impact on the environment due to trapped seagrass wrack by the CBH development future proposal. • **Management Trigger SWMT1**: Persistent accumulations of shoreline seagrass wrack that impact the recreational value (including odour) of surrounding areas. • **(Not Applicable) Management Trigger SWMT2**: Seagrass wrack accumulations within the KBSC marina future proposal that impact the required navigable design depth. DoT is already responsible for safe

Item	Description
	navigational depths across its facilities, so this management trigger is not applicable to the CBH development future proposal. • **Management Trigger SWMT3**: Seagrass wrack accumulations that impact water quality within Casuarina Boat Harbour development future proposal does not meet the MEQMP (GHD 2023b) guideline values.
Proposed construction date	To be determined at the future proposal stage
CPMP require pre-construction?	No

This report is subject to, and must be read in conjunction with, the limitations, assumptions and qualifications contained throughout this plan.

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Acronyms and abbreviations

Acronym / Definition	Description
Baseline condition	The environmental conditions prior to being subject to pressures from a development or operation of concern. This may include natural environmental conditions that are largely un-impacted by human influences or the state of the environment just prior to influences and effects of development
CBH	Casuarina Boat Harbour
CHRMAP	Coastal Hazard Risk Management and Adaptation Plan(ning)
CoB	City of Bunbury
CPMT	Coastal Processes Management Trigger
CPMP	Coastal Processes Management Plan
DDC	Dolphin Discovery Centre
DoT	Department of Transport
DWER	Department of Water and Environmental Regulation
EPA	Environmental Protection Authority
ESD	Environmental Scoping Document
KBMS	Koombana Bay Marine Structures (the strategic proposal)
KBSC	Koombana Bay Sailing Club
KEF	Key Environmental Factor
Management actions	The identified actions implemented to meet the environmental objective
Management trigger	Defines when the environmental objective is not met.
MEQ	Marine Environmental Quality
MEQMP	Marine Environmental Quality Management Plan
SPA	Southern Ports Authority
SPER	Strategic Public Environmental Review
SWDC	South West Development Commission
SWMT	Seagrass Wrack Management Trigger
TG	Technical Group

1. Context, scope and rationale

1.1 Scope of plan

This Coastal Processes Management Plan (CPMP) has been prepared only for the Casuarina Boat Harbour (CBH) development. This CPMP was prepared in recognition that the CBH development future proposal will be implemented shortly after approval of the Koombana Bay Marine Structures (KBMS) strategic proposal, where the risks posed to coastal processes and seagrass wrack dynamics are much lower than those of the Koombana Bay Sailing Club (KBSC) marina future proposal. Upon construction of the KBMS marina, then this plan will be superseded by a DWER (EPA Services) approved CPMP for the entire KBMS Strategic proposal.

1.2 Proposal

The South West Development Commission (SWDC) is the proponent for the Koombana Bay Marine Structures (KBMS) proposal. In March 2015 the SWDC referred the KBMS proposal to the Western Australia Environmental Protection Authority (EPA), which determined the KBMS proposal to be assessed at the level of "Strategic Proposal" (Public Environment Review or SPER). The EPA approved an Environmental Scoping Document (ESD) for the KBMS SPER (Assessment Number 2049) on 26 June 2015.

The KBMS proposal (or the strategic proposal) is located within the City of Bunbury, about 174 kilometres (km) south of Perth, Western Australia. The marine structures subject to the KBMS strategic proposal are situated within Koombana Bay which neighbours the Bunbury Central Business District and the Marlston North residential and waterfront developments. Figure 1 illustrates the indicative KBMS proposal.

The KBMS strategic proposal aims to construct and operate the following marine structures within Koombana Bay:

1. Casuarina Boat Harbour expansion.
2. Koombana Bay Sailing Club (KBSC) marina.
3. Dolphin Discovery Centre (DDC) finger jetty.

Collectively, these three (3) separate marine structures are referred to as the KBMS strategic proposal. Individually, and because they will be constructed over different timescales, the three (3) individual marine structures are referred to as "future proposals". This is consistent with the EPA's assessment process and terminology under the *Environmental Protection Ac, 1986.*

1.2.1 General description of KBMS strategic proposal

A general description of the KBMS strategic proposal is provided in Table 1.

Table 1 General strategic proposal description

Strategic proposal title	Koombana Bay Marine Structures
Strategic proponent name	South West Development Commission
Short description	The strategic proposal is to develop areas in Koombana Bay for small craft marine infrastructure (Figure 1). The proposed marine infrastructure includes jetties, boat ramps and boat pens. The identified future proposals under the strategic proposal are for the construction and operation of: – **Casuarina Boat Harbour** – **Koombana Bay Sailing Club Marina** – **Dolphin Discovery Centre Finger Jetty** The construction of future proposals will be undertaken in stages. The marine infrastructure is located adjacent to, or in close proximity to existing infrastructure in Koombana Bay, Bunbury.

1.2.2 Identified future proposal description and elements

A description and elements of the KBMS future proposals are provided in Table 2.

Table 2 Identified future proposal description and elements

Casuarina boat harbour This future proposal includes a dredging and dredge spoil disposal, piling activities, land reclamation and construction of a breakwater and revetment walls. The marine infrastructure includes the construction and operation of floating jetties, boat ramps and boat pens.		
Proposal element	**Location / Description**	**Maximum Extent, Capacity or Range**
Physical elements		
Development Envelope	Figure 1	Up to 40 ha
(Indicative) Casuarina Boat Harbour (CBH) disturbance footprint	Figure 1	Up to 32 ha within CBH disturbance footprint
Breakwater	Figure 1	Up to 3.5 ha within CBH disturbance footprint
Reclamation	Figure 1	Up to 3.5 ha within CBH disturbance footprint
Marine infrastructure	Within CBH	Floating jetties, boat ramps and boat pens within CBH disturbance footprint.
Koombana Bay Sailing Club marina This future proposal includes a dredging component, a piling component, land reclamation (including onshore dredge spoil disposal) and construction of breakwaters. The marine infrastructure includes the construction and operation of floating jetties, boat ramps and boat pens.		
Proposal element	**Location / Description**	**Maximum Extent, Capacity or Range**
Physical elements		
Development Envelope	Figure 1	Up to 16 ha
(Indicative) Koombana Bay Sailing Club (KBSC) marina disturbance footprint	Figure 1	Up to 10 ha within KBSC disturbance footprint
Breakwaters	Figure 1	Up to 2.5 ha within KBSC disturbance footprint
Reclamation	Figure 1	Up to 2 ha within KBSC disturbance footprint
Marine infrastructure	Within KBSC	Floating jetties, boat ramps and boat pens within KBSC disturbance footprint
Dolphin Discovery Centre finger jetty This future proposal includes a finger jetty, a piling component and a temporary onshore construction laydown area.		
Proposal element	**Location / Description**	**Maximum Extent, Capacity or Range**
Physical elements		
Development Envelope	Figure 1	Up to 0.5 ha
(Indicative) Dolphin Discovery Centre (DDC) jetty disturbance footprint	Figure 1	Up to 0.15 ha within DDC disturbance footprint
Marine infrastructure	Figure 1	Jetty up to 110 metres long

Figure 1 ***Development envelope, indicative disturbance footprint and marine elements***

1.3 Coastal processes

Only the KBSC marina future proposal of the KBMS strategic proposal is predicted to have modest impacts on the coastal processes of southern Koombana Bay (GHD 2023a) except for decreased sediment movement:

– Along the Marlston Waterfront – Ski Beach area due to alteration of circulation patterns (in particular the nearshore boundary current of the bay) in this region from the proposed KBSC marina breakwaters (Figure 2).
– Within the proposed KBSC marina due to sheltering (decreased currents and wave climate) (Figure 2).

As southern Koombana Bay is a low energy setting (waves and currents) there is a degree of uncertainty in predicted potential impacts to coastal processes primarily from the KBSC marina future proposal (i.e. CBH development future proposal predicted to have modest impacts on coastal processes). Given the modest effects of the Casuarina Boat Harbour development future proposal on coastal processes, an appropriate monitoring and management regime (this plan) has been developed to maintain the coastal processes of southern Koombana Bay in the absence of the KBSC marina future proposal.

1.4 Seagrass wrack

The KBMS strategic proposal is not predicted to materially impact the seagrass wrack transport of southern Koombana Bay (Figure 2, GHD 2023a). However, as southern Koombana Bay is a low energy (waves and currents), there is a degree of uncertainty in the predicted potential impacts thereby necessitating an appropriate monitoring and management regime (this plan) to confirm (or otherwise) these predictions. It is also necessary to continue any current monitoring and management regime to minimise adverse impacts of seagrass wrack accumulations on the beaches and within the waterways of southern Koombana Bay.

1.5 Key environmental factors

1.5.1 Coastal processes

EPA's objective for the key environmental factor (KEF) coastal processes is 'to maintain the geophysical processes that shape coastal morphology so that the environmental values of the coast are protected'. The ESD also required assessment of any seagrass wrack impacts, which can be inferred as the following objective "to maintain the existing seagrass wrack dynamics'.

1.5.2 Marine environmental quality

EPA's objective for the KEF marine environmental quality (MEQ) is 'to maintain the quality of water, sediment and biota so that the environmental values (both ecological and social) are protected'.

MEQ monitoring in relation to maintenance activities after implementation of the Casuarina Boat Harbour development future proposal in regards to coastal processes (e.g. dredging) will be aligned in terms of methodology and environmental quality criteria with the Marine Environmental Quality Management Plan (MEQMP) (GHD 2023b). Similarly, the monitoring in relation to the effect of seagrass wrack on MEQ after implementation of the Casuarina Boat Harbour development future proposal will be aligned in terms of methodology and environmental quality criteria with the MEQMP.

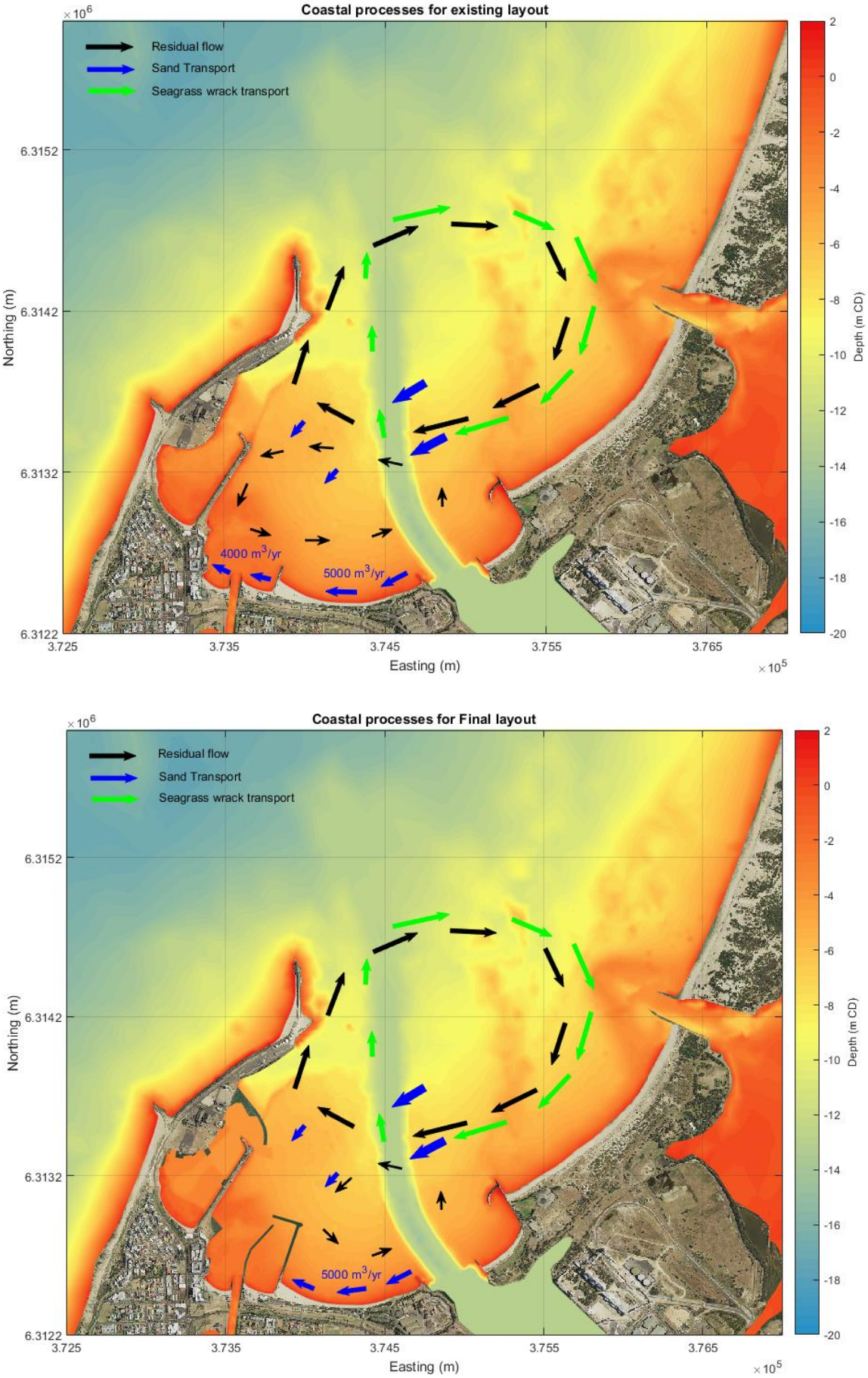

Figure 2 ***Predicted patterns of circulation, sand transport potential and seagrass wrack transport for the baseline condition (top) and KBMS proposal (bottom) (GHD 2023a)***

1.6 CPMP requirements

This CPMP has been prepared in accordance with the EPA instructions on the preparation of environmental management plans (EPA 2020).

1.6.1 ESD requirements

This CPMP has been prepared to address three ESD items for the coastal processes KEF (Table 3) in regards to the monitoring and management of coastal processes and seagrass wrack.

Table 3 ESD 2049 requirements for management and monitoring of seagrass wrack for KEF 4 (coastal processes)

ESD Item No	ESD 2049 KEF CP Item Description	Supporting Technical Report and/or Plan
4	Identify management and mitigation measures for each of the future proposals to demonstrate that the EPA's objectives for coastal processes can be met and to ensure residual impacts are not greater than predicted. This is to include the identification of areas of land and sea within the harbour/marina boundary to allow for management works and buffer areas to manage sand and/or wrack accumulations. Management and mitigation measures are to have regard for existing coastal management plans, including the Bunbury Coastal Protection, Part A – Koombana Bay Coastal Erosion and Design Report (Seashore Engineering 2013).	– This CPMP – Coastal Processes Impact Assessment technical study (GHD 2023a)
5	Outline the agency responsible for the management of coastal processes including the roles and responsibilities for wrack management and maintenance dredging.	– This CPMP
6	Include a Coastal Processes Management Plan, which details the monitoring and management that will apply during and after construction to demonstrate and ensure that residual impacts to coastal processes are not greater than predicted.	– This CPMP (after construction) – Construction Environmental Management Plan (RPS 2023) (during construction)

1.7 Limitations

This report: has been prepared by GHD for South West Development Commission and may only be used and relied on by South West Development Commission for the purpose agreed between GHD and South West Development Commission as set out in this plan.

GHD otherwise disclaims responsibility to any person other than South West Development Commission arising in connection with this plan. GHD also excludes implied warranties and conditions, to the extent legally permissible.

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The opinions, conclusions and any recommendations in this plan are based on assumptions made by GHD described in this plan. GHD disclaims liability arising from any of the assumptions being incorrect.

1.8 Rationale and approach

The following sub-sections provide background information on:

- The KBMS strategic proposal that informed and developed the management approach for this CPMP.
- Results of modelling investigations and reviews of historic/recent information.
- The assumptions and uncertainties associated with the development and the proposed management approach.

– The management triggers, monitoring and management actions in the subsequent sections of this CPMP are aligned with the overall management approach.

The Transforming Bunbury Waterfront Coastal Hazard Risk Management and Adaptation Plan (CHRMAP) (GHD 2019) was prepared in 2018 on the basis of the full implementation of the KBMS proposal. The CHRMAP identifies:

– Coastal erosion/inundation hazards/risks.
– Recommendations for an adaptation pathway with monitoring/management actions to assist adapting to immediate/short-term coastal erosion/inundation risks.
– Appropriate planning to address increasing risk over four timeframes (immediate, to 2030, 2030-2070, 2070-2120).

This CPMP is aligned with the CHRMAP (GHD 2019) immediate and short-term monitoring and management actions[1] as both are based on the evaluation of potential impacts to coastal processes from implementation of the KBMS strategic proposal as reported in the Coastal Process Impact Assessment technical study (GHD 2023a).

1.8.1 Technical studies and key past investigations

Potential impacts from the KBMS strategic proposal relative to the existing conditions have been predicted for:

– Coastal processes (GHD 2023a)
– Hydrodynamics (GHD 2023c)
– Flushing (GHD 2023c).

Past and recent investigations have informed the understanding of the coastal processes and seagrass wrack dynamics of southern Koombana Bay. These are summarised in Table 4 and are briefly described in the following sub-sections.

Table 4 Technical studies completed for the KBMS proposal and key past investigations of coastal processes

Study	Reference	Timeframe	Key outcomes
Characterisation of seagrass wrack dynamics in Geographe Bay	Oldham et al (2010) Pattiaratchi et al (2011)	2010-2011	– Understanding of fundamental processes of seagrass wrack dynamics in south-western Western Australia
Koombana Beach management options	Seashore Engineering (2013)	1991-2012	– Most recent investigation of Koombana Beach morphology – Longshore sediment transport estimates
Coastal processes modelling	GHD (2023a)	2016-2021	– Predicted large decrease in sand transport along the Marlston Waterfront and Ski Beach due to reduced circulation in embayment between KBSC marina and Jetty Road Causeway – Predicted large decrease in sand transport along KBSC beach due to proposed KBSC marina breakwaters – Comparative modelling assessment between existing condition and KBMS proposal indicates modest impacts to coastal processes and seagrass wrack dynamics
Marine environmental quality modelling	GHD (2023c)	2016-2021	– Altered circulation patterns in southwestern Koombana Bay predicted due to the proposed KBSC marina breakwaters – Increased flushing times of Leschenault Inlet and Casuarina Boat Harbour due to altered circulation patterns and the proposed Casuarina Boat Harbour Northern Breakwater, respectively – Predicted flushing of proposed KBSC marina similar to Casuarina Boat Harbour

[1] Exclusive of coastal infrastructure asset management in the CHRMAP (GHD 2019).

1.8.1.1 Seagrass wrack dynamics in Geographe Bay

The most comprehensive study of seagrass wrack dynamics was undertaken for Geographe Bay to inform Port Geographe management (Oldham et al 2010), which characterised the seasonal dynamics as follows:

– Seagrass wrack is generated in offshore seagrass meadows from shedding (leaves and stems) that accumulate in the meadows and unvegetated zones until autumn as the material is denser than seawater.
– The first winter storms distribute seagrass wrack through the water column and transport it towards shore where:
  - Some of the wrack becomes buoyant and accumulates at the surface of the water column.
  - Some of the wrack remains dense and remains near the seabed.
  - Generally, seagrass wrack is deposited on beaches during storm events with high water levels.
– The wrack may be repeatedly washed (and moved) onto and from the beaches depending on local metocean conditions. Seagrass wrack deposits high on the beach may become incorporated into the beach sand, compacted and difficult to be remobilised into the water during subsequent storm events. As seagrass wrack dries on beaches, it becomes more buoyant.
– The next storm event can remobilise the seagrass wrack from the beach to the nearshore waters where it may be transported from the beach.

These processes are likely to be similar for the Bunbury coastal waters given its proximity to Geographe Bay and the presence of seagrass meadows with the same seagrass species (*Posidonia sinuosa* and *Amphilbolis Antarctica*).

1.8.1.2 Past Koombana Beach management options

Seashore Engineering (2013) undertook an assessment of eight (8) coastal management options for Koombana Beach that included:

– A description of the evolution of beach formation over two monitoring periods (i.e. 1991-2009, 2009-2012) and the mechanisms contributing to sediment accretion and erosion along the western and eastern limits, respectively.
– An evaluation of beach profiles over time and estimates of the volume changes that represent the balance of longshore sediment transport (i.e. volume-based estimates of longshore transport).
– The selection of two preferred options for detailed evaluation.

One of the Seashore Engineering (2013) options has been partially implemented with the construction of the Point Busaco revetment in 2015. Further, the additional recommendation of renourishment of eastern Koombana Beach with sand from the Outer Harbour traps (i.e. south of BP Beach Groyne and/or west of Outer Harbour Breakwater) has been implemented by the Southern Ports Authority on at least several occasions (pers. comm. Department of Transport). It is recommended that establishment of monitoring and any renourishment of Koombana Beach rely on the Seashore Engineering (2013) specifications in the first instance.

1.8.1.3 Coastal processes modelling

The baseline condition and original design[2] of the KBMS proposal (Figure 2) was modelled to comparatively evaluate potential impacts to coastal processes and seagrass wrack dynamics (GHD 2023a). Generally, relatively small changes to coastal processes and seagrass wrack dynamics were predicted from implementation of the KBMS proposal except for:

– Circulation patterns along western Koombana Beach are predicted to shift offshore to the north by the Koombana Bay Eastern Breakwater, but this is not predicted to cause material changes to longshore sand transport along Koombana Beach.
– Relatedly, the KBSC marina is predicted to disrupt the baseline condition circulation pattern between these structures and the Jetty Road Causeway with a concomitant decrease in the longshore sediment transport along the Marlston Waterfront-Ski Beach and the KBSC beach.

[2] Refer to Section 1.8.2 regarding coastal processes modelling undertaken for the larger original KBSC marina design than the smaller footprint of the revised design.

– The KBSC marina will reduce sand supply to the beach therein with likely sand quality deterioration that will potentially require renourishment.
– Reduced flushing of Casuarina Boat Harbour, KBSC marina and Leschenault Inlet may lead to water quality degradation (GHD 2023c), which will be monitored and managed as per the MEQMP (GHD 2023b).
– The proposed Casuarina Harbour Northern Breakwater is predicted to reduce currents along the southern extent of the Outer Harbour, though material increases to sedimentation are not predicted.

Predicted changes to coastal process due to the KBMS strategic proposal that may require active management include:

– Potential beach realignment of Ski Beach.
– Sedimentation in Casuarina Boat Harbour and KBSC marina, and the embayment between these marine structures.
– Potential scour and/or deposition in proximity to proposed structures.

In short, impacts to coastal process are predicted to be constrained to southwestern Koombana Bay in the immediate locale of KBMS proposal with no/minor impacts predicted for eastern Koombana Bay (e.g. Koombana Beach).

1.8.1.4 MEQ modelling

The baseline condition and revised design of the KBMS proposal (Figure 2) were modelled to comparatively evaluate potential impacts to hydrodynamics including flushing (GHD 2023c). Generally, relatively small changes to hydrodynamics were predicted from implementation of the KBMS proposal except for:

– Altered circulation patterns in southwestern Koombana Bay as described in Section 1.8.1.3.
– Increased median flushing time of Leschenault Inlet from ~8 days to ~9.5 days.
– Increased median flushing time of Casuarina Boat Harbour from ~2 days to ~5-6 days.
– A median flushing time for KBSC marina of ~5 days.

1.8.2 Key assumptions and uncertainties

Relevant assumptions and uncertainties associated with the implementation of only the Casuarina Boat Harbour future proposal in regards to potential impacts on coastal processes and seagrass wrack dynamics are provided in (GHD 2023a), which include:

– The re-arrangement of the northern breakwater (in future design optimisations) may result in altered wave reflection patterns. This is unlikely to impact coastal processes, however any potential impact on navigation and other structures are to be reviewed by the designer.
– The GHD (2023a) coastal processes impact assessment was primarily through a comparative analysis of simulated changes in coastal processes between the KBMS strategic proposal and the baseline condition. A comparative analysis approach was adopted because:
    - Generally, there was insufficient information/data to verify all of the models and quantitative approaches used to address coastal processes. However, industry-standard models and approaches, and their application, were utilised to identify if the KBMS strategic proposal causes changes (impacts) relative to the baseline condition.
    - Whether or not relative impacts occur in terms of a specific coastal process at a particular location from implementation of the KBMS strategic proposal were forecast. For example, predicted impacts were primarily limited to southwestern Koombana Bay in proximity (or within) the proposed structures, whereas no/minimal impacts were predicted in southeastern Koombana Bay (e.g. Koombana Beach).
– Uncertainty in terms of the magnitude of impacts is partly ameliorated due to the low energy coastal processes setting of southwestern Koombana Bay with relatively modest sediment movement and seagrass wrack accumulation relative to higher energy open ocean coastal settings. This relatively low energy setting of the KBMS proposal extends the timescales to monitor and to identify changes, to implement management actions and to continually improve this CPMP relative to open ocean coastal settings.

In short, though predicted impacts to coastal processes and seagrass wrack are relatively minor and are predicted to occur in southwestern Koombana Bay within proximity of the KBMS strategic proposal, almost entirely from the KBSC marina future proposal, this CPMP provides an adaptive and flexible monitoring and management framework to manage uncertainties in the predicted impacts from only the Casuarina Boat Harbour development future proposal in the absence of the KBSC marina future proposal.

1.8.3 Objective-based management approach

The management of the KBMS proposal via this CPMP is focused on monitoring and management of two components:

– Sediment movement
– Seagrass wrack accumulations.

It is challenging to quantify numeric criteria and/or thresholds for coastal processes and seagrass wrack management that may be impacted by the KBMS proposal given the predicted low impacts relative to the existing condition and the degree of predictive uncertainty. Therefore, an objective-based management approach has been adopted for this CPMP.

1.8.4 Rationale for choice of management actions

The management triggers and management actions identified in this CPMP have been developed on the basis of previous investigations, the KBMS SPER technical studies (Section 1.8.1), the Transforming Bunbury Waterfront CHRMAP (GHD 2019) and the MEQMP (GHD 2023b). The objective-based management approach (Section 1.8.3) and the management actions outlined in this CPMP are consistent with past management of southern Koombana Bay coastal processes, and other Western Australia marinas and harbours.

Figure 3 ***Existing and proposed coastal infrastructure and KBMS proposal***

2. Implementation of the CPMP

2.1 KBMS management policy

The KBMS Management Policy (Final Version October 2023) underpins the coordination and management of this CPMP. The management framework of the policy is illustrated in Figure 4.

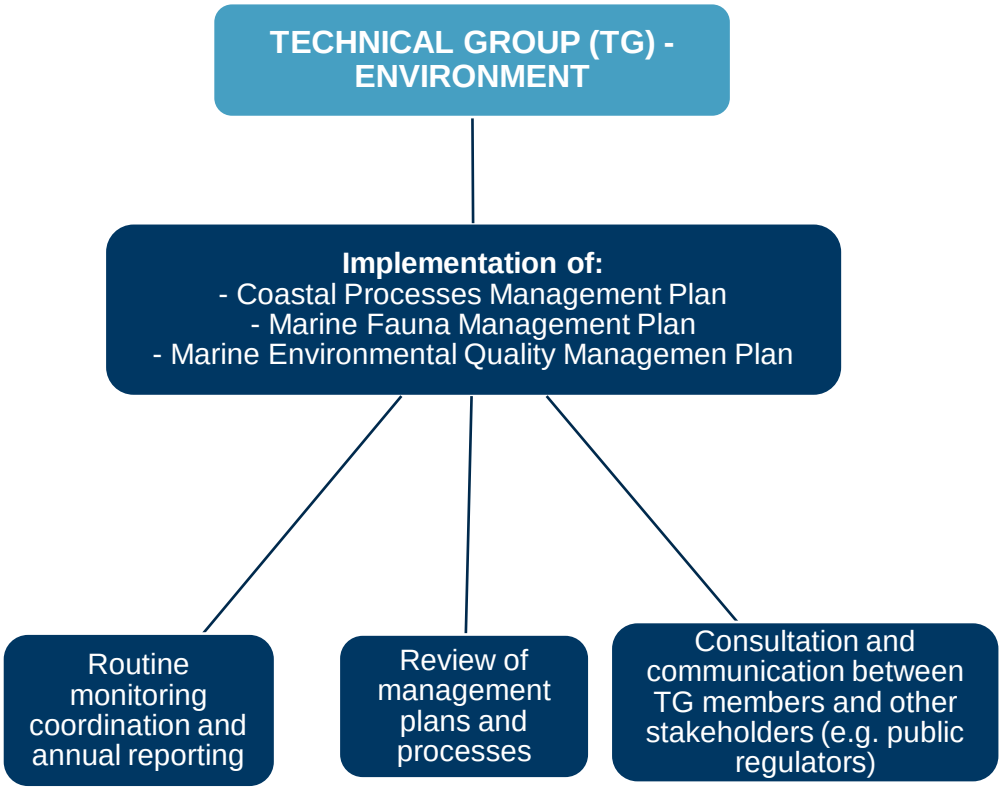

Figure 4 Management framework of the KBMS management policy

The key elements of the policy as they pertain to this CPMP include:

- Monitoring and management:
  - Environmental impacts are principally managed through implementing the requirements of this CPMP. It is the responsibility of each proponent to manage their future proposal within the coastal processes criteria outlined in this CPMP.
  - Proponents of each future proposal must comply with the conditions of any notice issued under the EP Act as they pertain to coastal processes and the monitoring requirements specified in this CPMP.
  - SWDC (or delegate entity) with advice from the Technical Group will support proponents with regards to routine monitoring coordination, annual reporting and review (and updates) of this CPMP.
- Compliance and reporting:
  - Future proposal proponents must comply with arrangements outlined in this CPMP and any other management controls imposed by any relevant statutory or government authority in relation to their activities in Koombana Bay. Importantly, it is the future proposal proponent and not the SWDC that is liable for any breaches.
  - The role of SWDC (or delegate entity) is as coordinator of the Framework, and by extension this CPMP.
- Reviews:
  - The SWDC (or delegate entity) and Technical Group will periodically review the CPMP (and the policy) to ensure it meets regulatory requirements and community expectations. The initial review period will be

two (2) years following the commencement of operations of the Casuarina Boat Harbour development future proposal (see Section 3).

2.2 CPMP coordination and management

The responsible parties for coordination and management of the CPMP are summarised in Table 5, which is underpinned by the KBMS management policy (Section 2.1).

Table 5 Coordination and monitoring/management responsibilities

Shorelines and Structures	Monitoring and Management Responsibility Entity	CPMP Coordination Entity
Jetty Baths Beach, Casuarina Boat Harbour breakwaters, internal Casuarina Boat Harbour water body, storm surge barrier at the Plug	DoT	SWDC (or delegate entity)

CPMP coordination responsibilities by SWDC (or delegate entity) include:

- Coordination support to proponents in the implementation of this CPMP.
- Preparation of annual reports and submissions to regulators.
- Reviews and updates to this CPMP.

CPMP monitoring and management responsibilities of entities responsible for shorelines/structures (see Table 5) include:

- Arrangements with service providers to carry out routine and trigger-based monitoring to industry-level standards.
- Carrying out all monitoring activities, and record keeping of implemented management actions (e.g. documentation, emails, phone logs).
- Carrying out management actions (mitigation measures) arising from management triggers.
- Carrying out preventative controls arising from prior management triggers.
- Reporting any management triggers that are not captured with this CPMP's monitoring regime.
- Provision of community and other stakeholder information regarding coastal process within respective areas of responsibility.

2.3 Coastal processes

2.3.1 Environmental objective

Minimise the impact on the environment and coastal processes due to interruption and/or alteration of sediment movement by the CBH development future proposal.

2.3.2 Management triggers

Appropriate coastal process management triggers (CPMTs) are established to ensure that the CBH development future proposal does not adversely coastal processes. If the event of a non-compliance of a management trigger(s), an adaptive management strategy to manage coastal processes is carried out via further monitoring and/or management action(s).

Because Jetty Baths Beach within the future proposal is in a quiescent water body, , erosion is not a risk.

The formation of a sill within the entrance channel to the harbour future proposal may impact navigation and safety.

Management actions (e.g. dredging) may potentially adversely affect water quality.

The coastal processes management triggers are:

– **(Not Applicable) Management Trigger CPMT1**: Erosion causing greater than 5 m recession of the 0 m AHD contour of Koombana Beach or Ski Beach from the pre-development position. This management trigger is for the erosion risk to Koombana Beach and Ski Beach, which is only applicable to the KBSC marina future proposal, and not the CBH development future proposal.
– **(Not Applicable) Management Trigger CPMT2**: Formation of a sill above the declared depth post development in the entrance of KBSC marina that impacts navigation and safety. DoT is already responsible for safe navigational depths across its facilities, so this management trigger is not applicable to the CBH development future proposal.
– **Management Trigger CPMT3**: During implementation of coastal processes management actions (e.g. dredging) bottom DO does meet MEQMP (GHD 2023b) Environmental Quality Guideline Values of >80% and >90% for Moderate and High Ecological Protection Areas, respectively.

2.3.3 Monitoring

This section describes coastal processes monitoring activities to water quality during specific management actions, which include:

– Water quality monitoring.

These monitoring programs are described in Table 6.

Table 6 Coastal processes monitoring specifications

Monitoring Activity	Purpose	Location	Methodology	Frequency and Timing
Water quality monitoring	DO monitoring will be undertaken during entrance channel management of the harbour future proposal to assess whether the management action impacts water quality.	In the locale of the entrance channel management.	As per the MEQMP (GHD 2023b) methodology.	Three (3) times a day at multiple locations in and adjacent to the entrance channel undergoing management action (e.g. dredging).

2.3.4 Analysis

The analysis of monitoring information and data (i.e. DO profiles) will be completed by an experienced water quality practitioner as required after the construction of the CBH future proposal to determine if there are any significant changes to MEQ from coastal processes management actions. The coastal processes analysis will:

– Assess changes against management triggers (Section 2.3.2).

2.3.5 Management actions

If the event of a non-compliance of a coastal processes management trigger, then coastal processes management actions are based on the following adaptive management strategy framework:

– Investigate whether non-compliance of the coastal processes management trigger is due to the CBH future proposal.
  - Carry out additional coastal processes monitoring/investigations if further information is required to evaluate whether the CBH future proposal is the cause of the coastal processes management trigger non-compliance.
– If the non-compliance of the coastal processes management trigger is due to the CBH future proposal, carry out the coastal processes management action to achieve compliance.
– The primary coastal processes management action is entrance channel management to maintain acceptable WQ, which is described in the next sub-section.

2.3.5.1 Entrance channel management

Temporary cessation during dredging of the entrance channel to be used as a management action if management trigger CPMT3 is not met.

Table 7 Overview of coastal processes adaptive management strategy

Location	Management Trigger	Monitoring and Timing	Review and Decision	Management Actions
Location of entrance channel management	CPMT 3: During implementation of coastal process management actions (e.g. dredging) meet MEQMP (GHD 2023b) bottom DO Environmental Quality Guideline Values of >80% and >90% for Moderate and High Ecological Protection Areas, respectively.	Monitoring occurs during entrance channel management	CPMT 3 compliance evaluated on basis of DO monitoring during management activity. If CPMT 3 compliance not met, then implement management actions.	Temporarily cease entrance channel management.

2.4 Seagrass wrack

2.4.1 Environmental objective

Minimise the impact on the environment due to trapped seagrass wrack by the CBH future proposal.

2.4.2 Management triggers

The seagrass wrack management triggers (SWMTs) are:

Management Trigger SWMT 1: Persistent accumulations of shoreline seagrass wrack that impacts the recreational value (including odour) of surrounding areas.

(Not Applicable) Management Trigger SWMT 2: Seagrass wrack accumulations within the KBSC marina future proposal that impacts the required navigable design depth. DoT is already responsible for safe navigational depths across its facilities, so this management trigger is not applicable to the CBH development future proposal.

Management Trigger SWMT 3: Seagrass wrack accumulations that impact water quality within the Casuarina Boat Harbour development future proposal and does not meet the MEQMP (GHD 2023b) guideline values.

2.4.3 Monitoring

This section describes seagrass wrack monitoring activities to track the accumulation of wrack within the Casuarina Boat Harbour development future proposals in a clear and systematic manner, which include:

– Visual monitoring.
– Navigation monitoring.
– Water quality monitoring.

These monitoring programs are described in Table 8.

Table 8 Seagrass wrack monitoring specifications

Monitoring Activity	Purpose	Location	Methodology	Frequency and Timing
Visual seagrass wrack monitoring	Seagrass wrack monitoring used to track the accumulation of wrack within the future proposal in a clear and systematic manner.	Monitoring will be carried out within the semi-enclosed harbour and Jetty Baths Beach.	Visual and photographic monitoring will be carried out to monitor seagrass wrack accumulations within the future proposal where: – Regular (weekly) inspections within the future proposal footprint with records of wrack accumulation documented by photographs that show location and extent. Photographic monitoring will be carried out by an experienced coastal engineer(s). This information will be used to estimate the volume of wrack accumulation(s) and the duration that wrack remains in place by an experienced coastal engineer(s).	Visual observations of the internal water bodies and beaches will be undertaken weekly once the CBH development future proposal is operational.
Water quality monitoring	Water quality monitoring of the harbour will be undertaken once this future proposal is operational to assess whether seagrass wrack decomposition impacts water quality.	As per the MEQMP (GHD 2023b) locations.	As per the MEQMP (GHD 2023b) methodology.	As per the MEQMP (GHD 2023b) frequency.

2.4.4 Analysis

Analysis of monitoring information and data will be completed by an experience coastal engineer(s) on an annual basis for at least 5 years after the completion of a future proposal to determine if there are any trends/patterns in seagrass wrack movement and accumulation.

2.4.5 Management actions

If the event of a non-compliance of a seagrass wrack management trigger, then wrack management actions are based on the following adaptive management strategy framework:

– Investigate whether non-compliance of the seagrass wrack management trigger is due to a future proposal.
  - Carry out additional wrack monitoring/investigations if further information is required to evaluate whether the future proposal is the cause of the wrack management trigger non-compliance.
– If the non-compliance of the wrack management trigger is due to a future proposal carry out the wrack management action to achieve compliance.

Seagrass wrack management actions include:

– Removal and relocation of shoreline wrack.
– Removal and relocation of suspended wrack in the internal water body of a future proposal.
– Removal and relocation of deposited' wrack on the seabed in the internal water body of a future proposal.

These seagrass wrack management actions are described next.

2.4.5.1 Removal and relocation of shoreline seagrass wrack

The requirement for removal and relocation of shoreline seagrass wrack will be determined adaptively on the basis of monitoring results as outlined in Table 9.

Removal of small quantities of shoreline wrack in/on the future proposal footprints (e.g. breakwaters, edge walls, other structures, internal water body beaches) will be removed as part of general rubbish removal/cleaning operations.

Large quantities of shoreline wrack will be relocated with land-based plant (e.g. bob-cat, small excavator).

The removed wrack would then likely be relocated to a potential discharge location (e.g. Back Beach).

Additional approvals may be required prior to commencement of relocation of large quantities of shoreline wrack.

2.4.5.2 Removal and relocation of suspended seagrass wrack

The requirement for removal and removal and relocation of suspended wrack will be determined adaptively on the basis of monitoring results as outlined in Table 9.

Large quantities of suspended wrack will be relocated via a weed barge or trap.

The removed wrack would then likely be relocated to a potential discharge location (e.g. offshore at wrack disposal locations used by the Southern Ports Authority).

Additional approvals may be required prior to commencement of relocation of large quantities of suspended wrack.

2.4.5.3 Removal and relocation of deposited seagrass wrack on the seabed

The requirement for removal and relocation of deposited wrack on the seabed will be determined adaptively on the basis of monitoring results as outlined in Table 9.

Large quantities of deposited wrack on the seabed will be removed via a fishing trawler or dredge.

The removed wrack would then likely be relocated to a potential discharge location (e.g. offshore at wrack disposal locations used by the Southern Ports Authority).

Additional approvals may be required prior to commencement of relocation of large quantities of deposited wrack.

Table 9 Overview of seagrass wrack adaptive management strategy

Location	Management Trigger	Monitoring and Timing	Review and Decision	Management Actions
CBH future proposal footprint	SWMT 1: Persistent accumulations of shoreline seagrass wrack that impact the recreational value (including odour) of surrounding areas.	Weekly visual inspections after commencement of future proposal operations. Monitor community complaints to DoT, KBSC and CoB.	SWMT 1 compliance evaluated on basis of visual inspections and shoreline mapping. If SWMT 1 compliance not met, then investigate whether wrack accumulation is attributable to future proposal through reviews of: – Historical aerial photography, photographic monitoring and/or shoreline mapping. – Metocean conditions over the period (e.g. SPA Beacon 3 and 10 wave, current and wind speed data). Carry out additional monitoring/investigations if further information is required to determine if the future proposal is responsible for non-compliance of SWMT 1 OR implement management actions to comply with SWMT 1.	Removal and relocation of shoreline wrack as outlined in Section 2.4.5.1..
Inner water body of Casuarina Boat Harbour	SWMT 3: Seagrass wrack accumulations that impact water quality within the Casuarina Boat Harbour development future proposal does not meet the MEQMP (GHD 2023b) guideline values.	Monitoring as per MEQMP (GHD (2023b).	SWMT 3 compliance evaluated on basis of MEQMP (GHD 2023b) monitoring. If SWMT 3 compliance not met, then confirm through additional monitoring as per methodology of GHD (2023b). If continued SWMT 3 non-compliance then implement management actions to comply with SWMT 3.	Removal and relocation of suspended and/or deposited on seabed wrack as outlined in Sections 2.4.5.2 and 2.4.5.3, respectively.

Management actions in response to seagrass wrack management triggers are summarised in Table 10.

Table 10 Management actions in event of seagrass wrack management trigger

Action	Method	Location	Management Trigger	Responsible Party
Removal of small volumes of seagrass wrack on structures and/or beach	Manually and disposal onshore rubbish[4]	Jetty Baths beach and breakwaters	At discretion of facility/asset operational personnel	DoT (Jetty Baths Beach and adjacent structures)
Removal and disposal of large volumes of seagrass wrack from beaches	Appropriate plant to remove and dispose of seagrass wrack (e.g. bobcat, small excavator) from beaches	Jetty Baths beach	Management trigger SWM1	
Removal and disposal of large volumes of in-water seagrass wrack	Appropriate plant to remove seagrass wrack (e.g. fishing trawler, barge, dredge) from water and dispose offshore or onshore	Casuarina Boat Harbour	Management trigger SWM3	DoT (Casuarina Boat Harbour)
Increased frequency of water quality (bottom DO) monitoring	As per MEQMP (GHD 2023b)	Casuarina Boat Harbour	Management trigger SWM3	As per MEQMP (GHD 2023b)

2.5 Reporting

2.5.1 Annual report

An annual compliance report will state whether the environmental objectives for coastal processes and seagrass wrack management have been met. In the event the environmental objective was not achieved, the annual compliance report will include a description of the effectiveness of implemented management actions and an analysis of the trends from the monitoring results. The annual compliance report will be prepared by DoT (SWDC delegate entity) and submitted to DWER (EPA Services) by 1 March each year.

2.5.2 Reporting non-compliance of management triggers

If a management trigger(s) for coastal processes or seagrass wrack management occurs, then DWER (EPA Services) will be notified by the proponent of the relevant future proposal within ten (10) days of identification of the non-compliance. An investigation report will be prepared by DoT that describes non-compliance and corrective actions.

[4] Small volumes of seagrass wrack that accumulate (e.g. among breakwaters, on the beaches) and pose an issue (i.e. aesthetics, odour, recreational impact, navigation, water quality) will be removed and relocated as part of the general rubbish removal and cleaning operations by DoT.

3. Adaptive management and review

DoT will implement an adaptive management framework to improve understanding of patterns and dynamics, to evaluate compliance with management triggers, and to appropriately implement management measures for coastal processes and seagrass wrack management. The extent to which coastal processes and seagrass wrack dynamics will replicate the predicted low impacts from the KBMS future proposals by GHD (2023a) relative to the pre-development baseline condition will be confirmed through implementation of this CPMP. Interannual variations in the coastal processes and wrack dynamics of Koombana Bay may require flexible and adaptive management approaches. The recommended adaptive approach is to:

– Undertake a systematic evaluation of the monitoring data to assess whether impacts from the KBMS future proposals are similar to the modelled predictions.
– Increase understanding of coastal processes and seagrass wrack dynamics in southern Koombana Bay from the monitoring and management actions that will be carried out.
– Review any environmental issues and recommendations that have any material bearing on coastal processes and seagrass wrack dynamics from close-out reports for any maintenance works in Koombana Bay, inclusive of the Shipping Channel and Inner Harbour (e.g. SPA dredging and Shipping Channel wrack removal, previous beach nourishment).
– Undertake a biennial review of the CPMP to assess the effectiveness of the management triggers, monitoring and management actions, and to identify continual improvement opportunities to incorporate into the CPMP.
– Review the frequency and methods of monitoring and management outlined in this CPMP to ascertain if the predicted low impacts of the KBMS proposal are supported.

Any proposed revisions to the CPMP will be considered in consultation with DWER (EPA Services Unit). Any revised plan will not be implemented until such time that DWER (EPA Services Unit) has confirmed by notice in writing.

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