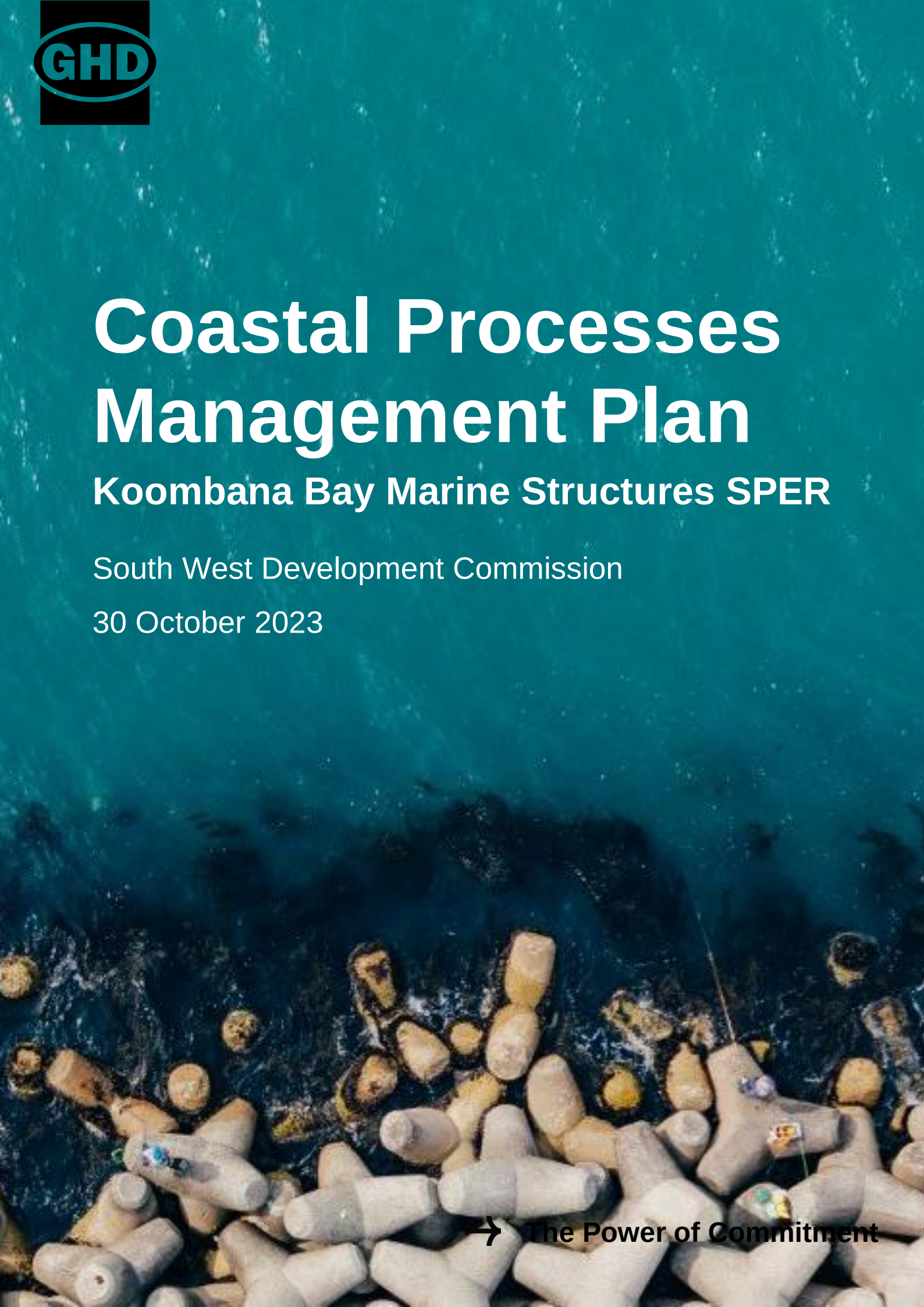
Coastal Processes Management Plan

Koombana Bay Marine Structures SPER

South West Development Commission

30 October 2023



The Power of Commitment

Document status

Status Code	Revision	Author	Reviewer		Approved for issue		
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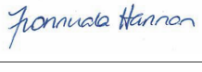
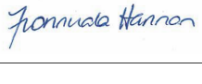
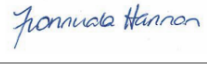
S2	1	Dr J. Romero	S. Hosseini		F. Hannon		29/6/22
S4	2	Dr J. Romero	F. Hannon		F. Hannon		4/4/23
S4	3	Dr J. Romero	F. Hannon		F. Hannon		30/10/23

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 the Koombana Bay Marine Structures (KBMS) Strategic proposal (Assessment Number 2049). 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. 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).
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, coastal processes and navigability due to interruption and/or alteration of sediment movement by the KBMS future proposals. • **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. • **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) bottom DO does not 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 KBMS future proposals. • **Management Trigger SWMT1**: Persistent accumulations of shoreline seagrass wrack that impact the recreational value (including odour) of surrounding areas. • **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 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 the KBSC marina and/or Casuarina Boat Harbour development future proposals do 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 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.*

1.1.1 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.

1.1.2 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***

1.2 Coastal processes

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). Therefore, an appropriate monitoring and management regime (this plan) has been developed to confirm these predictions and to maintain the coastal processes of southern Koombana Bay.

1.3 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.

1.4 Key environmental factors

1.4.1 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'.

1.4.2 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 KBMS future proposals in regards to coastal processes (e.g. dredging) will be aligned in terms of the methodology and environmental quality criteria through 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 KBMS future proposals will be aligned in terms of methodology and environmental quality criteria with the MEQMP.

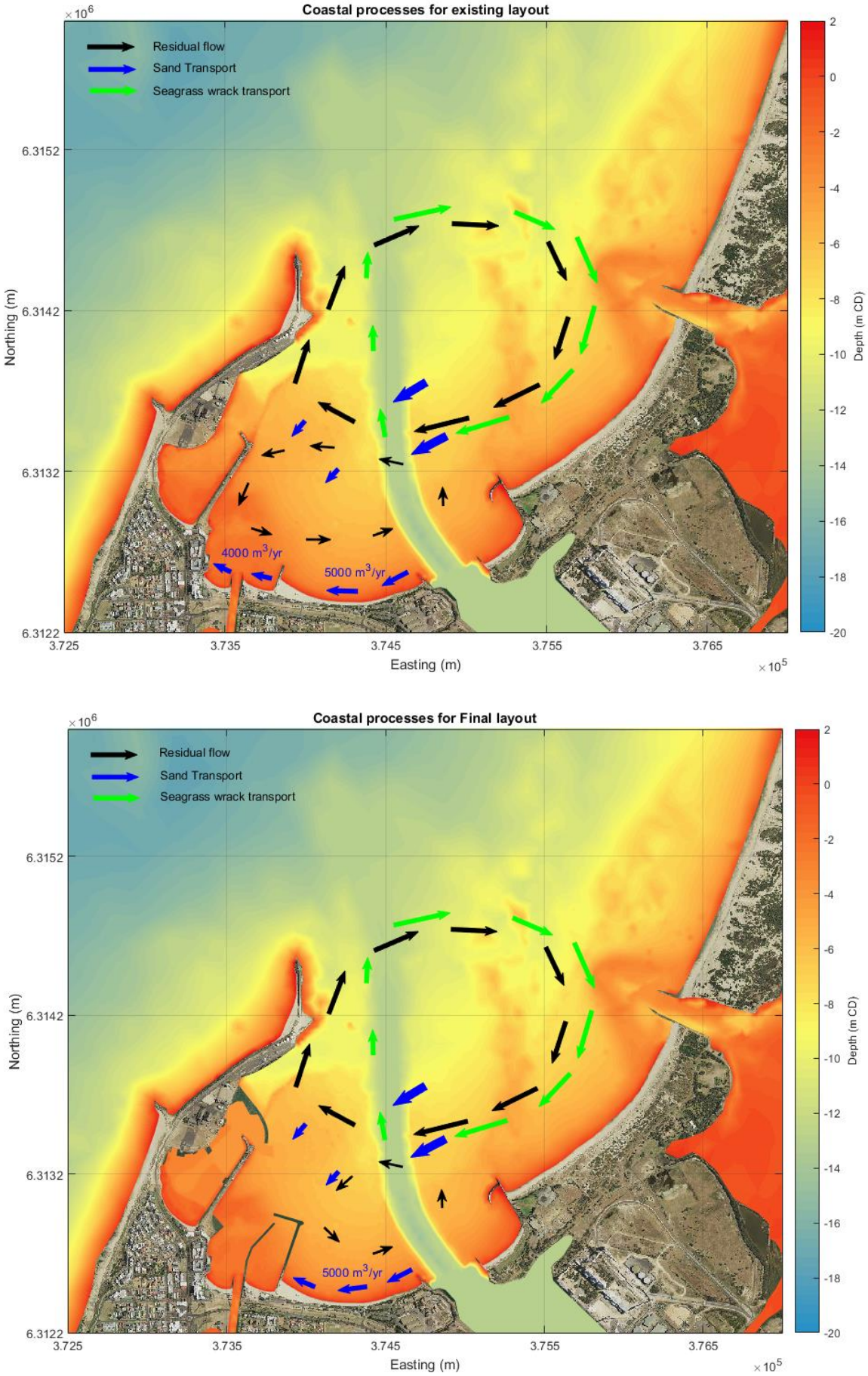

Figure 2 ***Predicted patterns of circulation, sand transport potential and seagrass wrack transport for the baseline condition (top) and KBMS proposal (bottom) (GHD 2023a)***

1.5 CPMP requirements

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

1.5.1 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)

1.6 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.

The services undertaken by GHD in connection with preparing this plan were limited to those specifically detailed in the plan and are subject to the scope limitations set out in the plan.

The opinions, conclusions and any recommendations in this plan are based on conditions encountered and information reviewed at the date of preparation of the plan. GHD has no responsibility or obligation to update this plan to account for events or changes occurring subsequent to the date that the plan was prepared.

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.

1.7 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).

1.7.1 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).

1.7.1.1 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*).

1.7.1.2 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.

1.7.1.3 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 1.7.2 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).

1.7.1.4 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 1.7.1.3.
– 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.

1.7.2 Key assumptions and uncertainties

Assumptions and uncertainties associated with the implementation of the KBMS strategic proposal in regards to potential impacts on coastal processes and seagrass wrack dynamics are provided in (GHD 2023a), which include:

– The original design of the KBSC marina derived proposal was revised (decreased in size) to improve the predicted future flushing of Leschenault Inlet (and thereby reduce potential MEQ impacts). The GHD (2023a) coastal processes assessment was completed prior to this design revision. However, as illustrated in Figure 3 the offshore extent of the revised design is similar to the original design. The smaller revised design will yield similar potential impacts to coastal processes as the original design. Hence, the GHD (2023a) coastal processes impact assessment on the basis of the original design is deemed ‘representative’ of the revised design.
– The re-arrangement of breakwaters (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 DDC finger jetty will be a piled structure that is not anticipated to have any material impact on coastal processes, and was not evaluated in the GHD (2023a) coastal processes impact assessment. Rather, any potential impacts to coastal processes from the proposed piled DDC finger jetty (none anticipated) will be monitored and managed via this CPMP.
– 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 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.

1.7.3 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.

1.7.4 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 1.7.1), the Transforming Bunbury Waterfront CHRMAP (GHD 2019) and the MEQMP (GHD 2023b). The objective-based management approach (Section 1.7.3) 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.

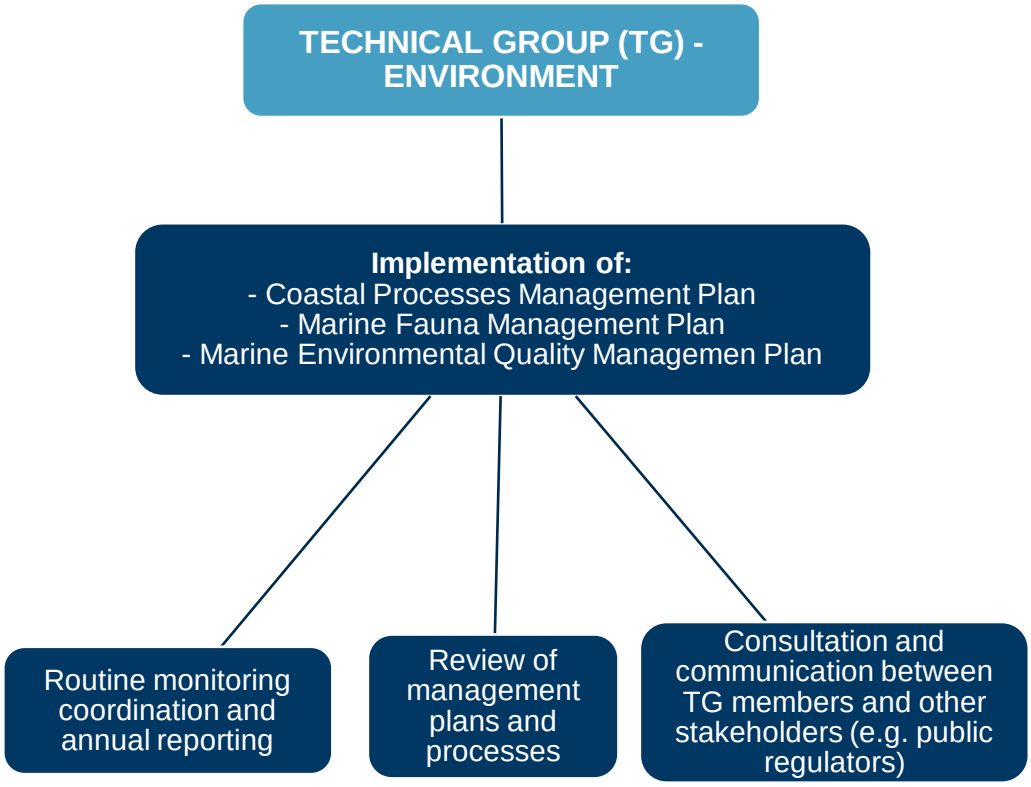

Figure 4 Management framework of the KBMS management policy

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 reviews (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
Koombana Beach, Ski Beach	CoB	SWDC (or delegate entity)
KBSC Marina Beach, KBSC marina breakwaters, internal KBSC marina water body	KBSC	
Jetty Baths Beach, Casuarina Boat Harbour breakwaters, internal Casuarina Boat Harbour water body, storm surge barrier at the Plug	DoT	

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, coastal processes and navigability (KBSC marine future proposal only) due to interruption and/or alteration of sediment movement by the KBMS future proposals.

2.3.2 Management triggers

Appropriate coastal process management triggers (CPMTs) are established to ensure that the KBSC marina and CBH development future proposals do 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 beaches within the future proposals are (will be) in quiescent water bodies (Jetty Baths Beach, KBSC Marina Beach), and recession of remnant shoreline vegetation on Koombana Beach and Ski Beach are limited by landside infrastructure, the use of shoreline vegetation movement as a management trigger is not appropriate in

this setting. Rather, the 0 m AHD contour (approximation of mean sea level) is used as the measure of shoreline position, which must be evaluated with care due to its susceptibility to short term fluctuations (e.g. tides, metocean conditions).

The formation of a sill within the entrance channel(s) to the marina and/or harbour future proposals may impact navigation and safety.

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

The coastal processes management triggers are:

– **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.
– **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 processes management actions (e.g. dredging) bottom DO does not 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 track changes in the shoreline in the vicinity of the future proposals, to inform volumes required for dredging and/or beach nourishment and to track water quality during specific management actions, which include:

– Hydrographic surveys.
– Surveyed beach profiles.
– Inspections inclusive of photographic monitoring.
– Shoreline mapping.
– 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
Hydrographic surveys	Hydrographic surveys will provide an accurate spatial record of the changes in shoreline and bathymetry in close proximity to the KBSC marina future proposal.	The hydrographic survey area for the KBSC marina development is defined to provide an accurate spatial record of the changes in shoreline and bathymetry in close proximity to the future proposals (Figure 5). In addition, hydrographic surveys of the KBSC marina entrance will monitor potential siltation (Figure 5).	Multibeam hydrographic surveys will be completed by a licenced surveyor from a vessel systematically traversing the indicative spatial extent of the survey area for the KBSC marina future proposal. Surveys will include the beach face and swash zone where relevant to be completed on foot or other appropriate means, such as LIDAR. Multibeam survey of the entrance channels to the harbour and marina will be carried out by a licenced surveyor to determine differences from the first post-development hydrographic survey.	Multibeam hydrographic surveys to allow a quantitative review of changes after the construction of the KBSC marina future proposal will be carried out for the indicative survey area: – Prior to construction of a future proposal. – Immediately (within 4 weeks) post-construction of a future proposal. – Three years post-construction of a future proposal. To reduce artefacts associated with seasonal changes to shoreline and bathymetry, hydrographic surveys to be conducted at the same time of year. The surveys are to be aligned with the beach monitoring surveys where possible. An additional hydrographic survey of the entrance channel will be completed 6 years post-construction, and every 3 years thereafter until the sediment dynamics are understood or reach equilibrium. The need and frequency for additional hydrographic surveys will be based on the degree of bathymetric and shoreline changes from hydrographic (and beach profile) monitoring as per Section 3.
Beach profile surveys	Beach profile surveys along fixed transects will be carried out to track beach change in both alongshore and cross shore directions over time. Changes in beach width, beach slope, beach scarps and high tide mark changes will be characterised from these profiles and to determine if they are attributable to a future proposal(s).	A total of 12 profiles (transects) will be surveyed that encompass Koombana Beach and Ski Beach as illustrated in Figure 5 with coordinates provided in Table 7.	Beach profile surveys will be carried out by an experienced surveyor as follows: – Surveys will include land and hydrographic surveys of the 12 profiles to the approximate locations in Figure 5. – Profiles will extend from the landward extent of the beach offshore ~200 m to a depth of 4-6 m. – Elevations will be taken at a minimum of 5 m intervals and at changes in grade (e.g. top and toe of a slope). – All profiles will illustrate the locations of the coastal vegetation line and the approximate waterline during the survey. – The vertical and horizontal datums will be Australian Height Datum (AHD) and GDA94, respectively. – Survey data is to be provided digitally as Autocad (dwg), text file with xyz data and survey metadata (e.g. projection, datums), and a PDF file with survey and details (e.g. projection, datums, dates). – Date(s) and accuracy of the survey data will be provided through a survey report,. – Profiles of future surveys are to be plotted on the same axes to demonstrate changes over time.	Beach profile surveys will be carried out twice annually at the end of winter (October) and at the end of summer (March) for at least 5 years from the completion of construction of the KBSC marina or until such time as the shoreline behaviour is understood. Surveys at the end of winter and summer will capture and allow assessment of seasonal fluctuations. As survey data is accumulated, the frequency and/or number of beach profiles (transects) will be made on a thorough review by a qualified coastal engineer(s) and subsequent consultation with relevant stakeholders in line with Section 3.

Monitoring Activity	Purpose	Location	Methodology	Frequency and Timing
Beach inspections and photographic monitoring	Photographic monitoring provides a documented visual history of shoreline changes that provides context to measured and assessed changes from surveys.	A total of 12 photographic monitoring locations that encompass Koombana Beach and Ski Beach as illustrated in Figure 5. The 8 Koombana Beach photo-monitoring locations are those established by Seashore (2013) to allow for consistent comparisons through time. Four additional locations are established for Ski Beach. Photographic monitoring locations coordinates are provided in Table 8.	Photographic monitoring will capture photographs with a controlled field of view at each monitoring location to ensure images are consistent and thereby provide a comparative review of coastal changes over time. Inspections and photographic monitoring will be carried out by an experienced coastal engineer(s).	Beach inspections and photographic monitoring will be carried out simultaneously with beach profile surveys, which will serve to ground truth surveys and confirm changes to the shoreline.
Shoreline mapping	Shoreline mapping will provide spatial context to broader shoreline change.	The shorelines of the KBSC marina future proposal's hydrographic survey area for (Figure 5).	Shoreline mapping will be based on the coastal vegetation line from ortho-rectified aerial photographs at regular time intervals in accordance with DoT (2009). Time intervals depend on the regularity of aerial photography which is anticipated on at least an annual basis. The movement of the shoreline will be evaluated during each report, where over time the database will allow long term trends in shoreline movement to be determined.	Shoreline mapping will be carried out on an annual basis in October.
Water quality monitoring	DO monitoring will be undertaken during entrance channel management of a 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 (e.g. dredging).

Figure 5 *Indicative spatial extents of hydrographic surveys for the Casuarina Boat Harbour (yellow polygon) and Koombana Bay Sailing Club (red polygon) marina future proposals, beach profiling (lines) and photographic monitoring locations (labelled symbols).*

Table 7 *Beach profile surveys: transect start and end coordinates.*[3]

Beach Profile (Transect) ID	Shoreline Starting Coordinate	Offshore Ending Coordinate
BP1 – Eastern end of Koombana Beach	33° 19.17192'S, 115° 39.22704'E	33° 19.05228'S, 115° 39.168'E
BP2	33° 19.19094'S, 115° 39.15792'E	33° 19.07838'S, 115° 39.1152'E
BP3	33° 19.21086'S, 115° 39.09924'E	33° 19.09332'S, 115° 39.05898'E
BP4 – Dolphin Discovery Centre	33° 19.2171'S, 115° 39.04698'E	33° 19.10076'S, 115° 39.01698'E
BP5	33° 19.2261'S, 115° 38.94726'E	33° 19.10526'S, 115° 38.96706'E
BP6	33° 19.2201'S, 115° 38.88018'E	33° 19.10202'S, 115° 38.89902'E
BP7	33° 19.21842'S, 115° 38.8149'E	33° 19.1097'S, 115° 38.84982'E
BP8	33° 19.1958'S, 115° 38.745'E	33° 19.07802'S, 115° 38.81808'E
BP9 - Western end of Koombana Beach	33° 19.17066'S, 115° 38.6745'E	33° 19.01616'S, 115° 38.76366'E
BP10 – Eastern end of Ski Beach	33° 19.17726'S, 115° 38.4693'E	33° 19.06512'S, 115° 38.4663'E
BP11	33° 19.1607'S, 115° 38.4015'E	33° 19.06416'S, 115° 38.46396'E
BP12 – Western end of Ski Beach	33° 19.13658'S, 115° 38.37'E	33° 19.04964'S, 115° 38.4474'E

[3] Transects BP1, BP5 and BP9 correspond to profiles 14, 7 and 2 in T Seashore (2013), respectively.

Table 8 Photographic monitoring locations: coordinates and photo orientations.

Location ID – Descriptor	Coordinates	Photo Orientations
PM1 – Eastern end of Koombana Bay	33° 19.151'S, 115° 39.256'E	315°N, 60°N, 135°N, °240°N
PM2	33° 19.194'S, 115° 39.147'E	345°N, 75°N, 165°N, °255°N
PM3 – Dolphin Discovery Centre	33° 19.228'S, 115° 38.994'E	0°N, 90°N, 180°N, °270°N
PM4	33° 19.219'S, 115° 38.823'E	10°N, 100°N, 190°N, °280°N
PM5	33° 19.204'S, 115° 38.712'E	10°N, 100°N, 190°N, °280°N
PM6 – Start of KBSC groyne	33° 19.187'S, 115° 38.651'E	20°N, 110°N, 200°N, °290°N
PM7 – Middle of former KBSC groyne	33° 19.151'S, 115° 38.666'E	20°N, 110°N, 200°N, °290°N
PM8 – End of former KBSC groyne	33° 19.096'S, 115° 38.687'E	20°N, 110°N, 200°N, °290°N
PM9 – End of Western Leschenault Inlet Entrance Groyne	33° 19.121'S, 115° 38.488'E	20°N, 110°N, 200°N, °290°N
PM10 – Middle of Western Leschenault Inlet Entrance Groyne	33° 19.168'S, 115° 38.481'E	20°N, 110°N, 200°N, °290°N
PM11 – Middle of Ski Beach	33° 19.169'S, 169° 38.417'E	30°N, 120°N, 210°N, °300°N
PM12 – Western Ski Beach	33° 19.148'S, 169° 38.378'E	45°N, 135°N, 225°N, °315°N

2.3.4 Analysis

The analysis of monitoring information and data (i.e. photographs, shoreline mapping, hydrographic surveys, beach profiles) will be completed by an experienced coastal engineer(s) on an annual basis for at least 5 years after the construction of a future proposal to determine if there are any trends in shoreline movement and/or significant changes to coastal processes with reference to metocean conditions that have been experienced. The coastal processes analysis will:

– Identify significant changes in shoreline movement.
– Assess changes against management triggers (Section 2.3.2).
– Inform further investigation and/or management actions where required where shoreline changes are attributable to the KBSC marina future proposal.

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 a future proposal.
  - Carry out additional coastal processes monitoring/investigations if further information is required to evaluate whether a 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 a future proposal, carry out the coastal processes management action to achieve compliance.

Coastal processes management actions include:

– Sand nourishment.
– Entrance channel management.

These coastal processes management actions are described in the following sections.

2.3.5.1 Sand nourishment

The requirement for sand nourishment will be determined adaptively on the basis of monitoring results as outlined in Table 9.

Sources of sand for beach nourishment of eastern Koombana Bay are likely to be from excavating:

– Accreted beach to the east of the existing Koombana Beach groyne.
– Accreted sand from the Outer Harbour or Western Groyne sand traps.

Sand from source locations will likely be transported via trucks to the shoreline of western Koombana Bay with placement of material at a nearshore disposal location. Targeted survey of the extraction and placement areas will be carried out immediately prior to and following sand nourishment operations to confirm sand volume for this management action. The excavated sand will be required to have:

– Particle sizes similar to or larger than the placement location.
– Similar colour to the placement location.
– No contamination or deleterious material.

2.3.5.2 Entrance channel management

The requirement for entrance channel management of the KBSC marina development future proposal[4] will be determined adaptively on the basis of monitoring results as outlined in Table 9.

Potential management actions include:

– The use of temporary navigation markers. For example, if safe navigation can be maintained in the existing channel with temporary navigation markers because a sill does not develop across the full width of the entrance.
– A self-flushing assessment. For example, if the sill is seasonal and has the capacity to 'self-flush' and restored 'naturally' without the need for mechanical removal. If self-flushing is reasonably likely, then it is likely to be appropriate to monitor the entrance (and sill) with regular hydrographic surveys to confirm (or otherwise).
– Dredging of the entrance channel. If temporary navigation markers and self-flushing are not considered sufficient, the mechanical removal via dredging will be required where:
    - Prior to dredging the composition of the sill material (e.g. sand, wrack, mixture) and a suitable disposal location (e.g. if primarily sand onshore, if largely wrack then further from shore) will be determined.
– Temporary cessation of dredging of the entrance channel if management trigger CPMT3 is not met.

[4] DoT is already responsible for save navigational depths across all its facilities.

Table 9 Overview of coastal processes adaptive management strategy

Location	Management Trigger	Monitoring and Timing	Review and Decision	Management Actions
Koombana Beach and/or Ski Beach	CPMT 1: Any erosion causing greater than 5 m recession of the 0 m AHD contour of Koombana Beach or Ski Beach from the pre-development position.	Monitoring commences prior to KBSC marina construction and then continues with following frequency: – Beach profile surveys in March and October each year. – Shoreline mapping in October each year. – Photographic monitoring in March and October each year.	CPMT 1 compliance evaluated on basis of beach profile surveys and shoreline mapping. If CPMT 1 compliance not met, then investigate whether any erosion or accretion is attributable to the KBSC marina future proposal through reviews of: – Photographic monitoring. – 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 KBSC marina future proposal is responsible for non-compliance of CPMT 1 OR implement management actions to comply with CPMT 1.	Sand nourishment as outlined in Section 2.3.5.1.
Entrance to KBSC marina or Casuarina Boat Harbour	CPMT 2: Formation of a sill in the entrance of KBSC marina or Casuarina Boat Harbour that impacts navigation and safety.	Hydrographic surveys will be completed independently for the KBSC marina and CBH development future proposals with following frequency: – Prior to construction. – Immediately post-construction. – Subsequently at a frequency of every 3 years.	CPMT 2 compliance evaluated on basis of hydrographic surveys. If CPMT 2 compliance not met, then implement management actions.	Entrance channel management as outlined in Section 2.3.5.2.
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 KBMS future proposals.

2.4.2 Management triggers

The seagrass wrack management triggers (SWMTs) are:

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

Management Trigger SWMT 2: Seagrass wrack accumulations within the KBSC marina and/or Casuarina Boat Harbour development future proposals that impact 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 KBSC marina and/or Casuarina Boat Harbour development future proposals and do 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 and adjacent to the KBSC marina and/or 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 10.

Table 10 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 and adjacent to the future proposals in a clear and systematic manner.	Monitoring will be carried out in the semi-enclosed water bodies, internal beaches (KBSC Marina Beach, Jetty Baths Beach), Ski Beach and Koombana Beach.	Visual and photographic monitoring will be carried out to monitor seagrass wrack accumulations within and immediately adjacent to the future proposals where: – Regular (weekly) inspections within the future proposal footprints with records of wrack accumulation documented by photographs that show location and extent. – Outside of the project footprint, photographic monitoring to be carried out twice per year at the coastal processes monitoring locations on Koombana Beach and Ski Beach (Figure 5, Table 8). 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 a future proposal is operational. Outside of the internal water bodies the visual monitoring of seagrass wrack accumulation on Koombana Beach and Ski Beach once the KBSC marina becomes operational will be completed as part of the coastal processes monitoring element of beach inspections and photographic monitoring (Section 2.3.3).
Navigation seagrass wrack monitoring	Wrack monitoring used to track accumulations of material that may impact navigational depths and/or have an adverse impact on water quality.	Entrance channel and internal water body of the KBSC marina once this future proposal is operational.	Navigation wrack monitoring will be undertaken through multibeam surveys[7] of the surface of the wrack layer.	Hydrographic surveys of the entrance channels will be carried out every 3 years as per the coastal processing element of hydrographic surveys (Section 2.3.3). A full survey of the marina water body will be completed at 6 year intervals as per the coastal processing element of hydrographic surveys (Section 2.3.3).
Water quality monitoring	Water quality monitoring of the internal water bodies will be undertaken once a 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.

[7] To ensure safe navigation for vessels into the entrance to the KBSC marina future proposal through maintenance of seabed depths, periodic surveys of the navigable depth will be used to assess areas (if any) of seagrass wrack accumulation. Note DoT has found multibeam surveys effective to resolve the surface of the seagrass wrack layer at Jurien Bay and Port Geographe.

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 11.

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 11.

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 11.

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 11 Overview of seagrass wrack adaptive management strategy

Location	Management Trigger	Monitoring and Timing	Review and Decision	Management Actions
Future proposal footprint(s)	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, photographic monitoring 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..
Koombana Beach, Ski Beach		Monitoring commences prior to future proposal construction and then continues with following frequency: – Shoreline mapping in October each year. – Photographic monitoring in March and October each year. Monitor community complaints to DoT, KBSC and CoB.		
Inner water body of KBSC marina	SWMT 2: Seagrass wrack accumulations within the KBSC marina future proposal that impacts the required navigable design depth.	Hydrographic surveys will be completed independently for the KBSC marina future proposal with following frequency: – Prior to construction. – Immediately post-construction. – Subsequently at a frequency of every 3 years.	SWMT 2 compliance evaluated on basis of hydrographic surveys. If SWMT 2 compliance not met, then implement management actions.	Removal and relocation of deposited wrack on the seabed as outlined in Section 2.4.5.3.
Inner water bodies of KBSC marina or Casuarina Boat Harbour	SWMT 3: Seagrass wrack accumulations that impact water quality within the KBSC marina and/or Casuarina Boat Harbour development future proposals do 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 12.

Table 12 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 beaches	Manually and disposal onshore rubbish[9]	KBSC beach and breakwaters	At discretion of facility/asset operational personnel	CoB (Koombana and Ski beaches and adjacent structures) DoT (Jetty Baths Beach and adjacent structures) KBSC (KBSC Marina Beach and adjacent structures)
		Jetty Baths beach and breakwaters		
		Koombana Beach, Ski Beach		
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	Southern Koombana Bay beaches (Jetty Baths, KBSC marina, Koombana, Ski)	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	KBSC marina Casuarina Boat Harbour	Management trigger SWM2 and/or SWM3	KBSC (KBSC marina) DoT (Casuarina Boat Harbour)
Increased frequency of water quality (bottom DO) monitoring	As per MEQMP (GHD 2023b)	KBSC marina 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 SWDC (or 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 the proponent of the relevant future proposal that describes non-compliance and corrective actions.

[9] 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 CoB (Koombana Beach, Ski Beach), KBSC (KBSC marina) and DoT (Casuarina Boat Harbour).

3. Adaptive management and review

CoB, DoT and KBSC 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.

4. References

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