Environmental Impact Assessment

Geraldton Port Maximisation Project

Mid West Ports Authority

298 Marine Terrace, Geraldton WA 6530

Prepared by:

SLR Consulting Australia

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Revision Record

Revision	Date	Prepared By	Reviewed By	Authorised By
0.1	13 April 2025	AW, DZ, LB, EH	FB, KF	AW
1.0	16 April 2025	AW, DZ, LB, EH	FB, AW, MWPA	AW
2.0	24 July 2025	AW, DZ, LB, EH	KF, AW, MWPA	AW

Basis of Report

Scoping and Required Work

The Geraldton Port Maximisation Project (PMaxP) (significant amendment to Ministerial statement 600) was referred to the Environmental Protection Authority (EPA) under Section 38 of the *Environmental Protection Act 1986* (EP Act) on 29 August 2024.

Pursuant to s. 38G(1) of the Environmental Protection Act 1986 (EP Act), the EPA decided to assess the proposal at a level of 'Assessed on referral Information with additional information required under s.40(2(a))'. Pursuant to section 40(2)(a) of the EP Act, the EPA required that MWPA provide further information. The requested information and where it has been addressed is detailed in **Table 1**.

Table 1 Environmental information required and how it has been addressed

Item	Request for Information	Where addressed
1. Proposed investigations and studies to inform assessment	In the Environmental Referral Supporting Information (ERSI) and in subsequent communications with the Department of Water and Environmental Regulation (DWER), the Mid West Ports Authority (MWPA) noted a number of technical investigations and studies that were in the process of being finalised to complete the assessment of the proposal's impacts and develop environmental outcomes. The EPA's environmental factor guidelines summarise the type of information that may be required by the EPA for assessment. Investigations and studies required to inform the environmental review document is to be conducted in accordance with the requirements of the most recent relevant EPA environmental factor guidelines and technical guidance. Relevant recovery plans, conservation advice, and/or threat abatement plans must be followed. Any instances where published guidance is not followed must be justified	Section 7.0 to Section 14.0 and attached appendices
2. Cumulative impacts	Cumulative environmental impacts are the successive, incremental and interactive impacts on the environment of a proposal with one or more past, present and reasonably foreseeable future activities. Refer to the EPA's Procedures Manual for further information on reasonably foreseeable future activities.	Section 14.0
3. Environmental outcomes	The EPA's ability to consider whether its environmental factor objectives are met is improved when it is provided with information about proposed environmental outcomes, rather than just being provided with measures to minimise or manage impacts. The EPA's preference is therefore for outcome-based conditions where practical as they can provide clarity, transparency, and flexibility (see Interim guidance - environmental outcomes and outcome-based conditions).	Table A-3 Section 7.0-10.0 DEMMP MFMP CPMP

Item	Request for Information	Where addressed
4. EMPs	The conditions and commitments of MS 600 require the preparation and implementation of environmental management plans (EMPs), or specify the measures required to monitor, minimise, or manage the impacts of the original implemented proposal. The s.40AA application notes that the proposal will be controlled through the implementation of several objective-based management plans in MS 600. EMPs should be prepared (or revised) and implemented to monitor and substantiate whether environmental outcomes (see item 3) are being achieved, as opposed to outlining mitigation measures by way of management actions to meet an environmental objective.	See the following: • DEMMP • CPMP • MFMP
5. Targeted consultation with relevant stakeholders and groups	Please provide information which shows evidence of MWPA's targeted consultation with relevant stakeholders and groups and outcomes of the consultation (e.g. has the proposal or management measures changed in response to consultation?)	Section 11.1
6. MEMMP	It is noted that MWPA has developed a draft MEMMP to define the Environmental Quality Management Framework and associated Environmental Values, Environmental Quality Objectives and Levels of Ecological Protection. Several components of this document require amendment in relation to monitoring locations, monitoring parameters, the sampling and analytical methodology, and appropriateness of the reference sites.	The MEMMP submitted in 2024 was for the Port operations. A DEMMP has been developed for PMaxP and is submitted with this EIA.
7. Surveys, IMSA packages	Please note that any additional biological survey work requires an accompanying Index of Biodiversity Surveys for Assessments (IBSA) and the Index of Marine Surveys for Assessment (IMSA) data packages. For instructions on preparing IBSA and IMSA data packages please see Instructions for preparing IBSA data packages and Instructions for preparing IMSA data packages.	IMSA data packages submitted for BCH survey and sediment investigation.
8. Other DMAs	In making its decision, the EPA can take account of other statutory decision-making processes that can mitigate the potential impacts of the proposal on the environment (s44(2AA) EP Act).	Section 3.2

Executive Summary

The Geraldton Port Authority (now Mid West Ports Authority [MWPA]) received approval for the Geraldton Port Enhancement Project (PEP) and Preparatory Works for the Town Beach Foreshore Redevelopment in July 2002. The PEP included dredging, land reclamation, reconfiguration and construction of breakwaters, construction of a railway line on the eastern breakwater, construction of beach stabilisation groynes in Town Beach and reclamation of Town Beach by sand nourishment. Most of the PEP is complete with the ongoing implementation of the approved Northern Beaches Stabilisation Plan the remaining action.

The Port Maximisation Project (PMaxP; this Proposal) is an infrastructure project aimed at modernising and optimising the capacity of the Port of Geraldton (the Port) through the upgrade of existing facilities and construction of both new and replacement facilities. The PMaxP involves dredging, land reclamation, construction of new breakwaters, and installation of marine infrastructure. The PMaxP is a significant amendment to the PEP.

Table A-1 presents the Proposal Description and **Table A-2** details the Proposal Elements.

The potential environmental impacts of the PMaxP have been assessed using information obtained through numerous technical studies. It is considered that the PMaxP can be successfully managed through the implementation of targeted monitoring and mitigation strategies to ensure all environmental objectives for all environmental values are met. A summary of the impact assessment and outcomes related to the four preliminary key environmental factors is presented in **Table A-3**.

Table A-1: Proposal Description

Proposal title	Geraldton Port Maximisation Project
Proponent name	Mid West Ports Authority
Short description	The proposal is for marine infrastructure upgrades at the Port of Geraldton (the Port), located in Western Australia's mid-west region. The proposal has a disturbance footprint of up to 38 ha within a 75 ha Development Envelope. Of this, 17 ha is a new footprint, and the remaining 21 ha is within the existing Port. The PMaxP is a significant amendment to the Port Enhancement Project (PEP) subject of Ministerial Statement 600, dated 2002. The PMaxP will modernise and improve the Port through the upgrade of existing facilities and construction of new and replacement facilities in optimised locations. PMaxP includes dredging and land reclamation using dredge spoil, piling, and installation of a rock revetment (seawall) extending north from the existing Port footprint. Marine infrastructure includes new wharf decks related to new Berth 1 (relocated) and Berth 8/9, an extension of the existing Berth 6 wharf, and a new (relocated) tug harbour. From an operational perspective, implementation of the PMaxP does not result in a throughput increase.

Table A-2: Proposal Elements

Proposal element	Location / description	Maximum extent, capacity or range		
		Port Enhancement Plan (PEP; 2002)	Port Maximisation Project (PMaxP; 2025)	Combined (PEP/PMaxP)
Physical elements				
PMaxP Footprint and Development Envelope (DE), including marine structures	Figure A-1 Figure A-2	No DE was defined; the indicative DE is 207 ha, including: • Extension of the Town Beach groynes • Northern breakwater extension and reclamation area • Modification of Seal Rocks • Eastern breakwater extension and railway line	Disturbance footprint of up to 38 ha within a 75 ha DE, including: • Seawall extending north beyond existing Port boundary • Three new wharf decks (B1, B8/9) • Two jetties (tug harbour) • Extension of Berth 6 wharf deck	DE (including indicative DE for PEP) of 222 ha (15ha of PMaxP DE is outside PEP DE)
Construction elements				
Dredging	Figure A-2	No dredge volume defined (indicative capital dredging of up to 5 Mm^3), comprised of: • Deepening of the harbour basin from 9.3 m to 12.1 m • Widening and extension of existing shipping channel • Offshore disposal of dredge spoil (3.5Mm3) from channel • Up to 0.4 Mm^3 dredged material disposed to the northern reclamation area	Dredging of up to 258,000 m^3 from the following areas: • Berth 1 • Berth 6 • Berth 8/9 • New tug harbour	Combined dredging of up to 5,258,000 m^3
Operational elements				
Not applicable				

Table A-3: Summary Environmental Impact Assessment

Theme	Factor	Objective	Receiving Environment	Potential Impacts	Mitigation	Residual Impacts and Assessment of Significance	Proposed Environmental Outcome
Sea	Benthic communities and habitats (BCH)	To protect benthic communities and habitats so that biological diversity and ecological integrity are maintained	Intertidal and subtidal waters in and around the Port of Geraldton. Subtidal BCH includes bare soft sediment, seagrass meadows, macroalgae low relief reefs and mixed communities. The seagrass meadows are considered to be commensurate with the *Posidonia australis* complex threatened ecological community (TEC). Some hard corals have also been recorded to the north of the shipping channel.	• Permanent loss/modification of approximately 19 ha of BCH. • Temporary elevated turbidity (resulting in the temporary modification of BCH). • Increased sedimentation (resulting in the temporary modification of BCH) • Mobilisation or contaminants and spills (resulting in the low/modification of BCH) • Increased risk of introducing/spreading marine pests. • Local alterations to sediment transport and/or hydrodynamics as a result of marine infrastructure and dredging.	• Rock breaking by hydro-hammer and material removal by long arm excavator in preference to cutter suction dredge. • Development of a Dredging Environmental Monitoring and Management Plan (DEMMP) to detail monitoring, BCH retention areas, sea conditions and scheduling, vessel anchoring areas and speeds, marine pest measures and other adaptive management measures.	Direct loss of BCH from dredging and installation of marine infrastructure is not expected to be significant. Impacts to BCH from indirect impacts (elevated turbidity and sedimentation) are expected to be localised and temporary based on the outcomes of plume modelling.	Based on the technical studies and modelling completed, and with the implementation of the mitigation hierarchy and the DEMMP, the PMaxP is expected to achieve the following outcomes related to BCH. • Permanent (irreversible) BCH loss limited to Zone of High Impact (ZoHI; 19 ha) • Temporary (reversible) BCH impact limited to Zone of Moderate Impact (ZoMI; 75 ha) • PMaxP will not result in a release of contaminants that can cause harm to the marine environment. • Maintain the geophysical processes that shape coastal morphology such that environmental values (including BCH) of the coast are protected.
	Coastal processes	To maintain the geophysical processes that shape coastal morphology so that the environmental values of the coast are protected	Shallow nearshore reef systems dissipate wave energy, promote the formation of tombolo features and sandy beaches and provide sheltered areas for seagrass to thrive. A combination of swell waves and strong sea-breeze wind fields drive the prevailing northward longshore sediment transport. Most of the sand in the area around the Port of Geraldton consists of fine modern skeletal sand, where 60% is derived from bioclasts living in association with seagrass. It is predicted that natural longshore sediment transport has been disrupted by marine infrastructure associated with the Port of Geraldton and the Batavia Coast Marina and thus reducing sand supply to beaches.	• Alteration of wave dynamics in the Port of Geraldton and adjacent areas, including a reduction in wave energy in exposed areas. • Alterations to longshore sediment transport affecting erosion and accretion, more likely to the north of the Port of Geraldton. Modelling indicates that while there may be minor changes related to PMaxP, they are not significant and that the existing shipping channel is the main driver of altered coastal processes.	• Ongoing commitment to relocate sand from Pages Beach to the northern beaches; volume to be reactive to monitoring • Sediment and coastal hazards monitoring to understand the behaviour of the coastline north and south of the Port of Geraldton to inform adaptive management. • Update of the Northern Beaches Stabilisation Plan (NBSP; approved as part of the PEP) to a contemporary Coastal Processes Management Plan (CPMP) to manage historical and contemporary impacts.	Hydrodynamic and sediment fate transport modelling indicates that the Proposal is not expected to significantly alter longshore sediment transport from current conditions.	Based on the modelling results and with the implementation of the mitigation hierarchy and the CPMP, the PMaxP is expected to meet the following objectives for coastal processes and related factors. • Maintain natural coastal processes while minimising sediment accumulation and migration within port navigable waters. • Maintain public safety and minimize social impacts while enhancing community awareness of coastal processes. Outcomes relevant to BCH have been included under that factor.

Theme	Factor	Objective	Receiving Environment	Potential Impacts	Mitigation	Residual Impacts and Assessment of Significance	Proposed Environmental Outcome
	Marine environmental quality	To maintain the quality of water, sediment and biota so that environmental values are protected	Exposure to seasonal strong storm swells and southerly winds result in naturally turbid waters in winter and spring and clearer waters in summer and autumn. Marine heat waves, cyclones, river discharge and vessel activities also influence the water quality of Champion Bay. All these factors influence the turbidity at varying temporal scales. Routine water quality monitoring indicates elevated levels of copper and zinc in the harbour and elevated metals were reported in Port sediments. However, bioavailable concentrations of these metals were below the relevant Australian and New Zealand guideline values.	• Localised increase in turbidity from dredging. • Mobilisation of contaminants from sediment disturbance. • Release of bioavailable contaminants via return water from reclamation areas.	• Dredge spoil to be utilised in reclamation areas in preference to sea dumping. • Development of a DEMMP to detail monitoring requirements, management targets, trigger and threshold criteria, and contingency actions.	Localised elevated turbidity and release of contaminants are predicted, based on hydrodynamic and plume modelling, however no permanent or ecologically significant impacts are expected.	Based on comparisons to previous dredging campaigns, combined with comprehensive technical studies and numerical modelling, and with the implementation of the mitigation hierarchy, the Proposal is expected to meet the objectives developed as part of the DEMMP, which defines the following outcome: PMaxP will not result in a release of contaminants that can cause harm to the marine environment. Outcomes relevant to Marine Fauna and BCH have been included under the relevant factors.
	Marine fauna	To protect marine fauna so that biological diversity and ecological integrity are maintained	Intertidal soft sediment, intertidal rocky reef, bare subtidal soft sediment, seagrass meadows, reef complex and coastal waters are the identified marine fauna habitat. Three BIAs also intersect with waters around the Port of Geraldton: • Caspian Tern (*Hydroprogne caspia*) foraging BIA; • Humpback Whale (*Megaptera novaeangliae*) migration BIA; and • Australian Sea-lion (*Neophoca cinerea*) foraging BIA. Other conservation-listed species (i.e. significant marine fauna) with potential to occur include: • Roseate Tern (*Sterna dougallii*); • Osprey (*Pandion haliaetus*); and • Indo-Pacific Bottlenose Dolphin (*Tursiops aduncus*). Several managed fisheries also encompass the waters around the Port of Geraldton. These fisheries target abalone (*Haliotis* spp.), common octopus (*Octopus djinda*), western rock lobster (*Panulirus cygnus*), finfish and elasmobranchs.	• Permanent loss or modification of BCH (as habitat for marine fauna) • Permanent loss of Australian Sea-lion haul-out habitat • Elevated turbidity and increased sedimentation (resulting in the temporary modification of BCH) • Mobilisation or contaminants and spills (causing harm to marine fauna) • Increased risk of injury or mortality from vessel collision/strike and interactions with equipment (i.e. entanglement and entrapment). • Permanent or temporary hearing loss from exposure to underwater noise and vibrations. • Permanent or temporary hearing loss from exposure to above-water noise and vibrations. • Induced behavioural or stress responses from increased activities associated with construction. • Degradation of retained habitat, competition and predation from the introductions/spread of marine pests.	• Optimisation of the Proposal footprint to reduce impact areas. • A net increase in viable Australia Sea-lion haul-out areas from the construction of new sea walls/berths. • An increase in colonising surface area for subtidal reef communities on submerged marine infrastructure. • Development of the Marine Fauna Management Plan (MFMP) to manage interactions and expectations between vessels and equipment, construction activities (marine or terrestrial) and marine fauna, detail marine pest management measures, exclusion areas, marine fauna observations, stop-works procedures and monitoring requirements. Mitigation of impacts to subtidal habitats are addressed in the BCH factor.	With the implementation of management measures, including exclusion zones defined through underwater acoustic modelling, no significant impacts to marine fauna as a result of the Proposal are expected.	Based on the temporary nature of disturbances to marine fauna, the proportionally small areas of subtidal habitat (i.e. BCH) loss, the potential creation of habitat and the application of the mitigation hierarchy, the Proposal is expected to meet the objective for marine fauna based on achievement of the following outcomes: • No significant impacts to key marine fauna or commercially and recreationally important marine species as a result of the PMaxP. Outcomes relevant to MEQ and BCH have been included under the relevant factors.

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Acronyms and Abbreviations

Acronym	Definition
3D	Three dimensional
ACHIS	Aboriginal Cultural Heritage Inquiry System
AH Act	*Aboriginal Heritage Act 1972*
ANZG	Australian and New Zealand guidelines
AQ	Air quality
BC Act	*Biodiversity Conservation Act 2016*
BCH	Benthic Communities and Habitat
BCM	Batavia Coast Marina
BCMI	Batavia Coast Maritime Institute
BIA	Biological Impact Areas
CD	Chart datum
CGG	City of Greater Geraldton
CLA	Cumulative loss assessment
COPC	Contaminants of potential concern
CPMP	Coastal Processes Management Plan
DAE	Dilute acid extraction
DBCA	Department of Biodiversity, Conservation and Attractions
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DEMIRS	Department of Energy, Mines, Industry Regulation and Safety
DEMMP	Dredging Environmental Monitoring and Management Plan
DFES	Department of Fire and Emergency Services
DJTSI	Department of Jobs, Tourism, Science and Innovation
DOT	Department of Transport
DPIRD	Department of Primary Industries and Regional Development
DPLH	Department of Planning and Heritage
DWER	Department of Water and Environmental Regulation
EIA	Environmental impact assessment
EP Act	*Environmental Protection Act 1986*
EPA	Environmental Protection Authority
EPAS	Environmental Protection Authority Services
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EQMF	Environmental Quality Management Framework
EQO	Environmental quality objective
EV	Environmental value
FAQs	Frequently asked questions

FBH	Fishing Boat Harbour
GHG	Greenhouse gas
ha	Hectares
HEPA	High ecological protection area
HWA Act	*Heritage of Western Australia Act 1990*
IAP2	International Association for Public Participation
ILUA	Indigenous Land Use Agreement
km	Kilometres
km^2	Square kilometres
LAU	Local Assessment Unit
LEP	Levels of Environmental Protection
LEPA	Low ecological protection area
LGA	Local government area
LOR	Limit of reporting
LVIA	Landscape and Visual Impact Assessment
m	Metres
m^3	Cubic metres
MA Act	*Maritime Archaeology Act 1973*
mCD	metres Chart Datum
MCEMP	Marine Construction Environmental Management Plan
MEPA	Moderate ecological protection area
MEQ	Marine Environmental Quality
MFMP	Marine Fauna Management Plan
mm	Millimetres
MNES	Matters of National Environmental Significance
MRWA	Main Roads Western Australia
MS600	Ministerial Statement 600
Mtpa	Million tonnes per annum
MWCCI	Mid West Chamber of Commerce and Industry
MWDC	Mid West Development Commission
MWPA	Mid West Ports Authority
NACC NRM	Northern Agricultural Catchments Council – Natural Resource Management
NADG	National Assessment Guidelines for Dredging
NBSP	Northern Beaches Stabilisation Plan
NIMPIS	National Introduced Marine Pest Information System
OTH	old tug harbour (material disposal area)
pa	per annum
PA Act	*Port Authorities Act 1999*

PAR	photosynthetically active radiation
PD Act	*Planning and Development Act 2005*
PEP	Port Enhancement Project
PLA Act	*Port Legislation Amendment Act 2014*
PMaxP	Port Maximisation Project
PMST	Protected Matters Search Tool
Port	Port of Geraldton
SES	State Emergency Service
SIA	Social Impact Assessment
SLC	Surf Lifesaving Club
SPL	species protection level
SSD	suspended sediment concentration
TEC	threatened ecological communities
TBT	tributyltin
UCH Act	*Underwater Cultural Heritage Act 2018*
WA	Western Australia
WAM	Western Australia Museum
WAMSI	Western Australian Marine Science Institute
YSRC	Yamatji Southern Regional Corporation
ZoHI	Zone of High Impact
ZoI	Zone of Influence
ZoMI	Zone of Moderate Impact

1.0 Introduction

1.1 Document purpose and scope

This Environmental Impact Assessment (EIA; this document) provides a detailed assessment of the Geraldton Port Maximisation Project (PMaxP; the Proposal), which is considered a Significant Amendment of the Geraldton Port Enhancement Project (PEP) approved in 2002 under Ministerial Statement 600.

The purpose of this document is to present the necessary information to support the assessment of the Proposal under section 40AA of the *Environmental Protection Act 1986* (EP Act) and it includes:

- PMaxP Overview (Section 2.0)
- Legislative Context (Section 3.0)
- Stakeholder Engagement (Section 4.0)
- Object and Principals of the EP Act (Section 5.0)
- Overview of Environmental Factors (Section 6.0)
- Environmental Impact Assessment for Key Factors:
    - Marine Environmental Quality (Section 7.0)
    - Benthic Communities and Habitat (Section 8.0)
    - Marine Fauna (Section 9.0)
    - Coastal Processes (Section 10.0)
- Environmental Impact Assessment for Other Factors:
    - Social Surroundings (Section 11.0)
    - Terrestrial Environmental Quality, Air Quality, Greenhouse Gas Emissions (Section 11.0)
- Matters of National Environmental Significance (Section 11.1)
- Holistic Assessment (Section 13.0)
- Cumulative Assessment (Section 14.0).

This document was prepared in consideration of the following documents:

- Statement of environmental principals, factors and objectives, and aims of the Environmental Protection Authority (EPA 2023)
- Environmental Impact Assessment (Part IV Divisions 1 and 2) Administrative Procedures (EPA 2021)
- Environmental Impact Assessment (Part IV Divisions 1 and 2) Procedures Manual
- EPA Instructions on how to prepare an Environmental Review Document (EPA 2021)
- EPA Technical Guidance (various).

1.2 Proponent

The proponent is the Mid West Ports Authority (MWPA) who is responsible for the control and management of the Port of Geraldton (the Port). The Port currently encompasses seven commercial berths and associated marine assets providing critical supply chain infrastructure for the mining, agriculture, and fishing sectors within Western Australia's Mid-West region. **Table 1-1** presents the details of the proponent.

Table 1-1 Proponent Information

Entity Name	Mid West Ports Authority
Australian Business Number (ABN)	73 384 989 178
Address	298 Marine Terrace, Geraldton Western Australia
Key contact (CEO)	Damian Tully
Key contact email	pmaxpdocuments@midwestports.com,au

2.0 Proposal Overview

2.1 Port Enhancement Project (Approved Proposal)

The Geraldton Port Authority (now MWPA) received approval for the Geraldton Port Enhancement Project and Preparatory Works for the Town Beach Foreshore Redevelopment (herein referred to as the PEP) in July 2002 by administration of Ministerial Statement 600 (MS600) including relevant conditions.

The Port upgrades associated with the PEP included deepening and widening the shipping channel, deepening of the harbour basin, reclamation of land, offshore disposal of dredge spoil, reconfiguration and construction of breakwaters, construction of a railway line on the eastern breakwater, construction of beach stabilisation groynes in Town Beach and reclamation of Town Beach by sand nourishment. The only remaining active implementation condition on MS600 is related to Commitment 15 – the implementation of the approved Northern Beaches Stabilisation Plan. Other active MS600 conditions include reporting requirements and are expected to be incorporated with this amended proposal.

The Port currently has five operational berths (Berths 3, 4, 5, 6, 7), with existing Berth 1 and Berth 2 deemed unsuitable for operations due to the aged wharf infrastructure. The Port also has an active material reclamation (disposal) area north of Berth 7 approved for placement of harbour sediments identified as unsuitable for unconfined disposal at sea. This facility was approved under Part V of the *Environmental Protection Act 1986* (EP Act) in 2001 as part of the Bulk Handling Facility Environmental Action Plan.

2.2 Port Maximisation Project (Significant Amendment)

The Port Maximisation Project (PMaxP) is an infrastructure project aimed at modernising and optimising the capacity of the Port of Geraldton (the Port) through the upgrade of existing facilities and construction of both new and replacement facilities. The PMaxP was referred under the EP Act and deemed a significant amendment to the approved Geraldton PEP (further context is provided in Section 3.1). The key components of the PMaxP are detailed in the Proposal Content Document and will incorporate the ongoing commitments required under MS600.

The PMaxP Development Envelope and Proposal Footprint are depicted in **Figure A-1** and detailed layout presented in **Figure A-2**. The key components are represented in the artistic render of the project (pictured as complete, minus Berth 8/9) in **Figure 2-1** and include:

- Replacement (new) tug harbour, incorporating a new reclamation area and material disposal pond (north of the existing Berth 7 reclamation and disposal area, also featured in **Figure A-2**),
- Replacement Berth 1 including land-reclaimed wharf and causeway enclosing the existing tug harbour as a new material disposal area,
- Extension of existing Berth 6, and
- New Berth 8/9.

Figure 2-1 PMaxP Overview

2.2.1 Proposal Exclusions

Some components related to the delivery of the wider Port optimisation will be managed under alternate regulatory mechanisms and hence are not further addressed as part of the impact assessment presented herein, including:

- New truck unloader at Lease 11 (Works Approval secured April 2024)
- Demolition of Berths 1 and 2 (may be subject of a future Works Approval)
- Bulk material loading/unloading on Berth 1 and Berth 8/9 (subject to future Works Approvals and/or Licence Amendments)
- Road network upgrades and improvements.

References to PMaxP herein relate only to those components detailed as part of this significant amendment proposal and included in the Development Envelope and Proposal Footprint as depicted in Figure A-1 and Figure A-2.

From an operational perspective, the implementation of the PMaxP does not directly result in an increased throughput nor does it involve the addition of new products not already exported through the Port. Hence, the PMaxP is considered a construction only proposal.

As part of ongoing Port operations there may be routine operational and maintenance works that are excluded from the scope of this referral, including:

- maintenance activities on existing berths (Berths 3, 4, 5, 6, 7) and terrestrial lots,
- maintenance dredging within the Port harbour and shipping channel,
- relocation and upgrade (improvement) of the Berth 7 (B7) waste facility to the western end of the existing B7 reclamation pond.

2.2.2 Technical Summary of PMaxP

The implementation of the PMaxP requires maintenance dredging, capital dredging and piling to facilitate the construction of each of the key components.

Table 2-1 provides a summary of the relevant technical specifications associated with the required dredging and piling activities for PMaxP.

Table 2-1 PMaxP Technical Specifications

PMaxP Component	Capital dredge volume (m^3)^	Maintenance dredge volume (m^3)*	Piling detail (number and diameter)#
Tug harbour	31,000	0	~20; 914 mm
Berth 1	23,000	18,000	~120; 914 mm & 1,050 mm
Berth 6	98,000	0	~100; 762 mm & 914 mm
Berth 8/9	88,000	0	~240; up to 1,050 mm
Total	240,000	18,000	~480; various size

^dredge volumes are a best approximation and include over-dredge allowance
*once-off maintenance dredge activity (not ongoing)
#piling detail is based on the 85% design and is subject to change within a range that is not deemed to have a material impact on the outcomes of any related technical studies

2.2.3 PMaxP – Tug Harbour

The replacement tug harbour will involve:

- construction of a new breakwater extending north ~450 m into Champion Bay;
- capital dredging of ~31,000 m^3 to a design depth of -7.0 m chart datum (CD) within the new breakwater;
- a combination of vibratory and impact piling of ~20 tubular piles of 914 mm diameter to a depth of ~20 m; and
- construction of up to two jetties within the harbour (~100 x 6 m in dimension).

The breakwater will be constructed using a progressive rock placement method with a clean, hard rock (sourced and provided by third-party suppliers). The rock wall will be lined with geofabric liner to retain fine sediments within the core. The inner tug harbour rock wall toe will be buried to ensure the structural integrity is not undermined via ongoing vessel wash. An excavator mounted suction pump will be used to excavate a toe trench and then rock placement using a long reach excavator.

The capital dredging required to deepen the inner tug harbour will utilise a trailing suction hopper dredge, as per routine Port maintenance dredge campaigns, as there is no underlying rock required to be removed to meet the design depth.

The construction of the tug harbour will also involve land reclamation along the southern boundary of the tug harbour (north of existing Berth 7 reclamation area; refer **Figure A-2**). The land reclamation will utilise capital dredge spoil where sediment characterisation deems the material suitable for this use and supplemented by geotechnically suitable imported fill. The new tug harbour reclamation area will also include a new partially HDPE-lined pond (replicating the Berth 7 reclaim pond approved in 2001 for disposal of harbour sediments) and is intended for use as a dredge spoil disposal pond for future dredging campaigns, including the new tug harbour capital dredge (refer **Figure 2-2**). The new tug harbour pond will be hydraulically connected to the existing B7 pond by pipework and ultimately discharge to the Port harbour (i.e. no direct discharge to the new tug harbour); this method of disposal and discharge was approved under Part V of the EP Act in 2001 as part of the Bulk Handling Facility Environmental Action Plan.

The purpose of the replacement tug harbour is twofold – it provides a more accessible and operable hub for the Port tug fleet and affords protection from long period waves within the main harbour. The optimised design of the tug harbour provides surge mitigation to enhance the operability of berths, including a reduction in wait times and berth times, and potentially reducing greenhouse gas (GHG) emissions due to streamlined shipping operations.

The protection afforded to the Port by the new tug harbour breakwater will also result in a reduction of the required design strength for much of the proposed PMaxP marine infrastructure (e.g. wharf decks). This can reduce the volume of materials required, reduce the number and size of piles, allow steeper rock revetment angles and hence minimise the potential impact to the environment by optimising the disturbance footprint and reducing acoustic impacts during piling works.

2.2.4 PMaxP – Berth 1

Berth 1 will be constructed to replace the aged infrastructure of existing Berths 1 and 2. The replacement Berth 1 will be a new structure sited in a different orientation to the existing Berth 1/2, which has been optimised to maximise operability and berth utilisation based on reduced long period wave impacts (surge mitigation).

The construction of Berth 1 will initially require the maintenance dredging of ~18,000 m^3 of sediment from within an area that was capital dredged to design depth as part of the PEP

(MS600). The dredged material from this initial campaign will be conveyed to the existing Berth 7 reclamation area.

A capital dredge campaign will follow, to remove ~23,000 m^3 sediment and rock to deepen the berth pocket to -13.4 metres Chart Datum (mCD) using a hydro-hammer for rock breaking and long arm excavator to remove material. The dredge spoil is intended to be utilised for beneficial reuse within the new Berth 1 reclamation area (refer **Figure 2-2**) following confirmation through PMaxP on material suitability, which is further discussed in Section 7.0.

The Berth 1 reclamation area will be bordered by a rock revetment and supplemented by geotechnically suitable imported fill to create the land-backed wharf and causeway that will enclose the old tug harbour and provide access to the new Berth 1 wharf. The rock wall associated with the causeway will be lined with geofabric to retain fine sediments within the core. The newly enclosed old tug harbour (OTH) area would be used for the disposal of uncontaminated Port-sourced materials and hence will not be lined (refer **Figure 2-2**).

A combination of vibratory and impact piling of ~120 tubular piles of up to 1,050 mm diameter to a depth of ~40 m will be used to construct the 293x22 m wharf deck.

The primary intention for Berth 1 is to support ongoing trade and provide a dedicated and safe disembarkation point for cruise ships.

2.2.5 PMaxP – Berth 6

Berth 6 is an existing operational berth that requires an upgrade and extension to accommodate Panamax size vessels. The upgrade will include capital dredging of ~98,000 m^3 to a design depth of -13.4 mCD using the same method as Berth 1 (hydro-hammer and excavator). A portion of the capital dredging will be completed from the onshore northern reclamation area (i.e. land-based excavation). The dredged material is intended to be beneficially reused in the newly formed OTH disposal area, or the Berth 1 reclamation area, based on material suitability, which is further discussed in Section 7.0.

The wharf upgrade works will include a combination of vibratory and impact piling of~100 tubular piles of up to 914 mm diameter to a depth of ~20 m and extension of the wharf deck to a new length of 287 m (existing wharf deck length is 244 m) and width of 23 m.

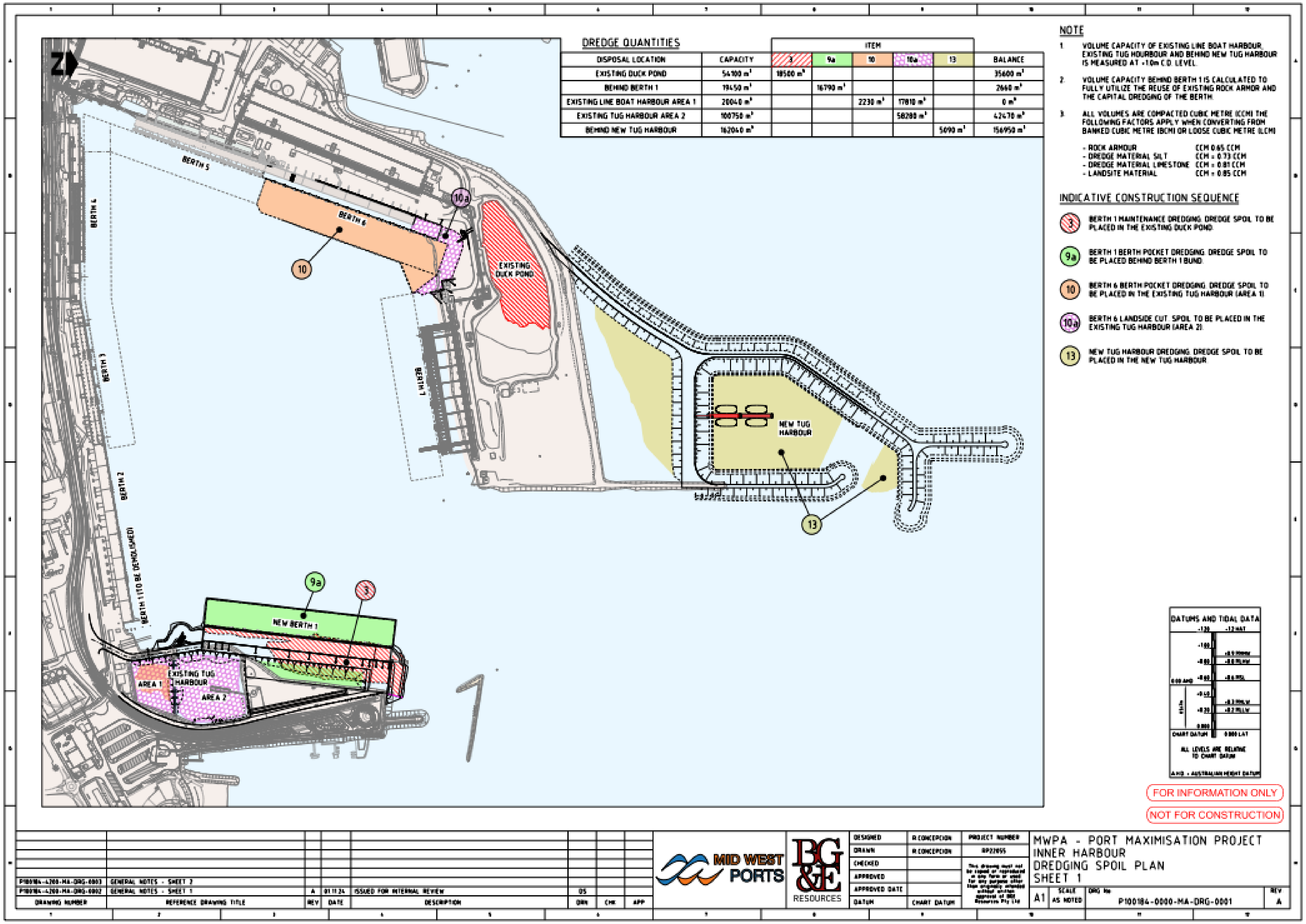
The wharf upgrade will disturb the existing Berth 7 reclaim pond discharge pipes, which will be reinstated and remain functional post-completion of the upgrade works at Berth 6. The disturbance will be managed such that the discharge from the pipeline emanating from the B7 reclaim area will remain within the designated area.

2.2.6 PMaxP – Berth 8/9

The Berth 8/9 development will involve capital dredging of ~88,000 m^3 within the berth pocket to a design depth of -13.4 mCD utilising the same methods as for Berths 1 and 6 (hydro-hammer and excavator). The dredged material will be relocated to the new tug harbour disposal pond, based on material suitability, which is further discussed in Section 7.0.

The new wharf construction will include a combination of vibratory and impact piling of ~240 tubular piles of up to 1,050 mm diameter to a depth of ~40 m, and construction of a ~500 m long wharf deck.

The purpose of the proposed Berth 8/9 is to support future renewables energy projects and break-bulk cargo.



DREDGE QUANTITIES

DISPOSAL LOCATION	CAPACITY	ITEM 3	ITEM 9a	ITEM 10	ITEM 10a	ITEM 13	BALANCE
EXISTING DUCK POND	54100 m³	18500 m³					35600 m³
BEHIND BERTH 1	19450 m³		16790 m³				2660 m³
EXISTING LINE BOAT HARBOUR AREA 1	20040 m³			2230 m³	17810 m³		0 m³
EXISTING TUG HARBOUR AREA 2	100750 m³				58280 m³		42470 m³
BEHIND NEW TUG HARBOUR	162040 m³					5090 m³	156950 m³

Figure 2-2 Dredge and Material Reuse Locations

2.2.7 Project Staging

Table 2-2 presents the construction staging for the PMaxP marine construction activities.

Table 2-2 Construction staging

Construction Stage	Location	Detail
1a-NTH	New tug harbour	Construction of outer seawall (rock revetment scheduled for completion by end of Stage 1); concurrent with Berth 1
1b-NTH		Construction of inner seawalls (outer seawall is substantially complete prior to inner seawall construction); concurrent with Berth 1
1a-B1	Berth 1	Maintenance dredging at the northern extent of the B1 footprint (~3 days by trailing suction hopper dredge [TSHD]) Concurrent with tug harbour
1b-B1		Causeway and piling (impact and vibratory) and preparatory works for wharf deck; concurrent with tug harbour
1c-B1		Capital dredging (~2 weeks by back-hoe dredge [BHD] and hydrohammer, if required); concurrent with tug harbour
2	Berth 6	Capital dredging (~12 weeks by BHD and hydrohammer, if required) Piling to be undertaken after completion of dredging
	New tug harbour	Piling for the construction of jetties
3	Berth 8/9	Capital dredging and piling (future works)
	New tug harbour	Capital dredging (~2 weeks by TSHD)

All modelling completed for the project, including underwater acoustic, sediment transport and plume dispersion, considered this staging to ensure infrastructure was in place when running relevant scenarios.

2.2.8 Alternatives Considered

Minimising environmental impact to as low as reasonably practicable is a key focus and **Table 2-3** outlines the considerations afforded during the development of the PMaxP design.

Table 2-3 Alternative Considered

Option	Advantages	Disadvantages	Comment
Do nothing	• No new disturbance • Port impacts ongoing (no change)	• Continued degradation of Port infrastructure • Loss of economic opportunities for Mid-West region • Ongoing surge impacts to Port	**Rejected**. PMaxP is required to maintain existing facilities and support growth of diverse Mid-West industries.
Timeframe			
No restrictions on timing	• Speed of construction	• Impacts to marine fauna possible	**Rejected.** Reasonable controls applied to mitigate environmental risks.

Option	Advantages	Disadvantages	Comment
No night piling or rock breaking	• Minimise underwater noise impacts during low light conditions • Minimise social impacts	• Slows pace of construction • Increased cost when compared to 24hr piling	**Implemented.** No night piling or rock breaking will significantly reduce underwater noise risks to fauna during low light conditions.
No summer capital dredging	• Avoid key periods of growth for numerous species of benthic primary producers (e.g. seagrass and macroalgae) • Reduced impacts to BCH mean reduced impacts to marine fauna (Australian Sea Lion) habitat	• Capital dredging during whale migration season	**Implemented.** Not possible to avoid impacts to both benthic communities and habitats (BCH) and Humpback Whales during migration. Avoidance of key seagrass growth period maximises environmental benefit, including to marine fauna that utilise the habitat.
Avoid Humpback Migration	• Minimise impacts to marine fauna (whales)	• Capital dredging over summer growth period for BCH	**Rejected**. Due to low likelihood of humpbacks within the exclusion zone, (where temporary threshold shift (TTS) impacts may occur) and the extended migration period (June to November) a better environmental outcome can be achieved by avoiding summer dredging and implementing robust controls for underwater noise mitigation.
Location			
B1 original orientation (east-west alignment)	• No new footprint	• Operability compromised leading to increased shipping movements	**Rejected**. Orientation not optimal for berth due to wave impacts
New tug harbour location and orientation	• Reduced design requirements for marine infrastructure (rock walls, wharf decks and pile size) due to surge (long-period wave) mitigation afforded by tug harbour • Reduces shipping movements by increasing available annual loading hours	• New footprint with direct impact to BCH • Alteration of longshore sediment transport	**Implemented.** New tug harbour is required, and it was not possible to avoid direct impacts to BCH; however, the footprint has been optimised to minimise this direct impact.

Option	Advantages	Disadvantages	Comment
Activities			
Capital dredge by cutter suction dredge (CSD)	• Availability and common practice	• Excessive turbidity	**Rejected**. Potential impacts to water quality, BCH, marine fauna, and social amenity considered unacceptable.
Back-hoe dredge (BHD)	• Minimised turbidity; intensity and extent of plume	• Requires rock-breaking for consolidated material prior to removal	**Implemented.** Lessons learnt from the Port Enhancement Project capital dredging by CSD, and detailed dredge method review indicate BHD is the most suitable method.
Dredge spoil disposal onshore/land reclamation	• No unconfined sea dumping of dredge spoil	• Need to ensure material is suitable from an environmental and geotechnical perspective for use as reclamation fill	**Implemented.** Dredge sediments (and excavated rock and soils) will be beneficially reused to create the land-backed wharfs and fill reclamation areas, supplemented by imported fill, as required.

3.0 Legislative Context

The key legislation relevant to this referral includes, but is not limited to:

- *Aboriginal Heritage Act 1972* (AH Act)
- *Biodiversity Conservation Act 2016* (BC Act)
- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- *Environmental Protection Act 1986* (EP Act)
- *Heritage of Western Australia Act 1990* (HWA Act)
- *Maritime Archaeology Act 1973* (MA Act)
- *Port Authorities Act 1999* (PA Act)
- *Ports Legislation Amendment Act 2014* (PLA Act) and
- *Underwater Cultural Heritage Act 2018* (UCH Act).

3.1 Environmental Impact Assessment

3.1.1 *Environmental Protection Act 1986* (EP Act; Part IV)

Part IV of the EP Act is the primary legislation that governs environmental impact assessments (EIAs) and environmental protection in WA. EIA in WA is conducted by the Environmental Protection Authority Services (EPAS) division of the Department of Water and Environmental Regulation (DWER) which has prepared administrative procedures for the purposes of establishing the practices of EIA.

It was recognised that the implementation of the PMaxP, in the absence of suitable mitigation, may result in significant impacts to environmental factors as defined by the EPA and hence a referral under Part IV of the EP Act was deemed necessary.

The PMaxP was referred as a significant amendment to the approved Geraldton PEP under section 38(a) of the EP Act in August 2024. On 18 September 2024, a Notice of Decision to Assess Proposal was issued under s.38G(1) of the EP Act and determined that the PMaxP would be assessed on referral information, with additional information required under s.40(2) of the EP Act. No public review was deemed necessary.

3.2 Other Approvals and Regulation

3.2.1 Environmental

3.2.1.1 *Environmental Protection Act 1986* (EP Act; Part V)

Pursuant to Section 44(2AA) of the EP Act, the EPA may consider other decision-making processes that can mitigate potential impacts of the PMaxP on the environment. **Table 3-1** outlines the other process that are requested to be referenced by EPA when considering key environmental factors and recommendations in its assessment.

MWPA currently holds Environmental Licence L4275/1982/15 issued by DWER, permitting the bulk loading, and unloading of granular materials from or onto vessels as specified under Schedule 1 Categories 58 and 58A of the Environmental Protection Regulations. The conditions of the licence are applicable to those activities linked to these categories including the storage, handling, and transport of bulk materials within the prescribed premises as well as any wastes generated during the handling activities or infrastructure maintenance.

The Geraldton Port Licence L4275/1982/15 was recently amended in response to growing global demand for mineral and energy commodities, to reflect an annual production capacity of 23 million tonnes per annum (Mtpa). It is expected that any future changes to the permitted import and export products or increases to annual throughput will be addressed under Part V of the EP Act via a Licence Amendment and are not subject to this assessment.

Future Licence Amendments under Part V of the EP Act will be required for the new (Berth 1, Berths 8/9) and extended (Berth 6) wharf decks that are also subject of environmental impact assessment as part of PMaxP, as outlined in **Table 3-1**.

3.2.1.2 *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)

The EPBC Act defines a similar process for assessment and referral of actions with the potential to cause significant environmental impacts; however, environmental impact assessment is focused on matters of national environmental significance (MNES).

There are several MNES identified (threatened and migratory species) that may be placed at risk of environmental harm from the implementation of the PMaxP and hence a referral under the EPBC Act has been submitted and shall progress concurrently with this assessment.

Table 3-1 Other decision-making processes

Environmental impact	How is the impact regulated by other decision-making process?	Likely environmental outcome and consistency with EPA objective	Conditions, enforcement, and review process	Stakeholder engagement
Emissions and discharges to the environment	Regulated by Department of Water and Environmental Regulation (DWER) under Part V of the *Environmental Protection Act 1986* (EP Act) via Works Approvals and Licences	Routine monitoring related to water, sediment and air quality to meet relevant criteria for the level of protection afforded to that area. Expected to meet EPA objectives for relevant factors.	Conditions related to the Works Approval or Licence issued under Part V of the EP Act	Consultation with DWER and relevant key stakeholders
	Approval of a Construction Noise Management Plan (future) by the City of Greater Geraldton (CGG)	No adverse noise impacts to sensitive receptors. Expected to meet EPA objectives for Social Surroundings.	Conditional approval of a PMaxP Construction Noise Management Plan	Consultation with key stakeholders and the CGG
Alteration to coastal processes	CGG will review plans related to coastal processes under the existing Memorandum of Understanding (MoU) established in March 2003 based on a condition of the PEP approval (MS600), or future revisions.	Environmental outcomes defined in the CPMP to be met. Expected to meet EPA objectives for Coastal Processes.	The CPMP has been reviewed by CGG. Future revisions of the CPMP and any other future documentation developed in relation to coastal processes will be reviewed by CGG.	Consultation with the CGG
Disturbance or fatality of conservation significant marine fauna	Regulated by Department of Biodiversity Conservation and Attractions (DBCA) under Section 40 of the *Biodiversity Conservation Act 2016* (BC Act)	No unauthorised death of marine fauna. Expected to meet EPA objectives relevant to Marine Fauna	Conditions related to the Authority under Section 40 of the BC Act	Consultation with DBCA and relevant species specialists
Social Surroundings – Heritage	Activity Notice and Decision by Yamatji Southern Regional Corporation (YSRC) and Yamatji Nation Indigenous Land Use Agreement (ILUA) under *The Native Title Act 1993* (Cth)	No impact or disturbance to sites of cultural significance. Expected to meet EPA objectives relevant to Social Surroundings	No Section 18 approval required.	Engagement with YSRC Heritage team

Environmental impact	How is the impact regulated by other decision-making process?	Likely environmental outcome and consistency with EPA objective	Conditions, enforcement, and review process	Stakeholder engagement
Terrestrial and marine environmental quality impacts related to disposal of Port-derived material	Site-specific acceptance criteria have been developed for the disposal of Port-derived materials (i.e. dredged sediments and onshore excavated soils and other materials) to designated disposal areas, including those created by PMaxP (New and Old Tug Harbour disposal areas)	Return water quality from disposal areas to be compliant with the associated level of ecological protection afforded to that area. Expected to meet EPA objectives for relevant factors.	No relevant approval under a regulatory instrument but criteria reviewed by a Contaminated Sites Auditor for assurance of acceptability.	Consultation with DWER Contaminated Sites Branch

3.2.2 Planning

The Project is located within the area of water, land and seabed depicted as the 'Port Area' on Deposit Plan 410027 Sheet 1 as described in Government Gazette No.34: Port Authorities (Description of Port of Geraldton) Order 2017 (refer **Figure 3-1**).

The Port of Geraldton is vested with MWPA under the PA Act and is recognised within the City of Greater Geraldton Local Planning Scheme No. 1 zoned as 'Strategic Infrastructure Port Industry'.

Under Part 4, Section 30 of the PA Act, the functions of a port authority include:

a) to facilitate trade within and through the port and plan for future growth and development of the port;

b) to be responsible for the safe and efficient operation of the port;

c) to be responsible for maintaining port property; and

d) to protect the environment of the port and minimise the impact of port operations on that environment.

The MWPA has Development Guidelines that apply to works being undertaken in all land and waters that are managed by MWPA within Reserve 25300, which includes:

- 83.05 hectares (ha) of land comprising the Port of Geraldton, including the main commercial harbour, Fishing Boat Harbour, and various lots south of Marine Terrace;
- 180.11 ha of coastal land at Oakajee; and
- Waters extending approximately 7.5 kilometres (km) west from a line parallel to the Point Moore Lighthouse, then approximately 36.5 km to the north (28,893 ha in total).

Although the PMaxP will not be subject to a local government Development Approval under the *Planning and Development Act 2005* (PD Act) due to the 'public works' provisions defined in the PD Act and PA Act, the PMaxP will be subject to the planning process detailed in the MWPA Development Guidelines.

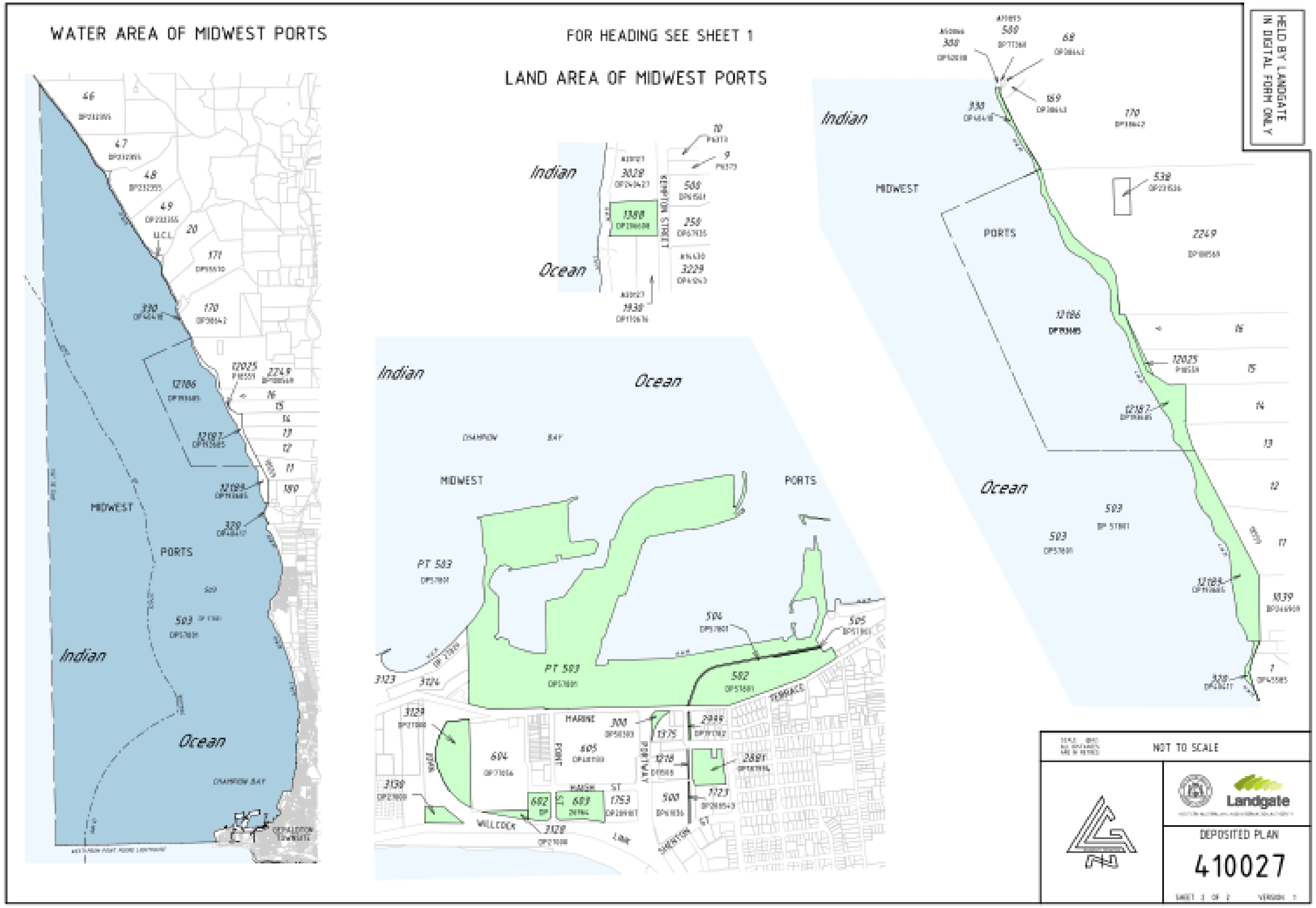


Figure 3-1 Port of Geraldton Land and Waters Extent

4.0 Stakeholder Engagement

Mid West Ports Authority (MWPA) is committed to on-going consultation throughout project development and implementation with a focus on transparent communication and the development of productive relationships with the community and key stakeholders.

Initial consultation commenced in 2022 to support preliminary project planning and has continued through the development of the PMaxP to:

- Inform MWPA's understanding of potential social impacts, risks, and associated mitigation opportunities.
- Provide clear, consistent, and timely information regarding PMaxP to support community and stakeholder understanding.
- Proactively address community queries.

A concentrated program of consultation was undertaken between August and October 2024, which included a combination of:

- Targeted stakeholder engagement with internal and external project stakeholders, including regulators.
- Consultation through existing MWPA forums including Fishing Boat Harbour, Berth User and Community Consultative Committees.
- Project briefings with key environmental, tourism, recreation, and community groups.
- Broader-reaching community information sessions.

Outcomes of this program were used to inform a Social Impact Assessment, which is further discussed in Section 11.0.

4.1 Key Stakeholders

The identified key PMaxP stakeholder groups are outlined in **Table 4-1**.

Table 4-1 PMaxP key stakeholder groups

Stakeholder group	Key stakeholders
State regulatory and approvals authorities	• Department of Biodiversity, Conservation and Attractions (DBCA) • Department of Fire and Emergency Services (DFES) • Department of Planning, Land and Heritage (DPLH) • Department of Water and Environmental Regulation (DWER) • DWER: EPA Services
State Ministers and Local Members	• Kirrilee Warr (previously Lara Dalton) – Member for Geraldton • Ronald (Shane) Love – Member for Moore, Shadow Minister for Regional Development • Reece Whitby (Minister for Energy, Environment, Climate Action). • Don Punch – Minister for Regional Development • David Michael – Minister for Mines and Petroleum; Ports; Road Safety; Minister Assisting the Minister for Transport • John Carey – Minister for Planning; Lands; Housing; Homelessness • Melissa Price – Federal Member for Durack

Stakeholder group	Key stakeholders
State government agencies and industry bodies (non-regulatory)	• Mid West Development Commission (MWDC) • Mid West Chamber of Commerce and Industry (MWCCI) • Main Roads WA (MRWA) – Geraldton • Department of Transport (DOT) • Department of Primary Industries and Regional Development (DPIRD) • Department of Jobs, Tourism, Science and Innovation (DJTSI) • Development WA • Infrastructure WA
Local government	• City of Greater Geraldton – technical officers elected members • Shire of Chapman Valley – technical officers and elected members
Traditional Owner Groups	• Yamatji Southern Regional Corporation

Internal stakeholders	• MWPA employees, contractors and volunteers
	• Geraldton Port berth users
	• MWPA reference forums and committees:
	  o Community Consultative Committee
	  o Fishing Boat Harbour Consultation forum

Community groups – environmental, tourism and marine volunteer, sporting and recreation	**Environmental:** • Chapman River Friends • Northern Agricultural Catchments Council – Natural Resource Management (NACC NRM) • Houtman Abrolhos Conservation Network • Birdlife Midwest – Geraldton • Batavia Coastcare Network **Tourism:** • Batavia Coast Dive • Eco Abrolhos • Geraldton Visitor Centre / Tourism WA **Marine volunteer, sporting, and recreation:** • Geraldton Yacht Club • Champion Bay Surf Lifesaving Club (SLC) • Mission to Seafarers • Geraldton and Districts Offshore Fishing Club • Sunset Beach Community Group • Drummonds Cove Progress Association • Geraldton Volunteer Marine Rescue • State Emergency Service (SES) • Rotary Probus

Stakeholder group	Key stakeholders
Fishing industry representatives	• Geraldton Fishing Co-op • Geraldton Professional Fisherman's Association • National Fisheries (Kalis)
Education and historical entities	• WA Shipwrecks Museum • Batavia Coast Maritime Institute (BCMI) • Durack Institute • Geraldton Universities Centre • Central Regional TAFE
General community	• Landowners and residents in proximity to Port • General community members • Local businesses and suppliers

4.2 Stakeholder Identification and Engagement Process

Communications and engagement were delivered in line with national and international best practice principles and guidelines, including:

- International Association for Public Participation (IAP2).
- AA1000SES: International Standard for Stakeholder Engagement.

A social risk assessment and community sentiment analysis was undertaken to establish a social baseline for the project and understand stakeholder values, expectations, perceptions and perceived and actual social risks. The communications and engagement approach proactively addressed identified areas of stakeholder interest and concern and ensured appropriate opportunities for education and feedback.

The key PMaxP stakeholder groups have been identified through stakeholder mapping of the local community. The level of engagement with each stakeholder group was guided by the stakeholders' level of interest in, and influence over, various facets of PMaxP. The International Association for Public Participation (IAP2)'s *Spectrum for Public Consultation* has been applied to assess and determine the appropriate level of engagement with each group, from *inform* through to *empower*.

Figure 4-1 illustrates the interest and influence matrix used to broadly categorise project stakeholders and the level of engagement required to meet expectations and manage project risk, as per the following stakeholder categories:

- **Tier 1:** High level of interest over project outcomes, where PMaxP directly impacts their interest. Engagement with Tier 1 stakeholders leveraged existing relationships and focused on regular and tailored communications and engagement touch points to ensure stakeholder feedback was adequately considered and integrated in project planning.
- **Tier 2:** High level of interest regarding specific facets of PMaxP. Touchpoints with this category were tailored to individual areas of interest and concern with some one-on-one interactions to effectively monitor and manage potential contention or issue.
- **Tier 3:** Stakeholders with a general level of interest in PMaxP and low influence.
- **Regulatory:** State and federal bodies with decision-making authority. Engagement was undertaken as per regulatory process and on an as-required basis.

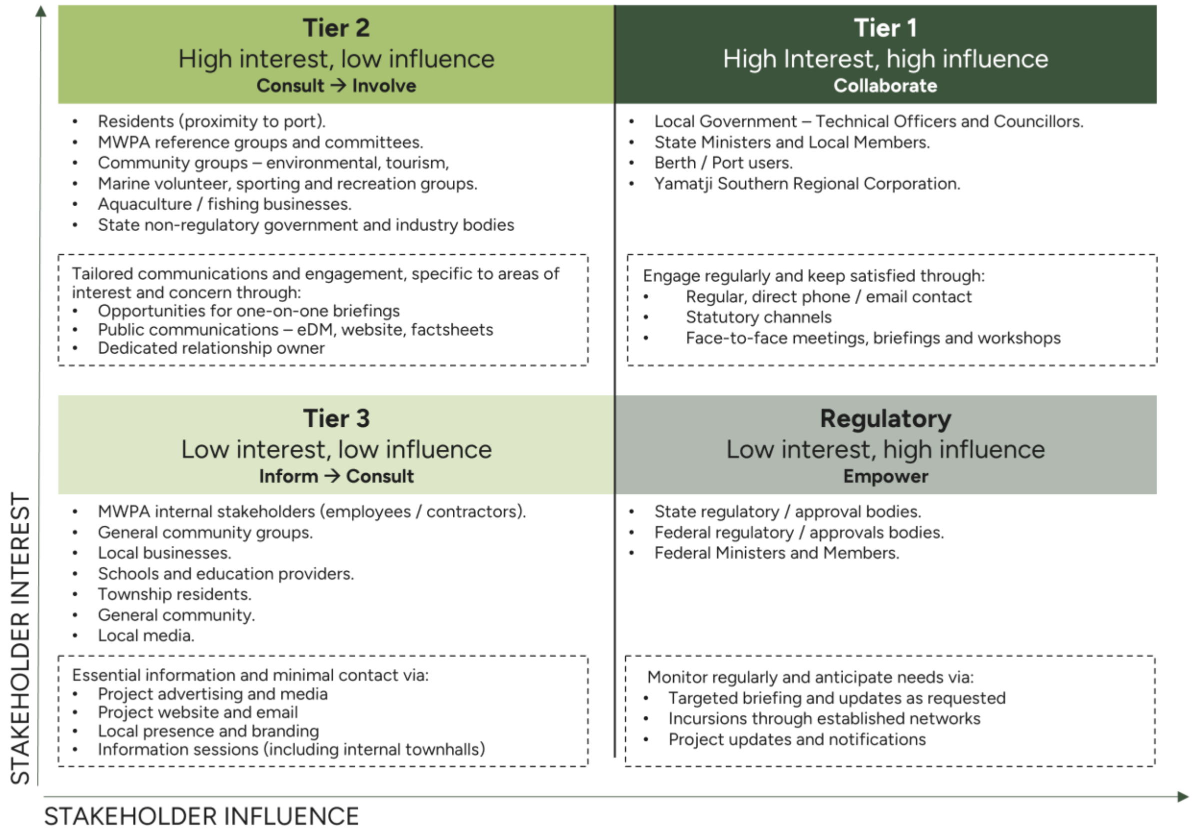


Figure 4-1 Interest and influence matrix for stakeholder prioritisation

Engagement with stakeholder groups occurs via a range of channels as outlined in **Table 4-2**.

Table 4-2 Communication and engagement tools

Tool	Description	Target stakeholder groups

Issue-specific meetings	Face-to-face or online meetings and briefings to share updates, discuss specific issues or facets of the Project and gather relevant feedback.	• Tier 1
		  ○ LGA technical officers
		  ○ YSRC
		• Tier 2
		  ○ Community groups
		  ○ Aquaculture / fishing businesses
		  ○ Traditional Owner groups

Project briefings	Formal briefings to share project updates and progress.	• Tier 1 • Tier 2 ○ State non-regulatory government and industry bodies • Regulatory

Tool	Description	Target stakeholder groups
Reference group meetings	Project briefings and issue-specific discussions within existing reference group forums to enable two-way dynamic discussion.	• Tier 2 ○ MWPA reference groups and committees

Community information sessions	Public information sessions to engage, inform, and educate the community on project-related progress, development and feedback.	• Tier 3
		  ○ General community
		  ○ Local businesses
		  ○ Township residents

Townhall events	Online and in-person information sessions to brief stakeholders on project program and progress and address queries.	• Tier 2 ○ MWPA internal stakeholders
Phone / email correspondence	Regular contact through existing relationship managers to maintain project awareness and understanding and foster productive stakeholder relationships.	• Tier 1 • Tier 2 (where appropriate) • Regulatory
Targeted letter	Personalised letter designed for targeted invitation to community information sessions. For distribution to residents / landowners in proximity to port and heavy haulage routes.	• Tier 2 ○ Impacted landowners
Enquiries email and phone line	Existing MWPA enquiries email and phone contact to provide stakeholders clear enquiries and escalation pathways.	All
Communications collateral	Digital and print materials to support engagement activities including posters, presentation decks and branded electronic direct mail (eDMs).	All
Public information pack	PDF and print information pack to build project understanding and awareness. To be supplemented with factsheets and frequently asked questions (FAQs), as required.	All
Fact sheets	Fact sheets to address specific concerns or anticipated areas of interest including construction, environment and project timeframes. PDF and print.	• Tier 2 • Tier 3
FAQs and key messages	Addresses key areas of interest and concern raised by stakeholders. Accessible via project webpage. Ensures a consistent approach to communications to minimise confusion / misinformation.	All

Tool	Description	Target stakeholder groups
Project visualisations	Site specific animations and visualisations that promote project understanding and enable constructive discussions surrounding infrastructure requirements and impacts.	All
Electronic direct mail campaigns	Bulk emails to key stakeholders to share project information and updates. Allows stakeholders to remain informed to minimise potential for misinformation. Provides opportunity to encourage eDM subscription.	• Tier 2 • Tier 3
Website	Project-specific webpage within existing MWPA website with key project information and updates, links to relevant FAQs and fact sheets and contact details	All
Social media	Promotion of key project information, webpage updates and engagement activities through MWPA existing social media channels.	• Tier 2 • Tier 3
Online and print adverts	Advertisements in local newspapers and key digital platforms to promote engagement activities.	Tier 3
Third party social media platforms	Distribution of project information via third-party Facebook pages and channels (e.g., community Facebook groups, local government area (LGA) channels).	Tier 3

4.3 Stakeholder Consultation Outcomes

Consultation with the community and stakeholders that have supported the project's concept design development is summarised in **Table 4-3**. The outcomes of the consultation have been used to inform the design, where possible.

Table 4-3 Summary of Stakeholder Engagement

Stakeholder	Date	Issues / topics covered	Overview / outcome
DWER, EPAS	24 October 2023	Site visit to present high-level PMaxP detail and familiarise regulators with the Port.	Site visit was well-received with some insightful discussions to inform future studies and expectations of a referral.
EPAS, DWER: Marine Ecosystems Branch	15 February 2024	Scope of the benthic communities and habitats (BCH) survey was presented and discussed with relevant parties. Key queries were timing and extent of the survey.	BCH survey was completed in the summary period and extended beyond the PMaxP footprint and adjacent areas throughout Champion Bay to ensure contemporary data is used for EIA.

Stakeholder	Date	Issues / topics covered	Overview / outcome
MWPA Community Consultative Committee	Dec-23 Feb-24 May-24 Aug-24	Overview of PMaxP provided and general queries related to sea lions, fuel storage, roadworks, existing infrastructure (workshop), cruise ships.	General support and no immediate concerns raised in any of the meetings.
DWER: EPAS	18 June 2024	Pre-referral meeting to present the PMaxP detail, key factors, studies and investigations that are being progressed to inform the EIA, and approvals process and timeframe.	Confirmation of scope and extent of studies and adequacy to inform the EIA. Follow-up discussion and agreement on early submission of the referral prior to completion of all technical studies; outcomes to be presented through the formal assessment process.
City of Greater Geraldton (CGG)	10 July 2024	PMaxP budget, scope, design and surge mitigation, EIA overview, dredge method. PMaxP specific queries were limited to supply of rock for new breakwater, trucking movements, and perceived harmful product (ammonia).	MWPA confirmed that rock supplier discussions have progressed and there is no change to products, nor trucking movements, at the Port because of PMaxP. Recommendation to present update to CGG Concept Forum (undertaken on 6 August 2024).
DCCEEW	24 July 2024	Pre-referral meeting to present the PMaxP detail, key factors, studies and investigations that are being progressed to inform the EIA, and approvals process and timeframe.	Confirmation of scope and extent of studies and adequacy to inform the MNES assessment. Discussions on ensuring that construction and operational impacts are considered, and controls are clearly presented.
CGG Concept Forum	6 August 2024	PMaxP overview presented to members of the forum as request by CGG at the 10 July 2024 meeting.	No specific concerns or queries were raised.
Fishing Boat Harbour	15 August 2024	Overview of PMaxP presented to members of the Fishing Boat Harbour.	Concerns raised on protection of sea lions and impacts of the new breakwater on sand movement. Commentary provided to the group around sediment transport modelling to inform sand movement and proposed management and mitigation to protect fauna.
MWPA employees and contractors	Various July to October 2024	In-person and online townhalls provided a platform to update on PMaxP progress.	Queries raised regarding any impacts to ongoing operations; confirmed minimal disturbance.
Media and Government representatives	Various July to October 2024	Port tours for wider operations where PMaxP was discussed to build awareness.	No issues raised.

Stakeholder	Date	Issues / topics covered	Overview / outcome
Community information sessions	19 September 2024 9 October 2024	Two community drop-in sessions were held to provide an opportunity to learn about PMaxP and ask questions of the Project and wider Port team in attendance.	Consensus was general acceptance of the PMaxP as necessary Port progress. Discussions focused on protection of fauna, particularly Australian Sea Lion and avifauna species.

The information gathered through the extensive consultation was used to inform the PMaxP Social Surroundings Study. The consultation undertaken with technical specialists at DWER and DBCA informed the development of the management and mitigation measures in the environmental management plans but did not require any fundamental changes to the proposal design or implementation.

Consultation will continue throughout the PMaxP delivery.

4.3.1 Aboriginal Heritage Consultation

MWPA has undertaken extensive consultation with Yamatji Southern Regional Corporation (YSRC), the regional corporation established to manage the benefits and actions under the Yamatji Nation Indigenous Land Use Agreement (ILUA). To date, MWPA has presented to the YSRC Board and met with the YSRC Heritage Manager and YSRC Heritage Coordinator to determine the scope of consultation needed to meet YSRC requirements.

In line with the requirements of the Yamatji Nation ILUA, MWPA prepared and submitted an activity notice for YRSC review and consideration. The YSRC decision on the Activity Notice confirmed no need for further heritage surveys or management plans, nor the requirement for an approval under Section 18 of the *Aboriginal Heritage Act 1972*.

MWPA is committed to ongoing consultation and collaboration with Yamatji people through engagement with YSRC.

5.0 Object and Principles of the EP Act

The Object of the EP Act is to protect the environment of the State, having regard to the five principles summarised in **Table 5-1**.

Table 5-1 Object and Principles of the EP Act

Principle	Consideration
1. The precautionary principle	Several technical studies have been completed to inform the impact assessment of the Proposal, including: • benthic communities and habitat mapping • marine (hydrodynamic, plume dispersion and sediment transport) modelling • water, sediment and soil quality investigations • underwater and terrestrial acoustic modelling • air quality monitoring and modelling • greenhouse gas emissions assessment • landscape visual impact assessment Potential impacts have been identified and described under the relevant key environmental factor (see Section 6.0). Technical management plans, informed by these studies, detail mitigation and management measures to ensure impacts are environmentally acceptable.
2. The principle of intergenerational equity	MWPA will ensure the health, diversity and productivity of the environment is maintained through the application of the mitigation hierarchy and minimising the environmental impacts during the implementation of the Proposal.
3. Principles relating to improved valuation, prices and incentive mechanisms	MWPA understands that environmental factors should be included in the valuation of assets and services and acknowledges that the cost of the Proposal should include environmental impact mitigation, management and maintenance activities. These requirements will be considered during the overall costing of the Proposal.
4. The principle of the conservation of biological diversity and ecological integrity	Throughout the design phases of the PMaxP, the conservation of biological diversity and ecological integrity has been a fundamental consideration, including: • reducing the direct disturbance footprint to conserve benthic communities, and • revising the dredge methodology to minimise impacts to water quality.
5. The principle of waste minimisation	MWPA has a sustainability framework aligned with the Ports Australia Sustainability Guidelines and the United Nations Sustainable Development Global Goals (UNSDGG). MWPA considers that all reasonable and practicable measures to minimise the generation of waste and its discharge to the environment will be taken. Where possible, the PMaxP design has included measures for beneficial reuse of dredged material for land reclamation and to create land-backed wharfs.

Principle	Consideration
6. Description of how the object of the EP Act has been considered:	
The object of the EP Act is ‘to protect the environment of the State’.	
MWPA has sought to avoid and minimise the potential impacts to key environmental factors through implementation of mitigation and adaptive management controls. With the successful implementation of proposed mitigation strategies and management controls, the MWPA considers the implementation of the PMaxP will be environmentally acceptable.	

6.0 Environmental Factors

Environmental factors are those parts of the environment that may be impacted by an aspect of a proposal. The EPA has 14 environmental factors, organised into five themes: Sea, Land, Water, Air and People. **Table 6-1** details the relevance of the environmental factors to the Proposal.

Table 6-1 Relevant Factor Assessment

Factor	Objective	Relevance to Proposal	
Sea			
Benthic Communities and Habitats (BCH)	To protect benthic communities and habitats so that biological diversity and ecological integrity are maintained.	The proposal will involve the direct loss and potentially indirect, albeit likely reversible impact, of BCH.	Key
Coastal Processes	To maintain the geophysical processes that shape coastal morphology so that the environmental values of the coast are protected.	Construction of the rock revetment related to the new tug harbour, may alter wave dynamics in the Port and adjacent areas and longshore sediment transport along the Geraldton coastline.	Key
Marine Environmental Quality (MEQ)	To maintain the quality of water, sediment and biota so that environmental values are protected.	Construction requires dredging which is likely to temporarily increase localised turbidity and mobilise contaminants via sediment disturbance.	Key
Marine Fauna	To protect marine fauna so that biological diversity and ecological integrity are maintained.	Conservation significant marine fauna are known to be present within the Development Envelope and will require considered management.	Key
Land			
Flora and Vegetation	To protect flora and vegetation so that biological diversity and ecological integrity are maintained.	There is no clearing of flora or vegetation associated with the implementation of the PMaxP.	NA
Landforms	To maintain the variety and integrity of significant physical landforms so that environmental values are protected.	There are no significant or local landforms located within the Development Envelope.	NA
Subterranean Fauna	To protect subterranean fauna so that biological diversity and ecological integrity are maintained.	There is no dewatering associated with the Proposal.	NA
Terrestrial Environmental Quality	To maintain the quality of land and soils so that environmental values are protected.	The PMaxP involves the reuse of dredged and excavated materials for land reclamation at various locations within the Proposal Footprint.	Other
Terrestrial Fauna	To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.	There is no clearing of terrestrial fauna habitat.	NA

Factor	Objective	Relevance to Proposal	
Water			
Inland Waters	To maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected.	The Development Envelope does not include any watercourses and is not located within a Public Drinking Water Source Area. There is no dewatering or interaction with groundwater associated with the Proposal.	NA
Air			
Air Quality	To maintain air quality and minimise emissions so that environmental values are protected.	Potential increases in air emissions during construction.	Other
Greenhouse Gas	To reduce net greenhouse gas emissions in order to minimise the risk of environmental harm associated with climate change	Potential increases in GHG emissions during construction and potential for decrease in GHG emissions during ongoing operations resulting from facility optimisation.	Other
People			
Social Surroundings	To protect social surroundings from significant harm.	Potential changes to the visual amenity from some vantage points or recreational uses of the area. Temporary interference with marine recreational and commercial activities.	Other
Human Health	To protect human health from significant harm.	No changes to products proposed as part of the implementation of PMaxP and no hazardous substances or dangerous goods proposed for export via Berth 1, being the closest proximity to sensitive receptors.	NA

The proceeding sections provide the detailed EIA for each of the key factors and an overview of the considerations afforded to the other factors.

Matters of national environmental significance (MNES) are identified where relevant within each factor discussion and summarised in Section 11.1.

7.0 Impact Assessment – Marine Environmental Quality

7.1 Policy and Guidance

The documentation utilised to inform the assessment of this factor includes:

- Environmental Factor Guideline: Marine Environmental Quality (EPA 2016a)
- Technical Guidance: Protecting the Quality of Western Australia's Marine Environment (EPA 2016b)
- Technical Guidance: Environmental impact assessment of marine dredging proposals (EPA 2021)

The environmental objective for this factor is *to maintain the quality of water, sediment and biota so that environmental values are protected,* where 'environmental value' is defined under the EP Act as *a beneficial use or an ecosystem health condition*.

A set of five environmental values that require protection from the effects of pollution, discharges and deposits in marine environments, agreed by all Australian state and territory governments through the National Water Quality Management Strategy (NWQMS), are:

- Ecosystem health
- Fishing and aquaculture
- Recreation and aesthetics
- Industrial water supply
- Cultural and spiritual.

7.2 Receiving Environment

Champion Bay is a highly dynamic environment that is exposed to strong storm swell from the western quarter in winter and strong southerly winds in spring and summer producing northerly longshore currents, and lighter winds in autumn. The bay is also affected by marine heat waves on occasion, rare cyclones and occasional river outflows. Studies of marine environmental quality that are relevant to the PMaxP are identified in **Table 7-1**.

Table 7-1 Marine Environmental Quality – Studies

Author (date)	Study
MWPA database	Marine water quality sampling results database, internal resource
URS (2001a)	Port Enhancement Project and Preparatory Works for Town Beach Foreshore Redevelopment – Public Environment Review
Oceanica (2010a)	Geraldton Port—Channel Maintenance Dredging – Dredging Environmental Impact Assessment
GPA (2013a)	2012 Maintenance Dredge Project – Environmental Water Quality Monitoring Report
GPA (2013b)	2012 Maintenance Dredge Project – Environmental Monitoring Report
Coffey (2015)	Geraldton Port Detailed Site Investigation
Coffey (2017)	Geraldton Port Groundwater Risk Assessment
O2 Marine (O2M) (2020)	Geraldton Port Tug Harbour Sediment Assessment
O2M (2022c)	Geraldton Fishing Boat Harbour Preliminary Site Assessment – Sediment Quality

Author (date)	Study
O2M (2022d)	Geraldton Fishing Boat Harbour Maintenance dredge 2022 EIA
O2M (2022e)	MWPA Tourist Jetty Sediment Quality Sampling Summary Report
SLR (2024)	PMaxP Capital and Maintenance Dredge Sediment Quality Investigation Summary Report
O2M (2024)	MWPA Marine Environmental Monitoring & Management Plan (MEMMP) - implementation ongoing
SLR (2025)	PMaxP Berth 6 Material Characterisation Summary Report

7.2.1 Environmental Quality Plan

MWPA has developed and are currently implementing a Marine Environmental Monitoring and Management Plan (MEMMP) consistent with the EPA's Technical Guidance for Protecting the Quality of Western Australia's Marine Environment (EPA 2016b), which defines the Environmental Values (EVs), Environmental Quality Objectives (EQOs) and spatial Levels of Ecological Protection (LEPs) that are appropriate to the Port of Geraldton and adjacent Champion Bay. The comprehensive dataset obtained from this scope will be utilised in the development of the marine water quality monitoring plan that is to be implemented during the construction phase of the PMaxP.

In addition, MWPA has been implementing a passive marine water quality monitoring program and as a prescribed premise is required to conduct annual compliance sediment sampling in accordance with the Port of Geraldton Licence (L4275/1982/15). These programs allow MWPA to monitor and manage potential impacts to marine environmental quality which may arise from Port and Fishing Boat Harbour (FBH) operations.

7.2.2 Water Clarity

Water clarity in Champion Bay is variable throughout the year due to varying strengths of the wind driven currents and wave energy, as well as intermittent rainfall runoff from the Greenough and Chapman Rivers that drain the hinterland catchments. Typically, the lowest water clarity occurs during winter with higher energy swells mobilising sediments and intermittent discharge of alluvial sediments from the rivers. Strong winds during summer create waves that cause an increase in suspended particulate matter which may also reduce water clarity. The period of greatest water clarity on the mid-west coast is usually in late summer to autumn (February to May) and occurs in response to reduced wind strengths and wave energy and absence of riverine sediment input (O2M 2023).

Turbidity within Champion Bay typically increases closer to shore, mostly because of wave action that lifts sands and silt-sized particles into the water column (URS 2001a). During spring and summer there is often a marked diurnal effect, with the increased wave action generated by the strong mid-morning to evening sea breezes increasing coastal turbidity compared to the early morning and dawn calms. During autumn and winter, turbidity and cloudiness (discolouration) is also often elevated in the inner half of Champion Bay, a period when fine organic material from the nearshore and shoreline wracks of decaying seaweed and seagrass is suspended and dispersed through the nearshore water column. Apart from the natural sources and cycles of turbidity, propeller wash from ship and tug movements along the inner sector of the entrance channel also contributes to turbidity. Marked variations in turbidity therefore occur within hourly, daily, weather-system and seasonal time cycles, as well as with depth. During periods of warmer water, when swell and wind conditions result in very calm sea surface condition, temporary blooms of *Trichodesmium*, a filamentous cyanobacteria, may occur within Champion Bay. These blooms typically dissipate quickly when wind or sea state become more unsettled and are considered natural events, however they may have short duration impacts upon water quality during periods of extended blooms (O2M 2023).

Continuous monitoring of turbidity (NTU) is ongoing at the following three sites within Champion Bay (**Figure 7-1**):

- LL1
- LL3
- LL4.

It is considered that the 2024 continuous turbidity monitoring dataset from these sites LL1, LL3 and LL4 within Champion Bay adequately describe baseline conditions (RHDHV 2025 - Port of Geraldton PMaxP Baseline Turbidity/ TSS Data Review – Version 3). It is noted that monitoring equipment at LL3 was deployed on its side and processed erroneous readings with higher-than-expected turbidity up until redeployment on 07 September 2024. As such, only data from the date of redeployment is considered accurate to describe the conditions at this location (RHDHV 2025 - Port of Geraldton PMaxP Baseline Turbidity/ TSS Data Review – Version 3).

Timeseries analysis of turbidity measurements at these locations between June and November 2024 indicated that:

- Each site experienced substantial pulses of higher turbidity with the greatest variance in turbidity measurements occurring at LL1 (**Figure 7-2**, **Figure 7-3**, and **Figure 7-4**)
- At LL1:
  - The maximum turbidity recorded was 148 NTU
  - Turbidity was highly variable throughout the monitoring period
  - Periods of increased turbidity typically last multiple days
  - Between periods of elevated turbidity measurements returned to less than 5 NTU
  - Elevated periods of higher turbidity occur every five to seven days
  - Between September and November few episodes of high turbidity were recorded
- At LL3:
  - The maximum turbidity recorded was 83 NTU
  - Periods of increased turbidity typically lasted multiple days
  - Between periods of elevated turbidity measurements returned to less than 5 NTU
  - Elevated periods of higher turbidity occur every five to seven days
  - Between September and November few episodes of high turbidity were recorded compared to between August and September.
- At LL4:
  - The maximum turbidity recorded was 82 NTU
  - Periods of increased turbidity typically lasted multiple days
  - Between periods of elevated turbidity measurements returned to less than 5 NTU

- The turbidity during elevated periods was typically lower than that recorded at LL1 and LL3
- Elevated periods of higher turbidity occur every two to three days
- The frequency of higher turbidity episodes was greater between June and August compared to between August and November although the intensity of higher turbidity episodes was similar between these two time periods.

Analysis indicates that the episodes of higher turbidity are not related to tidal currents (RHDHV 2025 - Port of Geraldton PMaxP Baseline Turbidity/ TSS Data Review – Version 3). Episodes of higher turbidity at LL1 and LL3 are likely associated with significant wave heights and increased wind speeds. At LL4, higher turbidity is not considered to be as influenced by waves and wind as LL1 and LL3 rather it is likely associated with particular direction of the prevailing sea and swell conditions (RHDHV 2025 - Port of Geraldton PMaxP Baseline Turbidity/ TSS Data Review – Version 3).

A summary of the turbidity measurements recorded at LL1, LL3 and LL4 during 2024 is presented in **Table 7-2**. This summary of measurements shows:

- The median Suspended Sediment Concentration (SSC) at each site is typically low between 0.8 mg/L and 2.1 mg/L
- At LL1:
  - The minimum SSC was 0.1 mg/L
  - The maximum SSC was 149 mg/L
  - The 20th and 80th percentile of SSC range between 0.2 mg/L and 8.9 mg/L respectively
  - The 95th and 99th percentile of SSC range between 16.7 mg/L and 49.1 mg/L respectively.
- At LL3
  - The minimum SSC was 0.1 mg/L
  - The maximum SSC was 75.9 mg/L
  - The 20th and 80th percentile of SSC range between 0.3 mg/L and 1.1 mg/L respectively
  - The 95th and 99th percentile of SSC range between 2.9 mg/L and 12 mg/L respectively.
- At LL4
  - The minimum SSC was 0.1 mg/L
  - The maximum SSC was 58.6 mg/L
  - The 20th and 80th percentile of SSC range between 0.4 mg/L and 5.1 mg/L respectively
  - The 95th and 99th percentile of SSC range between 16.5 mg/L and 31.4 mg/L respectively.

The results of the monitoring program at LL1 and LL3 between June and November 2024 are similar to those recorded by BMT (2021).

0 50 100 200 m

Scale: 1:15,000 at A4
Coordinate System: GDA2020 MGA Zone 50

Date Drawn: 17-Apr-2025
Project Number: 675.072500

Data Source:
ESRI

SLR

LOCATION OF TURBIDITY MONITORING SITES PROXIMAL TO GERALDTON PORT

FIGURE 7-1

\\AU.SLR.Local\Corporate\Projects-SLR\675-PER\675-PER\675.072500.00001 MWPA PMaxP - Marine\06 SLR Data\01 CADGIS\GIS\640_30470_F052_TurbidityMonitoringSites.mxd

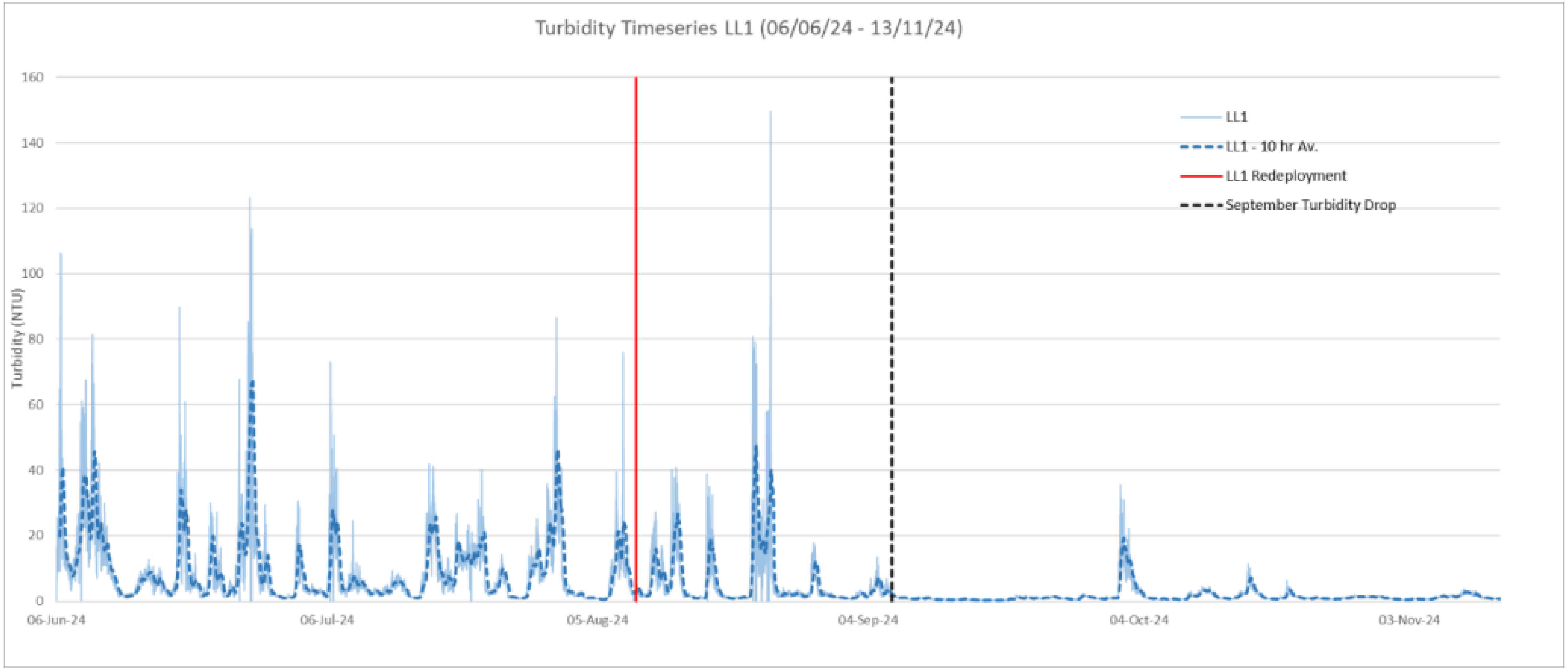


Figure 7-2 Timeseries measurements of turbidity (NTU) at site LL1 between June and November 2024

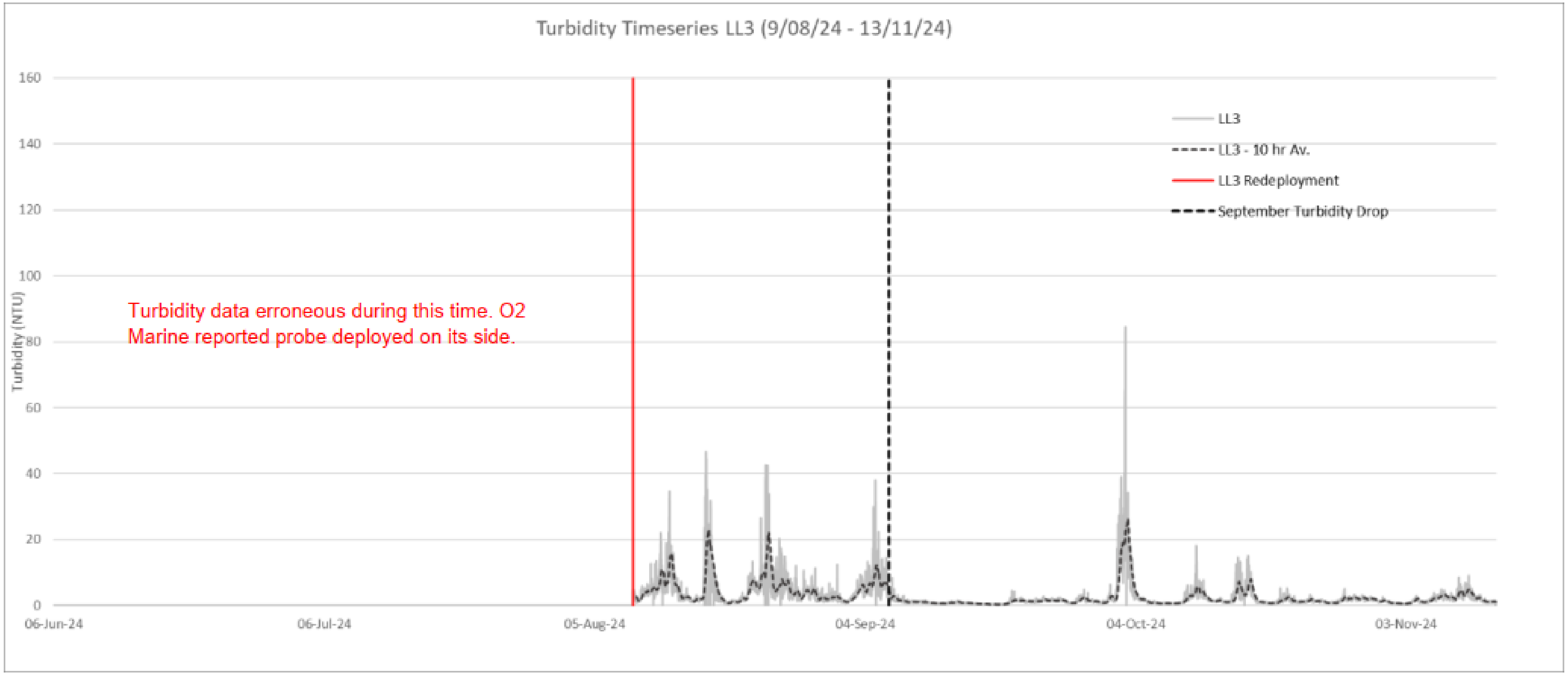


Figure 7-3 Timeseries measurements of turbidity (NTU) at site LL3 between June and November 2024

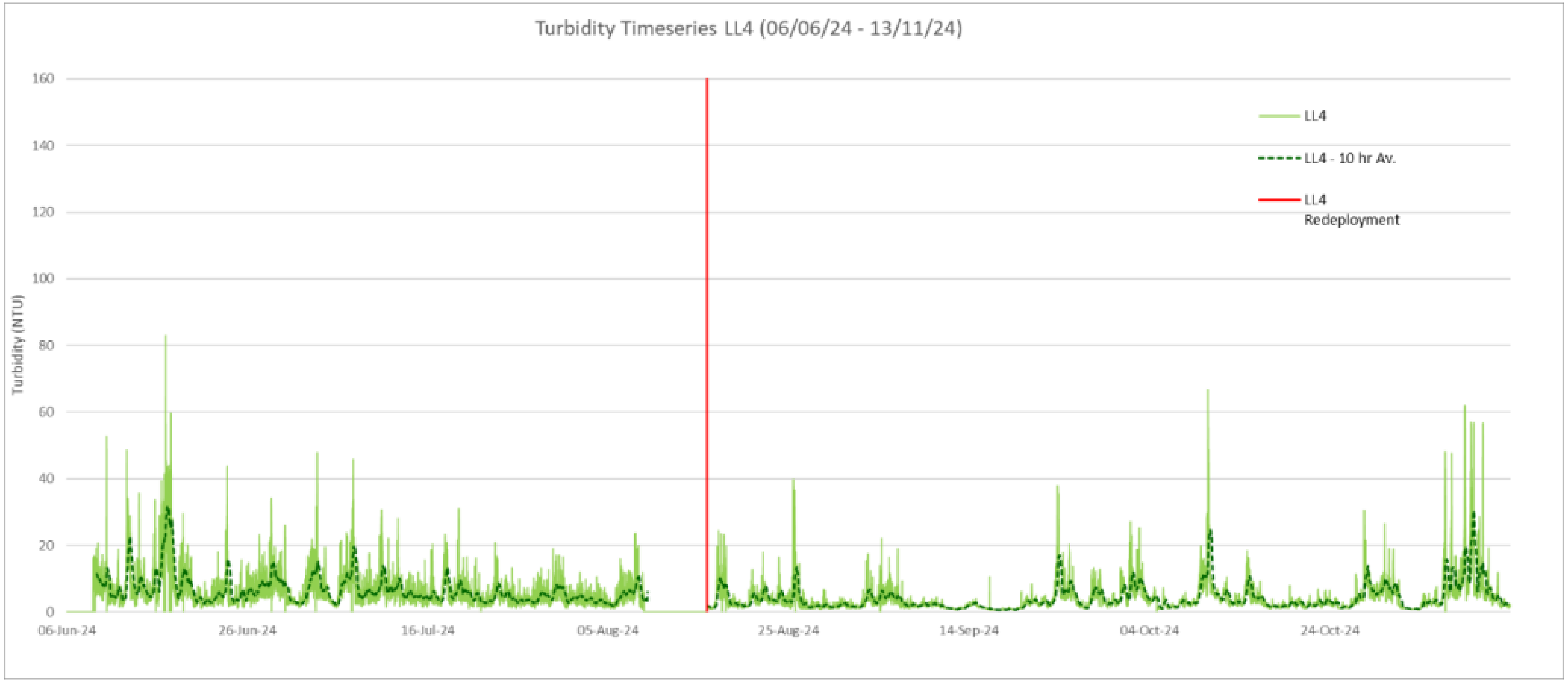


Figure 7-4 Timeseries measurements of turbidity (NTU) at site LL4 between June and November 2024

Table 7-2 Summary statistics of turbidity measurements at LL1, LL3, and LL4

	LL1 Full Dataset		LL1 Pre-September Turbidity Drop		LL1 Post-September Turbidity Drop		LL3 Post-September Turbidity Drop		LL4 Full Dataset	
Data range (2024)	*6 June - 13 November*		*6 June - 6 September*		*7 September - 13 November*		*7 September - 13 November*		*9 June - 13 November*	
Unit / Statistic	*Turb (NTU)*	*TSS (mg/L)*	*Turb (NTU)*	*TSS (mg/L)*	*Turb (NTU)*	*TSS (mg/L)*	*Turb (NTU)*	*TSS (mg/L)*	*Turb (NTU)*	*TSS (mg/L)*
Mean	5.5	3.1	8.5	5.2	1.4	0.7	2.0	1.0	5.2	3.2
Median	1.8	0.8	3.9	2.1	0.9	0.4	1.3	0.6	3.6	0.9
SD	9.4	5.9	11.4	7.3	2.2	1.1	3.2	1.7	5.3	5.1
Max.	149.3	149.0	149.3	149.0	35.5	27.8	83.8	75.9	82.1	58.6
Min.	0.2	0.1	0.4	0.2	0.2	0.1	0.3	0.1	0.5	0.1
1st Percentile	0.3	0.1	0.7	0.3	0.3	0.1	0.3	0.1	0.7	0.1
5th Percentile	0.5	0.2	0.9	0.4	0.4	0.1	0.5	0.2	1.1	0.2
10th Percentile	0.6	0.3	1.1	0.5	0.5	0.2	0.7	0.3	1.4	0.3
20th Percentile	0.8	0.3	1.5	0.7	0.6	0.2	0.8	0.3	1.9	0.4
30th Percentile	1.1	0.5	2.1	1.0	0.7	0.3	0.9	0.4	2.4	0.5
40th Percentile	1.3	0.6	2.8	1.4	0.8	0.3	1.1	0.5	2.9	0.6
50th Percentile	1.8	0.8	3.9	2.1	0.9	0.4	1.3	0.6	3.6	0.9
60th Percentile	2.6	1.3	5.9	3.4	1.1	0.5	1.5	0.7	4.4	1.4
70th Percentile	4.1	2.2	8.8	5.5	1.3	0.6	1.8	0.9	5.5	2.6
80th Percentile	7.8	4.7	13.4	8.9	1.5	0.7	2.3	1.1	7.1	5.1
90th Percentile	15.2	10.3	21.4	15.3	2.4	1.2	3.3	1.7	10.2	11.2
95th Percentile	22.9	16.7	29.5	22.4	3.5	1.8	5.2	2.9	14.3	16.5
99th Percentile	48.7	40.2	57.8	49.1	12.7	8.4	17.3	12.0	27.9	31.4

*TSS concentrations have been determined using the laboratory-based turbidity/ TSS relationship developed for a surface sediment sample obtained within the Port of Geraldton

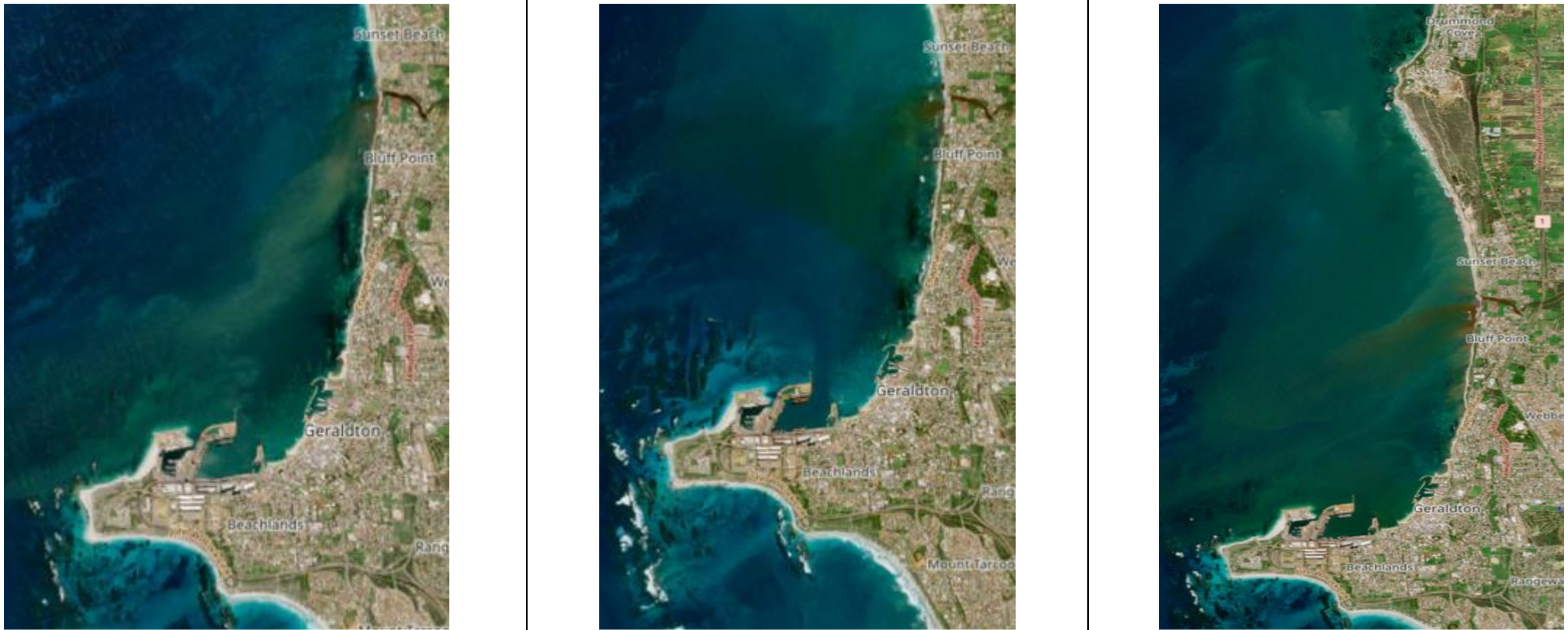
7.2.2.1 Chapman River and Champion Bay

The Chapman River is situated northeast of Geraldton with its headwaters on the Victoria Plateau, east of Northampton. Most of the Chapman River 1,160 km^2 catchment consists of cleared agricultural land which can result in high concentrations of nitrogen, phosphorus and chlorophyll-a within the river which has resulted in the eutrophication of the lower reaches.

The mouth of the Chapman River is usually closed by the formation of a sandbar. High flow events open the mouth of the river until flow recedes when a sandbar reforms. During periods where the Chapman River is open to the sea high concentrations of suspended sediments can be mobilised into Champion Bay. Based on a review of satellite imagery, the river is typically hydraulically connected to Champion Bay every two to three years. Confirmed recent breakthrough events occurred in 2019, 2021, and 2024.

During periods when the Chapman River is discharging into Champion Bay the area influenced by suspended sediment concentrations higher than ambient conditions can be extensive and at times cover large areas within the nearshore and offshore areas (see **Figure 7-5**). On 8 August 2019 turbid water from the Chapman River was observed extending westward of the Port with the plume remaining relatively close to the nearshore area. On 17 August 2021 the turbid water from the Chapman River was observed to head generally in a westerly direction from the discharge point without extending to the area in the vicinity of the Port. On 26 August 2024 the turbid water from the Chapman River was observed to cover most of Champion Bay extending westward of the Port and northward past Glenfield Beach (**Figure 7-5**). During periods of discharge from the Chapman River plumes of turbid water can remain visually discernible for durations of more than three weeks. These periods of higher suspended sediment concentrations during river discharge periods have not been linked to any reported changes in benthic community or habitats or other widespread impacts to the receiving environment.

In 2021, the extent of the area influenced by the Chapman River discharges was orders of magnitude greater than that influenced by Port maintenance dredging activities **Figure 7-6**. During the entirety of the 2021 maintenance dredge operations the plume was primarily confined to waters within and adjacent to the Port.



8 August 2019	17 August 2021	26 August 2024

Figure 7-5 Chapman River breakthrough events in Champion Bay (2019-2024)[1]

[1] Source: Copernicus Browser - https://browser.dataspace.copernicus.eu/?zoom=5&lat=50.16282&lng=20.78613&demSource3D=%22MAPZEN%22&cloudCoverage=30&dateMode=SINGLE

	
17 August 2021 (Chapman River)	**31 October 2021 (Port maintenance dredge)**

Figure 7-6 Comparison of the spatial extent of Chapman River breakthrough plume and Port maintenance dredging in 2021

7.2.2.2 Light environment

The light environment throughout the water column within Champion Bay is influenced by numerous factors including but not limited to turbidity, wind speed, sea state, and atmospheric characteristics. Fluctuations in light levels and particularly photosynthetically active radiation (PAR) recorded as instantaneous irradiance (μmol m^{-2} s^{-1}) in the spectral range of 400–700 nanometres can influence the productivity and viability of photosynthetic organisms and community such as seagrass meadows.

In-situ light loggers were deployed at three locations in Champion Bay in June 2024 as part of the MEMMP (O2M 2024) implementation and baseline data collection for PMaxP (refer **Figure 7-1** for logger locations).

Analysis of benthic PAR data collected between June 2024 and March 2025 indicated that the calculated daily light integral (DLI) is variable at various temporal and spatial scales (**Figure 7-7**). Collection of in-situ data at these locations continues and the interim data presented herein will form part of the PMaxP baseline data set used for the monitoring and assessment of potential impacts from dredging.

Generally, it was considered that reductions in light availability was likely caused by natural strong weather conditions (winds and sea state) that re-suspended sediment into the water column, which caused an increase in turbidity at that same time. Throughout the monitoring period there were times when PAR (and hence DLI) was substantially lower compared to typical measurements for several days at a time.

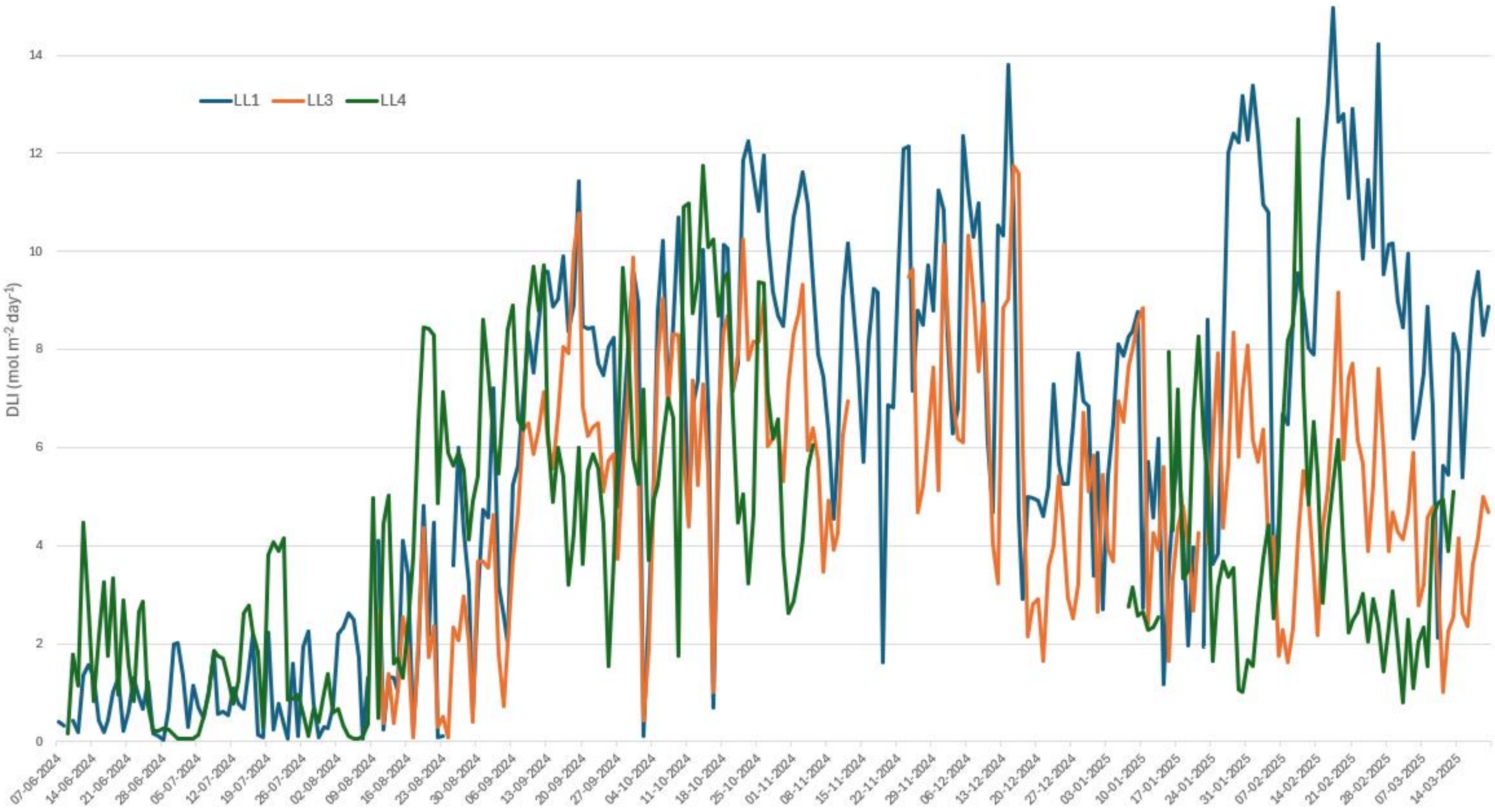


Figure 7-7 Daily Light Integral (June 2024 – March 2025) at three locations within Champion Bay

7.2.3 Chemical

A water quality monitoring program was implemented during the 2021 Port maintenance dredging campaign to assess water quality within the low, moderate and high ecological protection areas (LEPA, MEPA, HEPA) of the Port and adjacent waters. The sampling involved the collection and laboratory analysis of metals, tributyltin (TBT), hydrocarbons, nutrients, and total suspended solids. Results indicate that background concentrations of copper and zinc exceed the HEPA-adopted 99% species protection level (SPL), but all other analytes were either reported at low levels or below the limit of reporting (LOR) of the laboratory (O2M 2023).

A more comprehensive water quality dataset is being developed through the implementation of the MWPA MEMMP (O2M 2024) and will be used to establish site-specific criteria for the purpose of monitoring and assessment during the PMaxP.

The return water discharge point related to the existing Berth 7 reclamation and disposal area is monitored for toxicants as part of the implementation of the MWPA operational MEMMP. To date, this monitoring has confirmed that the disposal of material and resultant return water discharge has not had an adverse impact on the marine environment.

7.2.4 Sediment Quality

PMaxP specific sediment quality investigations were completed by SLR (2024, Appendix B). Contaminants of Potential Concern (COPC) were identified through a preliminary site investigation aligned review of previous investigations and identified potential sources. The primary COPC were identified as metals and hydrocarbons. Per- and polyfluoroalkyl substances (PFAS) was considered in the preliminary assessment but given there is no known source, groundwater bores closest to the Port are below criteria, and routine water quality monitoring in the Port harbour is compliant with criteria, PFAS was not deemed a COPC and hence was not included in the analytical suite for sediments.

This investigation reported elevated metals concentrations of COPC at most sites within the Port, with sporadic exceedances of the Australian and New Zealand default guideline values (DGV; ANZG 2018) for copper and zinc reported within the B1 and B6 locations. However, when assessed for bioavailability using the dilute acid extraction (DAE) method in accordance with the National Assessment Guidelines for Dredging (NAGD; CA 2009), the results indicated that the metals were not bioavailable at concentrations exceeding the DGV (ANZG 2018). All samples within the B8/9 and New Tug Harbour areas were compliant with the metals DGV and there were no exceedances of the GV-high (ANZG 2018) criteria at any location.

Two exceedances of the DGV (ANZG 2018) were reported for tributyltin (TBT), however elutriate analysis indicated that the bioavailable fraction of TBT was compliant with the 95% species protection level (SPL) for slightly to moderately disturbed marine ecosystems designated to port areas (ANZG 2018) for all samples. It is also considered that the release of dredge return water into the harbour would be sufficiently diluted at the entrance to Champion Bay to meet the assigned 99% SPL high ecological value.

All COPC were compliant with the industrial environmental and health investigation levels defined by the National Environment Protection (Assessment of Site Contamination) Measure (NEPM; NEPC 2013), which were considered for onshore disposal in accordance with the Assessment and management of contaminated sites (DWER 2021).

These results were consistent with previous investigations within the Port that reported the concentration of COPC in sediments at various locations exceeded the adopted criteria, however upon further analysis concluded that these were unlikely to be bioavailable to organisms (O2M 2020).

7.2.5 Other Materials

The PMaxP B6 extension requires the capital dredging (removal) of ~98,000 m^3 of material (mix of soils, rock armour, and sediments). A portion of this volume will be removed by excavation from the onshore northern reclaim area, of which it is expected that up to 5,000 m^3 would be soil, with the remaining volume rock. The B6 material is proposed for reuse within the Port, likely within the proposed OTH material disposal area.

A material characterisation and waste classification study was undertaken for the Berth 6 material. Due to the potential impacts to the marine environment following disposal, assessment of this material has been considered under the MEQ key factor. The primary aim of the investigation (SLR 2025; Appendix C) was to determine the suitability of the soils for beneficial reuse in the OTH material disposal area.

The investigation involved mechanically advancing five (5) soil bores at judgemental locations across B6 and selective sampling and analysis of COPC to adequately characterise and classify the soils for suitability for beneficial onsite reuse as reclamation material, or as a secondary measure and depending on material quality, for offsite disposal.

There were sporadic exceedances of the contaminant threshold (CT) class I landfill criteria (DWER 2019) for arsenic (As), nickel (Ni) and lead (Pb) and DGV (ANZG 2018) for As, chromium (Cr) and copper (Cu). Potential bioavailability of those exceeding metals was determined by dilute acid extraction, which indicated that the metals would not be bioavailable at levels exceeding the DGV (ANZG 2018). Further, leachate analysis was undertaken to determine the potential for contaminant release to the Port harbour following disposal into the OTH area. Following the application of an overly conservative (low) dilution factor, all COPC were compliant with the 95% marine SPL.

The assessment concluded that the B6 soils pose negligible risk to the marine environment from mobilisation of contaminants and hence are suitable for beneficial reuse within the proposed unlined OTH material disposal area.

7.3 Potential Environmental Impacts

Project activities and subsequent impacting pathways that have the potential to adversely affect MEQ are presented in Table 7-3.

Table 7-3 Project activities that have the potential to affect MEQ

Project activity	Impact pathway	Impact type
Dredging and marine infrastructure installation	Mobilisation of sediments leading to increased turbidity reducing MEQ	Direct (Section 7.3.1.1)
Dredging and dredged material placement	Mobilisation of sediment contaminants leading to decreased MEQ	Direct (Section 7.3.1.2)

7.3.1 Impact assessment

7.3.1.1 Dredging resulting in the mobilisation of sediments leading to increased turbidity reducing MEQ quality

Dredging associated with the PMaxP will occur at the following locations:

- New Berth 1 – Maintenance and capital dredging
- Berth 6 – Capital dredging
- New tug harbour – Capital dredging
- Berth 8/9 – Capital dredging.

The potential impact on MEQ resulting from the proposed maintenance and capital dredging activities at Geraldton Port was assessed using the following calibrated and validated numerical hydrodynamic and wave modelling tools, and suspended sediment transport tool (informed by the calibrated and validated hydrodynamic and wave modelling tools) (see Appendix D):

- Wave modelling (using the MIKE21 Spectral Wave module)
- Hydrodynamic (flow) modelling (using the MIKE21 and MIKE3 Flexible Mesh – Hydrodynamic module)
- Suspended sediment transport modelling (using the MIKE3 Mud Transport module).

To assist in determining the potential impacts of dredging at each location numerical modelling was partitioned into the following scenarios and associated timing and duration of each scenario based on dredge expert assessment of the methods to be used and volume of material to be dredged:

- Scenario 1: Maintenance dredging at the new Berth 1 (January - dredge duration approx. three (3) days)
- Scenario 2: Capital dredging at Berths 1, 6 and 8/9, as well as Berth 1 and Berth 6 only (April - dredge duration approx. 32 weeks)
- Scenario 3: Capital dredging at the New Tug Harbour (NTH) (April or May - dredge duration approx. seven (7) days).

MWPA have indicated that maintenance dredging at Berth 1 (Scenario 1) and capital dredging at the NTH (Scenario 3) will take place by means of a trailing suction hopper dredge (TSHD). Based on a dredge expert assessment it was determined that for capital dredging at Berths 1, 6 and 8/9 a backhoe dredge (BHD) should be used to reduce the potential mobilisation of material into the receiving environment. Examples of each type of dredge are presented in **Figure 7-8**.

Source terms for each dredge scenario were developed based on sediment investigations, expert knowledge of various dredging methods and available geotechnical information. Dredge plumes were modelled in 3D to consider bathymetric differences in depths throughout the modelled area.

Outputs of each model presented excess suspended sediment concentration (SSC). Outputs do not take into consideration ambient SSC during each scenario[2]. Investigations undertaken to inform this assessment indicate that SSC derived from dredging activities, particularly the underlying Tamala limestone, may flocculate with ambient and dredged suspended sediments that otherwise may not flocculate. As such, it was considered that the introduction of dredged material could in turn increase the settling velocity of mobilised sediments thereby reducing the extent of the plume compared to what is presented as outputs from the modelling completed to inform this assessment (RHDHV 2025).

Outputs of the models were compiled to output percentile figures which present the statistical summaries of the dredge plume concentrations over the selected analysis period, spatial extent and depth profile. The percentile plots show the value for which SSC throughout the dredging duration is 'less than' a given percentage of the time. For example:

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[2] The development of ambient turbidity model was attempted as part of the modelling activities for the project however reproducing existing SSC conditions (see Section 7.2.2) in a model environment at Geraldton proved to be very challenging and the results were not considered robust or reliable enough to inform the assessment. As a result, it was decided to exclude accounting for modelled ambient SSC as part of the current assessment.

- The 50th percentile shows the value that is predicted to be exceeded for 50 per cent of the time during the modelled scenario
- The 95th percentile shows the value that is predicted to be exceeded for five per cent of the time during the modelled scenario.

The percentage plots do not show the actual plume at any point in time or space during the modelled scenario.

Timeseries plots were also compiled for locations of interest for each dredge scenario based on factors such as location of potentially sensitive receptors (i.e. Town Beach [L1] and BCH [L2-L13]) (**Figure 7-9**) or locations at various distances north of the Port, along the modelled pathway of the dredge plume (**Figure 7-10**).

The outputs of the model were used to define the zones of impact in accordance with the EPA Technical Guidance for the EIA of Dredging Proposals (EPA 2021) and inform the water quality monitoring requirements during construction.

a)

b)

Figure 7-8 Examples of (a) trailing suction hopper dredge and (b) backhoe dredge

Figure 7-9 Location of potentially sensitive receptors for time series assessment

Figure 7-10 Location at various distances north of the Port for time series assessment

7.3.1.1.1 Scenario 1: Maintenance dredging at the new Berth 1 - Modelling Results and impacts to MEQ

It is anticipated that Scenario 1 dredge activities will be completed in approximately three (3) days. Given the short duration of the dredging and potential for varied meteorological and hydrodynamic condition affecting the plume extent and direction, the predictive modelling was completed for a range of different periods of time exhibiting varied conditions, but results were comparable so only one scenario and results are presented and further discussed herein.

During Scenario 1 dredging activities the models predict that the plume will typically move to the northeast of the Port and elevated turbidity will be present northward of the Batavia Coast Marina. The plume will remain relatively close to the nearshore area. The 50th and 95th percentile plots for the near surface and near bed predict that SSC greater than 100 mg/L will remain within the Port area (**Figure 7-11** and **Figure 7-12** respectively). SSC of between 50 and 100 mg/L is predicted to occur in the vicinity of Town Beach and subsequently dilute further northward from the Port.

Timeseries plots indicate that elevated SSC are predicted to occur at potentially sensitive receptor locations L1 (Town Beach) and L4 (BCH north of Batavia Coast Marina) during the active dredging period and rapidly decrease following the cessation of dredging activities (**Figure 7-13**). The dredge derived SSC was not predicted to exceed 5 mg/L (<80th percentile SSC of ambient conditions reported at LL4 (**Table 7-2**)) at any other potentially sensitive receptor locations (see Appendix D).

Timeseries plots indicate that the elevated SSC predicted to occur at points A to F (see **Figure 7-10**) during Scenario 1 dredging will not exceed 35 mg/L for the duration of the dredging and will return to background condition (i.e. no dredge-derived SSC) within three days of dredging ceasing (**Figure 7-14**).

Assessment of ambient turbidity at three sites in the receiving environment (**Figure 7-2**, **Figure 7-3** and **Figure 7-4**) showed that it is highly variable, fluctuating seasonally with prolonged periods of relatively high turbidity. Turbidity in the receiving environment was also variable on a daily basis influenced by afternoon sea-breeze and morning periods of low winds, and had 2 – 3 to 5 – 7 day cyclical pulses in turbidity at the three monitoring locations (**Figure 7-2** to **Figure 7-4**). Overall, turbidity pulses at all three sites were higher than was predicted by the model for Scenario 1 dredging, except for within the Port.

In summary, the impact of Scenario 1 dredging activities to marine environmental quality through the mobilisation of sediments will be of short duration, with dredge induced SSC returning to natural conditions within 4 days following the cessation of dredging and predominantly spatially isolated to the coastal area to the north of the Port area. It is considered unlikely during Scenario 1 dredging activities that increased SSC will represent a significant impact to marine environmental quality.

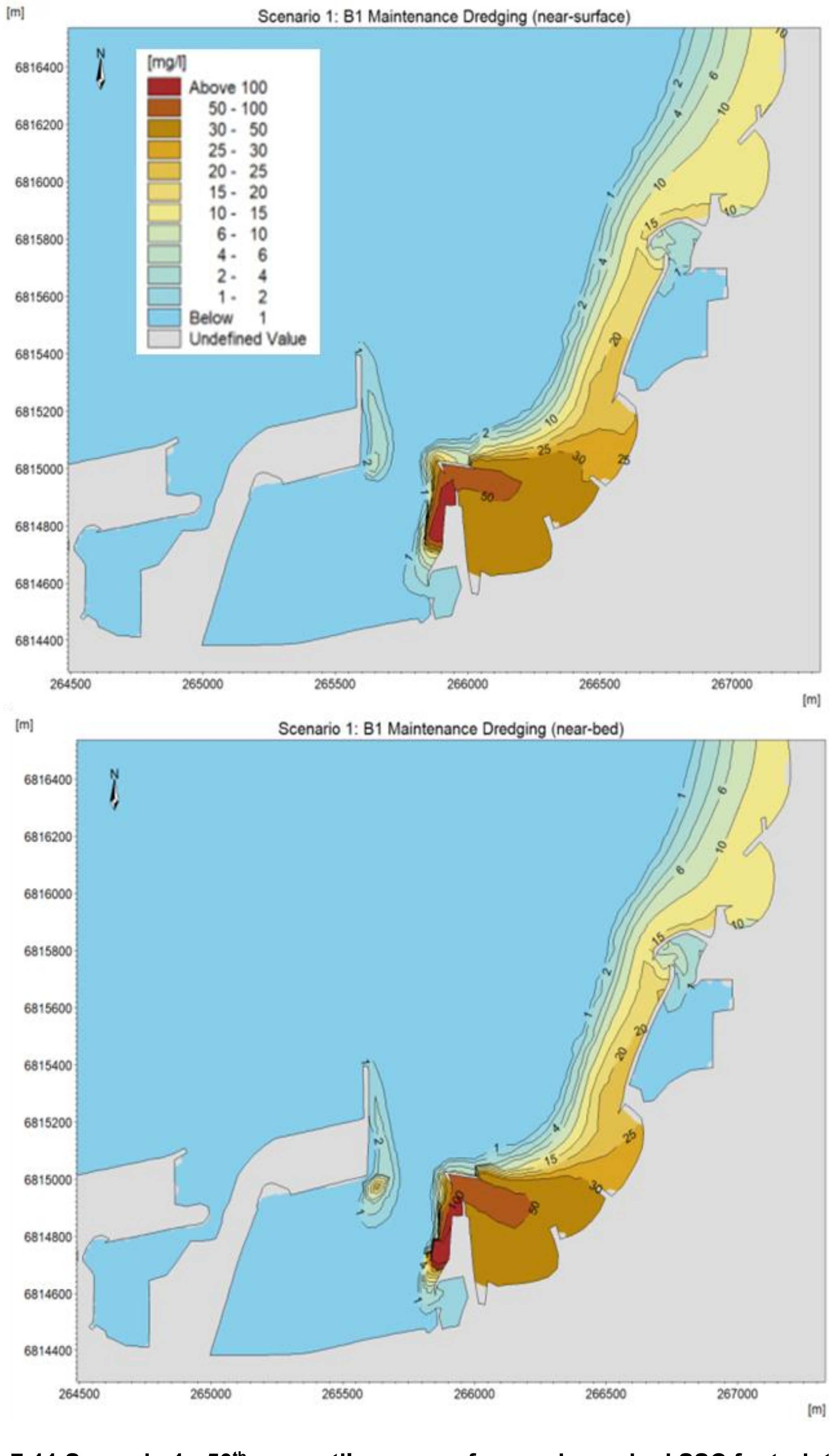


Figure 7-11 Scenario 1 - 50th percentile near-surface and near-bed SSC footprint

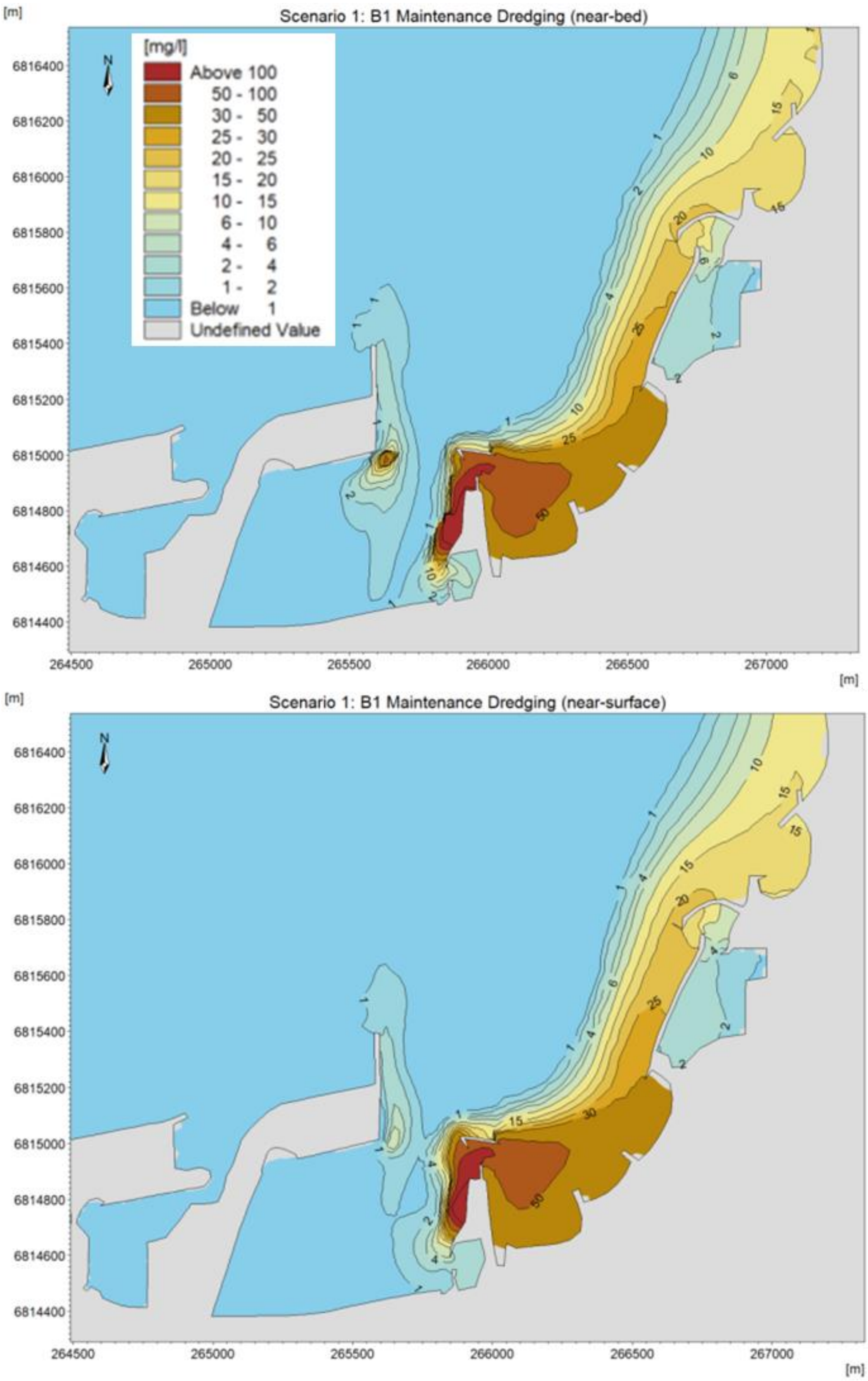


Figure 7-12 Scenario 1 - 95th percentile near-bed and near-surface SSC footprint

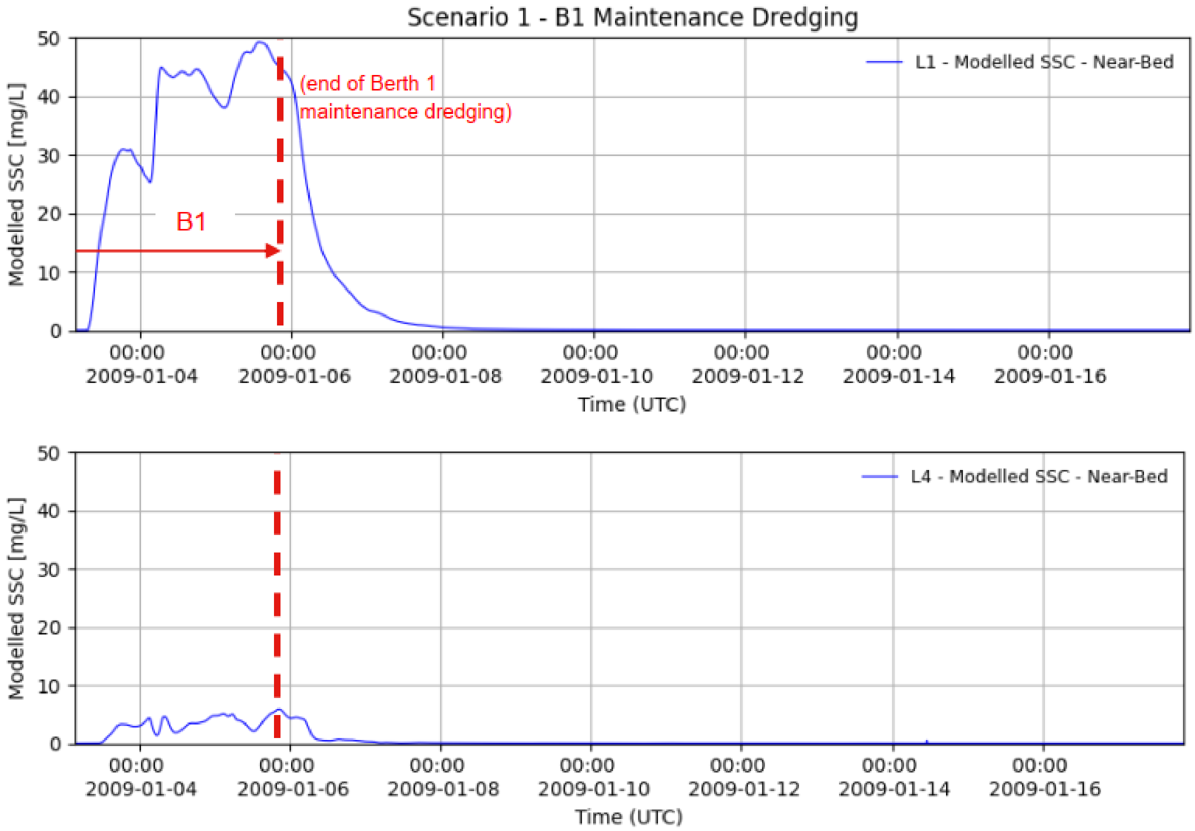


Figure 7-13 Time series of predicted SSC derived from Scenario 1 dredging at potential sensitive receptor locations L1 and L4

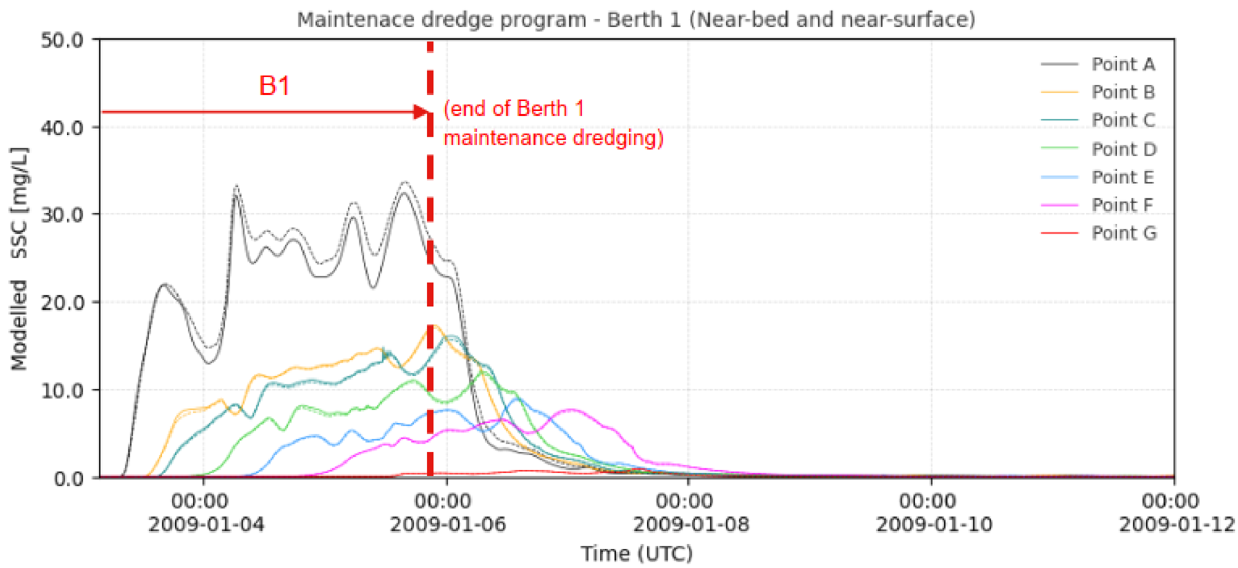


Figure 7-14 Time series of predicted SSC derived from Scenario 1 dredging at Point A to Point F northward along the coast from the Port.

7.3.1.1.2 Scenario 2: Capital dredging at Berths 1, 6 and 8

It is anticipated that Scenario 2 dredge activities will be completed in approximately thirty-two (32) weeks.

During Scenario 2 dredging activities, the models predict that the plume will move to the northeast and southwest of the Port and elevated turbidity will be present both northward and southward of the Batavia Coast Marina. The plume will remain relatively close to the nearshore area. The 50th percentile plots for the near surface and near bed predict that SSC will be lower than 20 mg/L within the Port area and lower than 6 mg/L outside the Port area (**Figure 7-15**). The 95th percentile plots for the near surface and near bed predict that SSC greater than 30 mg/L will remain within the Port area (**Figure 7-16**). SSC of between 10 mg/L and 15 mg/L is predicted to occur in the vicinity of Town Beach and subsequently dissipate further northward and southward from the Port.

Timeseries plots indicate that elevated SSC are predicted to occur at potentially sensitive receptor locations L1 to L11 during the active dredging period and rapidly decrease following the cessation of dredging activities (**Figure 7-17** to **Figure 7-19**). The dredge derived SSC was not predicted to exceed 5 mg/L (<80th percentile SSC of ambient conditions reported at LL4 (**Table 7-2**)) at any other potentially sensitive receptor locations (see Appendix D).

Timeseries plots indicate that the elevated SSC predicted to occur at points A to F (see **Figure 7-20**) during Scenario 2 dredging will not exceed 40 mg/L following the immediate initiation of dredging. Throughout the duration of the dredging period episodic pulses of water containing higher SSC will be experienced particularly at Point A to Point E although these pulses are predicted to occur for less than a week at a time. Following the cessation of dredging, dredge derived SSC at each point is predicted to rapidly reduce and not be detectable after a month (**Figure 7-20**).

Assessment of ambient turbidity at three sites in the receiving environment (**Figure 7-2**, **Figure 7-3** and **Figure 7-4**) showed that it is highly variable, fluctuating seasonally with prolonged periods of relatively high turbidity. Turbidity in the receiving environment was also variable on a daily basis influenced by afternoon sea-breeze and morning periods of low winds and had 2 – 3 to 5 – 7-day cyclical pulses in turbidity at the three monitoring locations which typically lasted several days. Overall, natural turbidity pulses at all three sites were higher than was predicted by the model for Scenario 2 dredging, except for within the Port.

In summary, the impact of Scenario 2 dredging activities will be of low magnitude, with dredge induced SSC returning to natural conditions less than a month after the cessation of dredging activities. The predicted dredge derived pulses of increased SSC within the receiving environment during the dredge campaign is likely to be similar to naturally occurring conditions within Champion Bay.

It is considered unlikely Scenario 2 dredging activities that increase SSC will represent a significant impact to marine environmental quality.

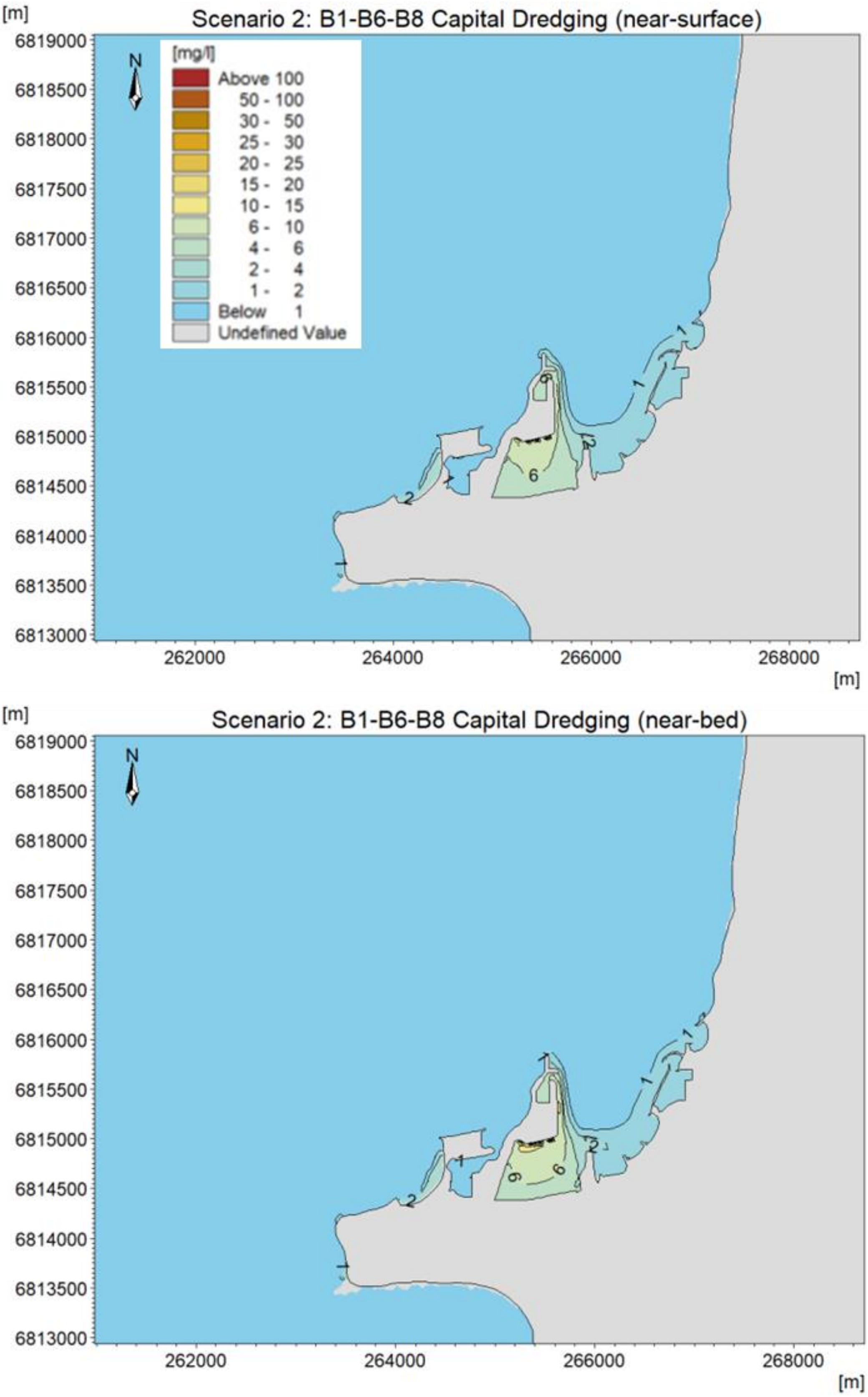


Figure 7-15 Scenario 2 - 50th percentile near-surface and near-bed SSC footprint

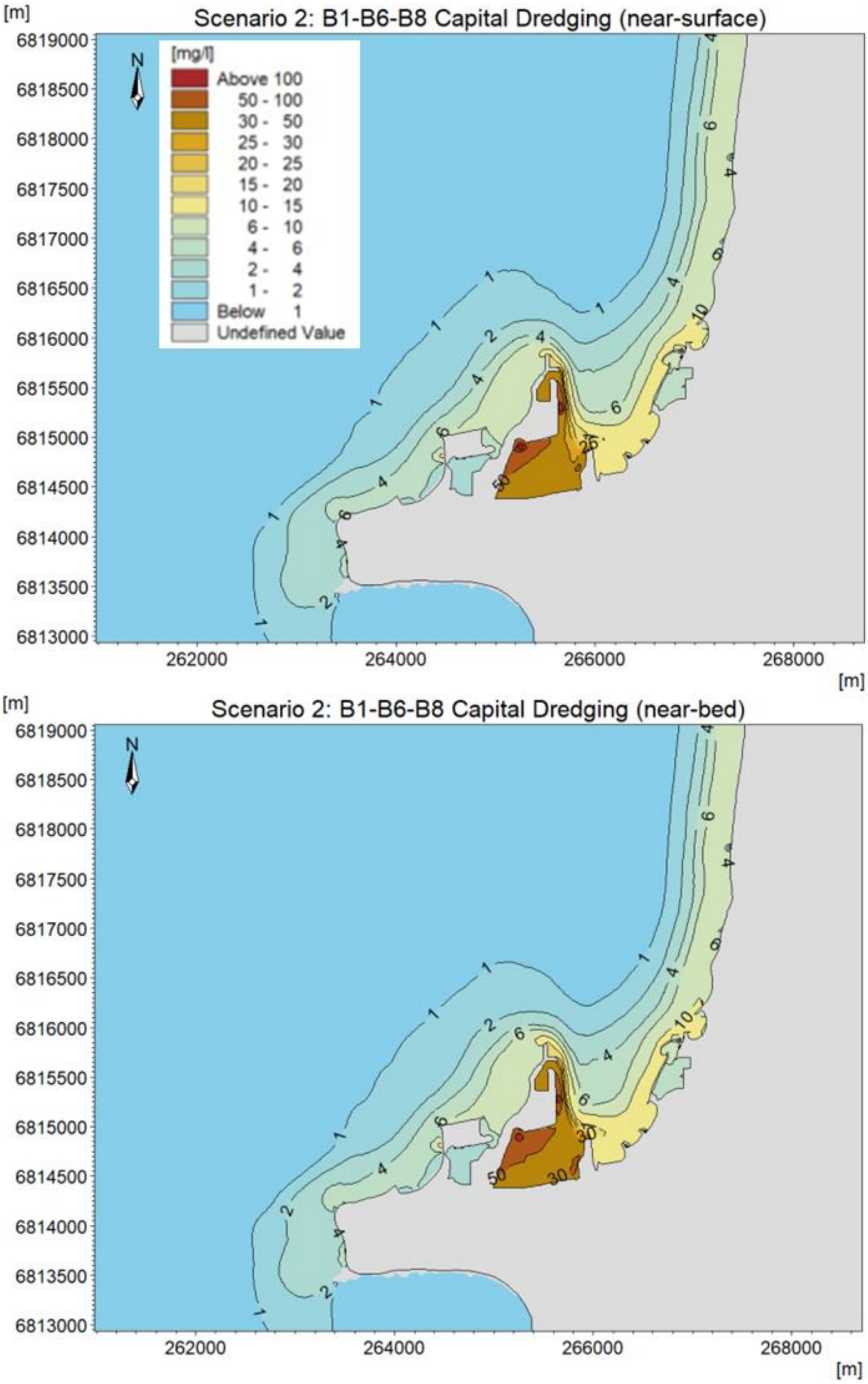


Figure 7-16 Scenario 2 - 95th percentile near-surface and near-bed SSC footprint

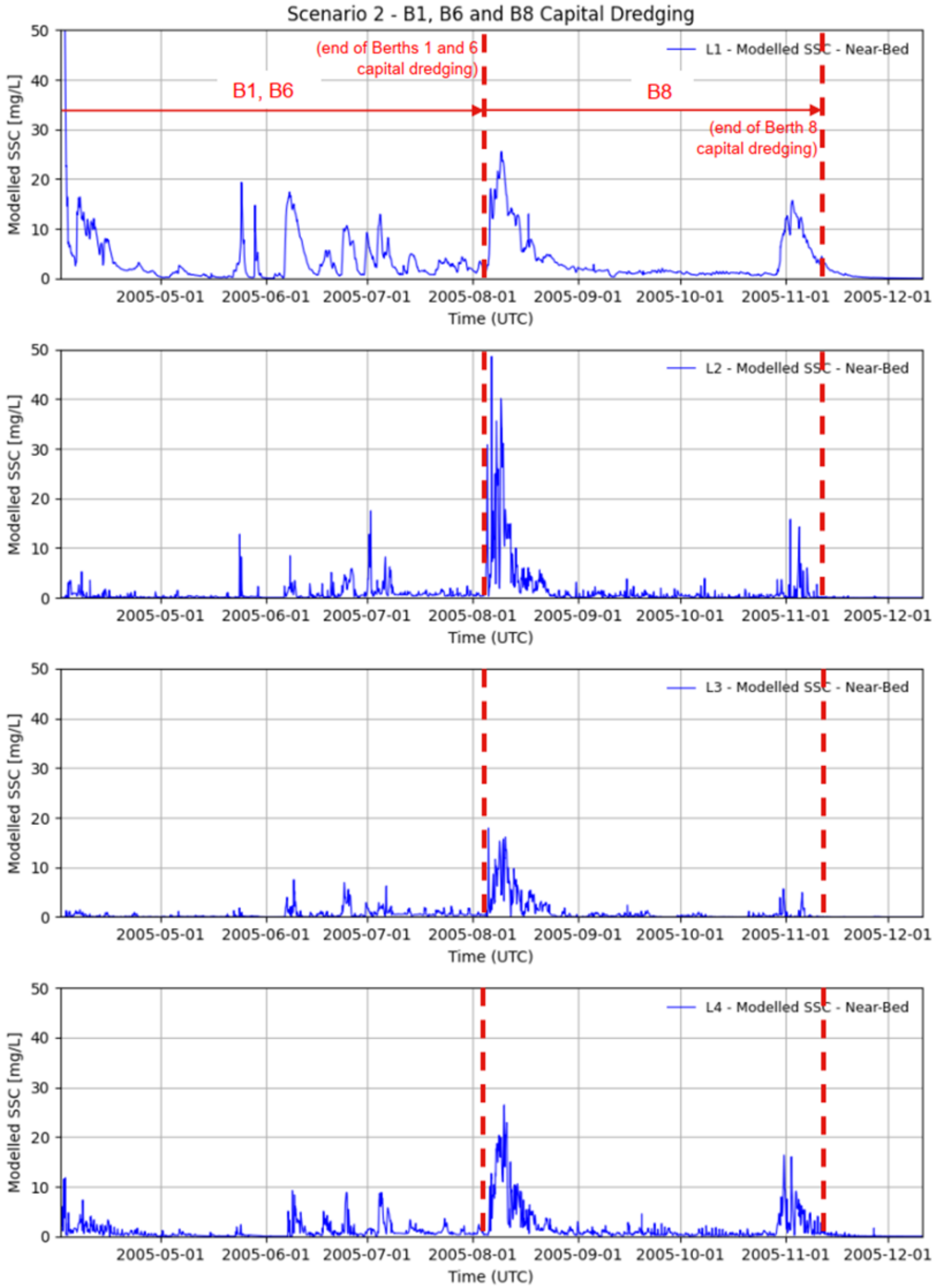


Figure 7-17 Time series of predicted SSC derived from Scenario 2 dredging at potential sensitive receptor locations L1 to L4

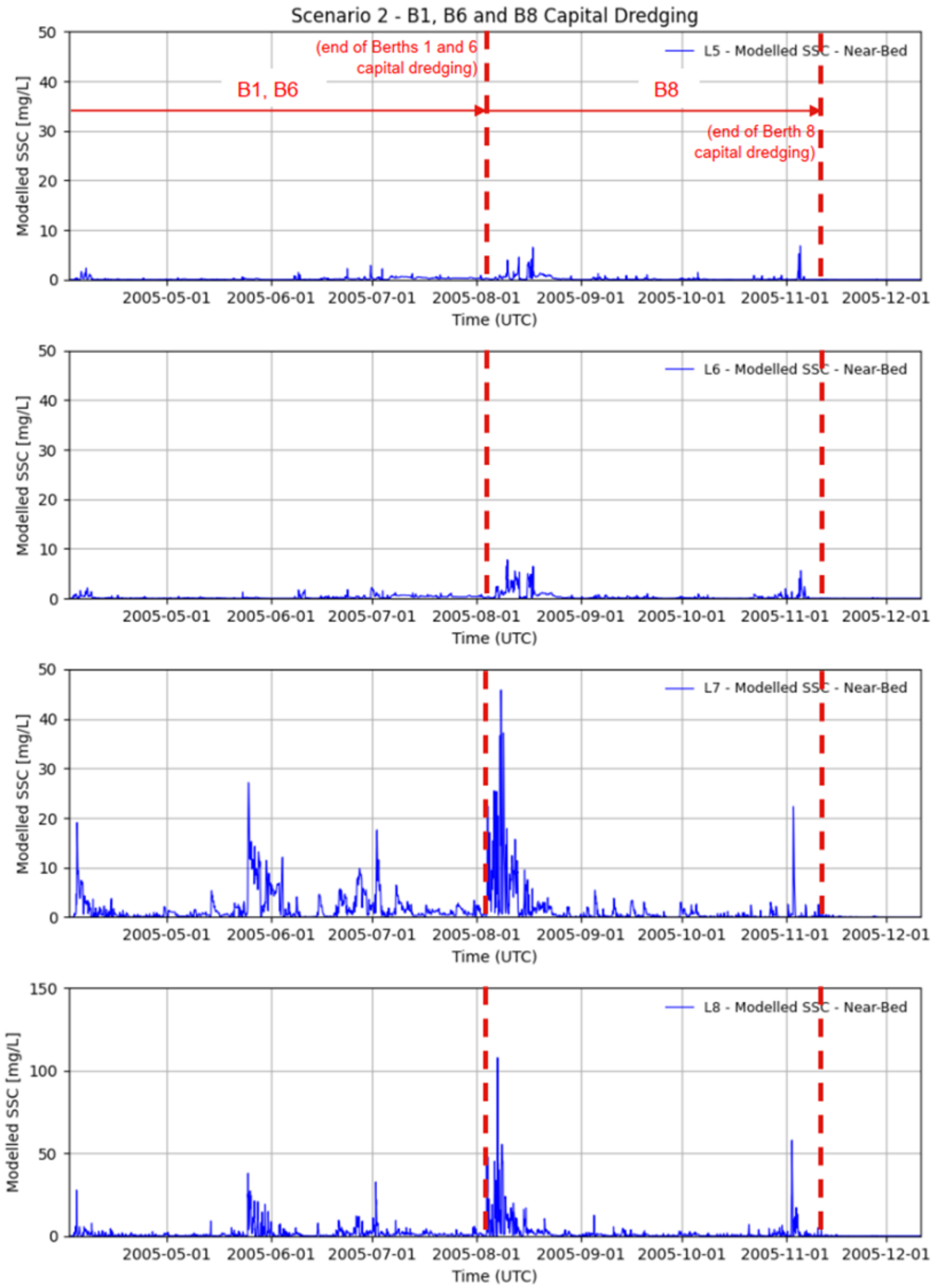


Figure 7-18 Time series of predicted SSC derived from Scenario 2 dredging at potential sensitive receptor locations L5 to L8

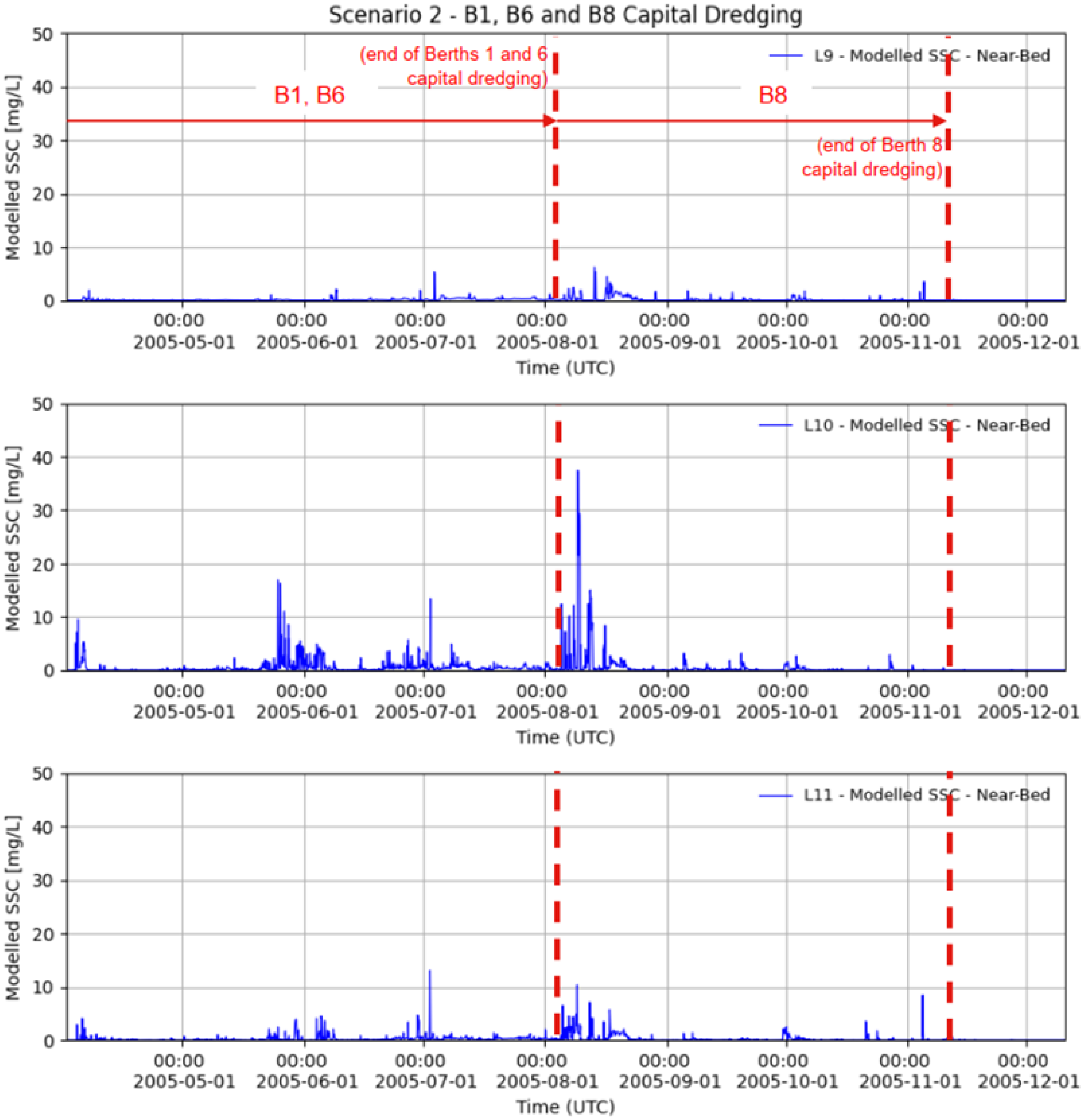


Figure 7-19 Time series of predicted SSC derived from Scenario 2 dredging at potential sensitive receptor locations L9 to L11

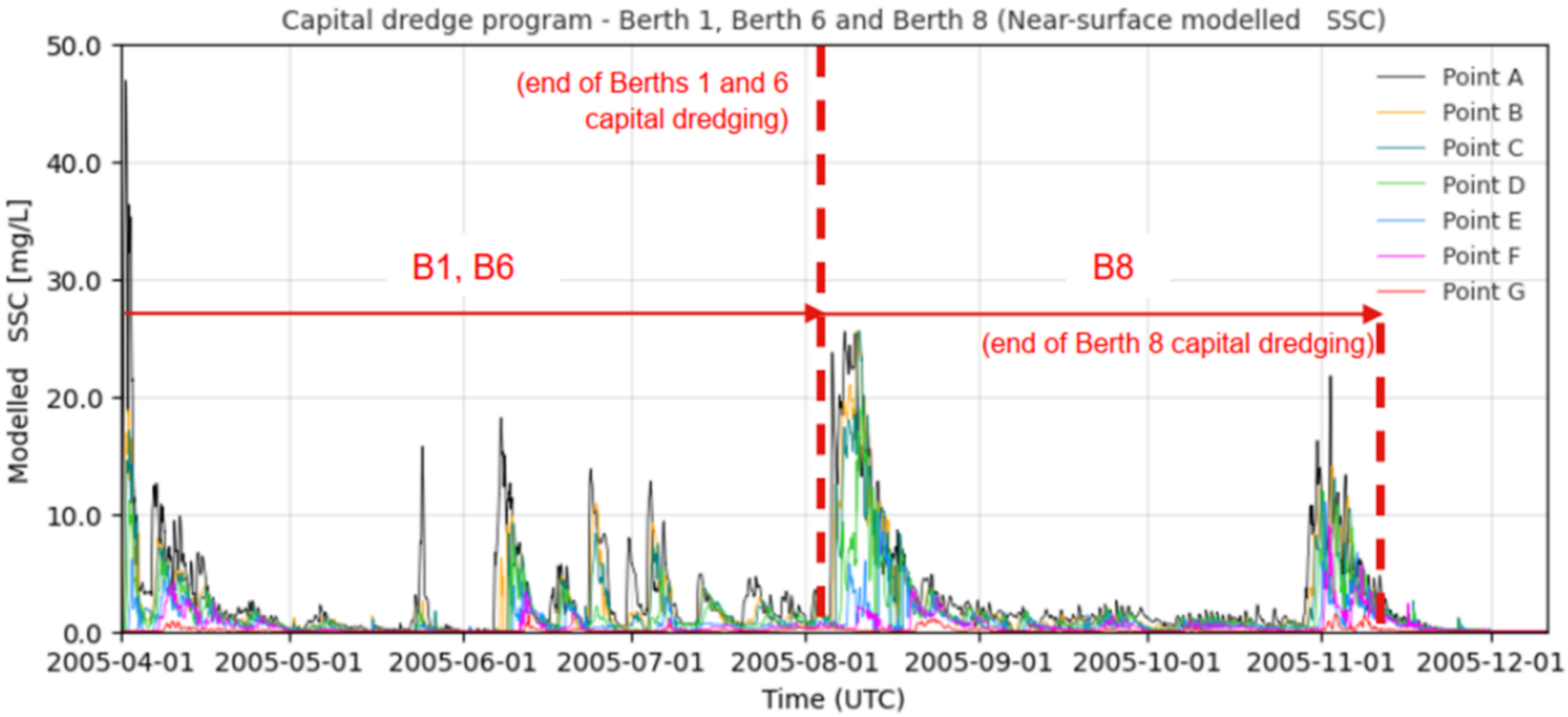


Figure 7-20 Time series of predicted SSC derived from Scenario 2 dredging at Point A to Point G north along the coast from Port

7.3.1.1.3 Scenario 3: Capital dredging at the New Tug Harbour

It is anticipated that Scenario 3 dredge activities related to capital dredging of the new tug harbour (NTH) will be completed in approximately seven (7) days. Given the short duration of the dredging and potential for varied meteorological and hydrodynamic condition affecting the plume extent and direction, the predictive modelling was completed for two different periods of time exhibiting varied conditions (April and May).

During Scenario 3 – April dredging activities, the models predict that elevated SSC would be present to the northeast and southwest of NTH. The plume will remain relatively close to the nearshore area. The 50th percentile plots for the near surface and near bed predict that SSC will be greater than 100 mg/L within the NTH area and lower than 4 mg/L outside the Port area (**Figure 7-21**). The 95th percentile plots for the near surface and near bed predict that SSC greater than 100 mg/L will remain within the NTH area (**Figure 7-22**). SSC of between 15 and 25 mg/L is predicted to occur in the vicinity of the NTH entrance to the west and the south and subsequently dilute further northward and southward from the NTH.

Under the Scenario 3 – May dredging activities, modelling completed during a period in May experienced a different set of weather conditions compared to the model completed in April, with uncharacteristic persistent northeasterly winds in the preceding days. During this May model run the direction of the dredge plume was predicted to extend predominately westward once outside the NTH (**Figure 7-23** and **Figure 7-24**). The 50th percentile plots indicated the highest SSC concentrations remained within the NTH while SSC concentrations of between 10 and 15 mg/L were predicted to occur to the northwest of the NTH (**Figure 7-23**). The 95th percentile plots for the near surface and near bed predict that SSC of between 30 and 50 mg/L could occur immediately to the west of the NTH and in front of the Fishing Boat Harbour (**Figure 7-24**). The 95th percentile plots for the near surface and near bed predicted SSC of between 6 and 10 mg/L in waters past Point Moore (**Figure** 7-24).

Timeseries plots indicate that elevated SSC are predicted to occur at potentially sensitive receptor locations L1 to L4 and L7 to L11 during the active dredging period if completed in April (**Figure 7-25** to **Figure 7-27**). Timeseries plots indicate that elevated SSC are predicted to occur at potentially sensitive receptor locations L7, L8, L10 and L11 during the active dredging period if completed in May (**Figure 7-28**). At each of these locations for dredge campaigns in April or May, a rapid decrease in dredge derived SSC is predicted to occur following the cessation of dredging activities. The dredge derived SSC was not predicted to exceed 5 mg/L (<80th percentile SSC of ambient conditions reported at LL4 (**Table 7-2**)) at any other potentially sensitive receptor locations (see Appendix D).

Timeseries plots indicate that the elevated SSC predicted to occur at points A to F (**Figure** 7-29) during Scenario 3 dredging in April will not exceed 35 mg/L while dredging is occurring and will within 15 days of dredging ceasing not be impacted by dredge derived SSC (**Figure** 7-29). Under the same Scenario 3 if dredging is completed in May, SSC will not exceed 5 mg/L and within seven (7) days of dredging ceasing, points A to F will not be impacted by dredge derived SSC (**Figure 7-30**).

Assessment of ambient turbidity at three sites in the receiving environment (**Figure 7-2**, **Figure 7-3** and **Figure 7-4**) showed that it is highly variable, fluctuating seasonally with prolonged periods of relatively high turbidity. Turbidity in the receiving environment was also variable on a daily basis influenced by afternoon sea-breeze and morning periods of low winds and had cyclical pulses in turbidity which typically lasted several days. Overall, natural pulses in turbidity at all three sites were higher than was predicted by the model for Scenario 3 dredging except for within the NTH.

In summary, the impact of Scenario 3 dredging activities will be of low magnitude, with dredge induced SSC returning to natural conditions within approximately 15 days following the cessation of dredging activities. The predicted dredge derived pulses of increased SSC within the receiving environment during the dredge campaign is likely to be similar to naturally occurring conditions within Champion Bay.

It is considered unlikely that increase SSC during Scenario 3 dredging activities will represent a significant impact to marine environmental quality.

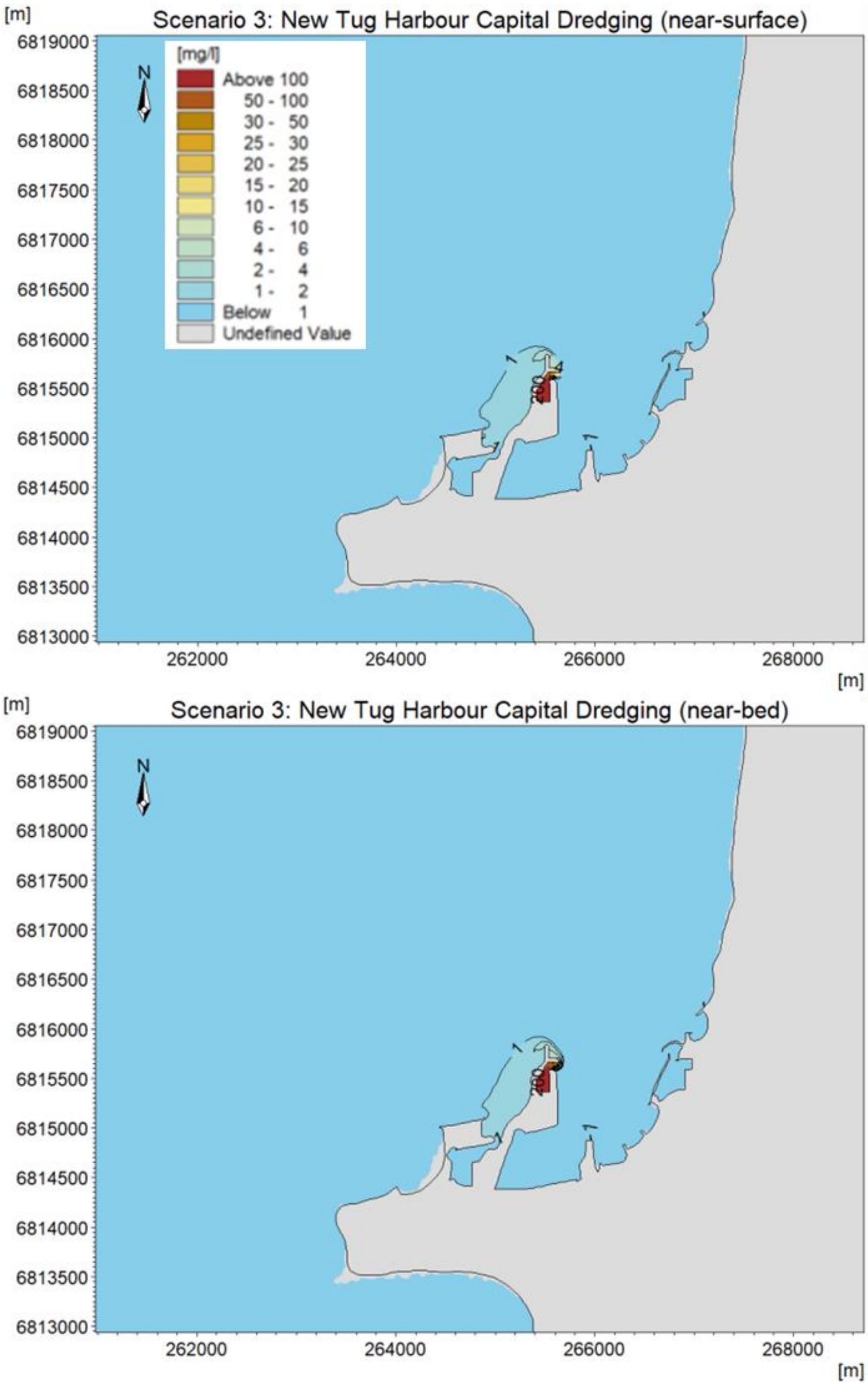


Figure 7-21 Scenario 3 - 50th percentile near-surface and near-bed SSC footprint in April

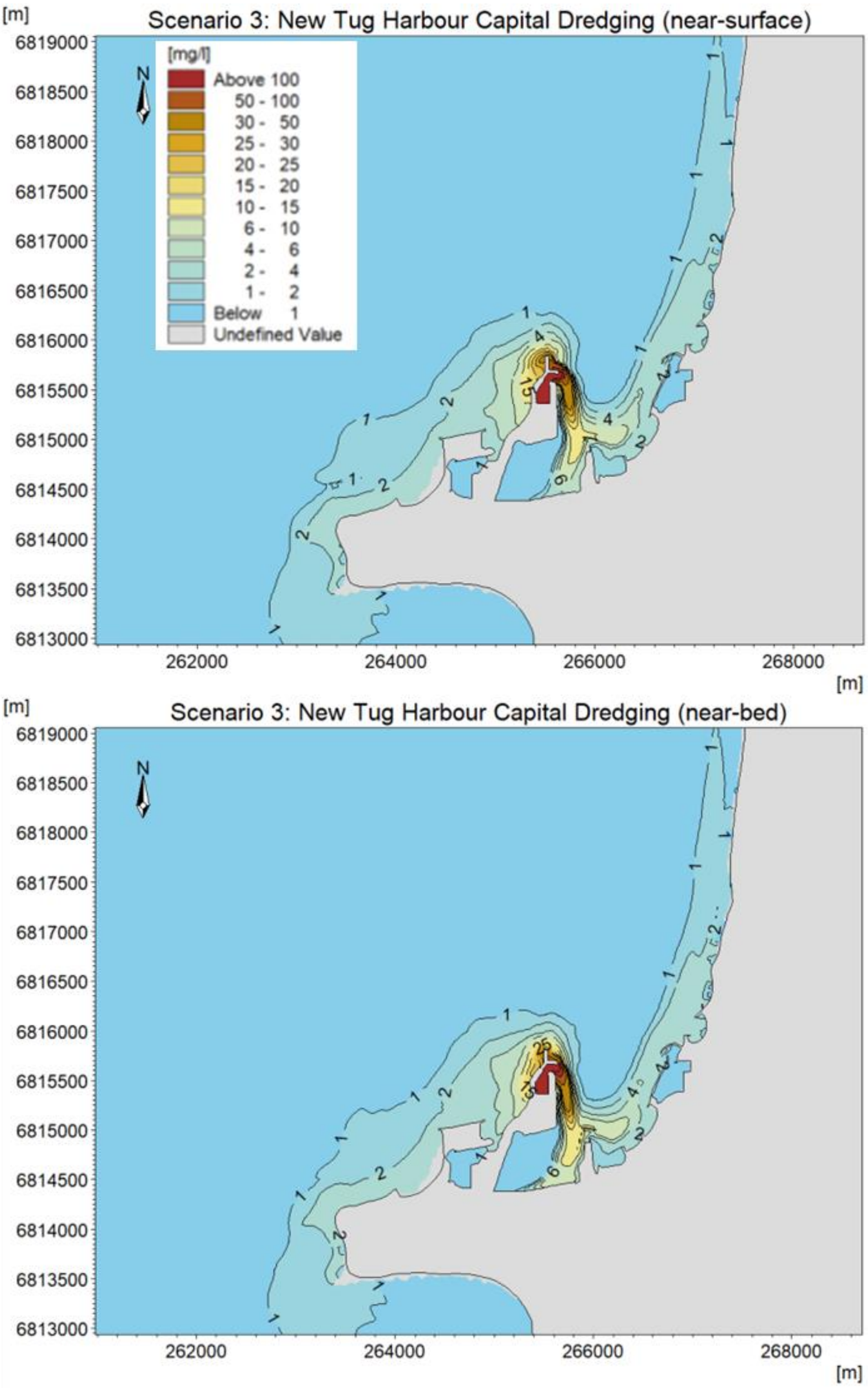


Figure 7-22 Scenario 3 - 95th percentile near-surface and near-bed SSC footprint in April

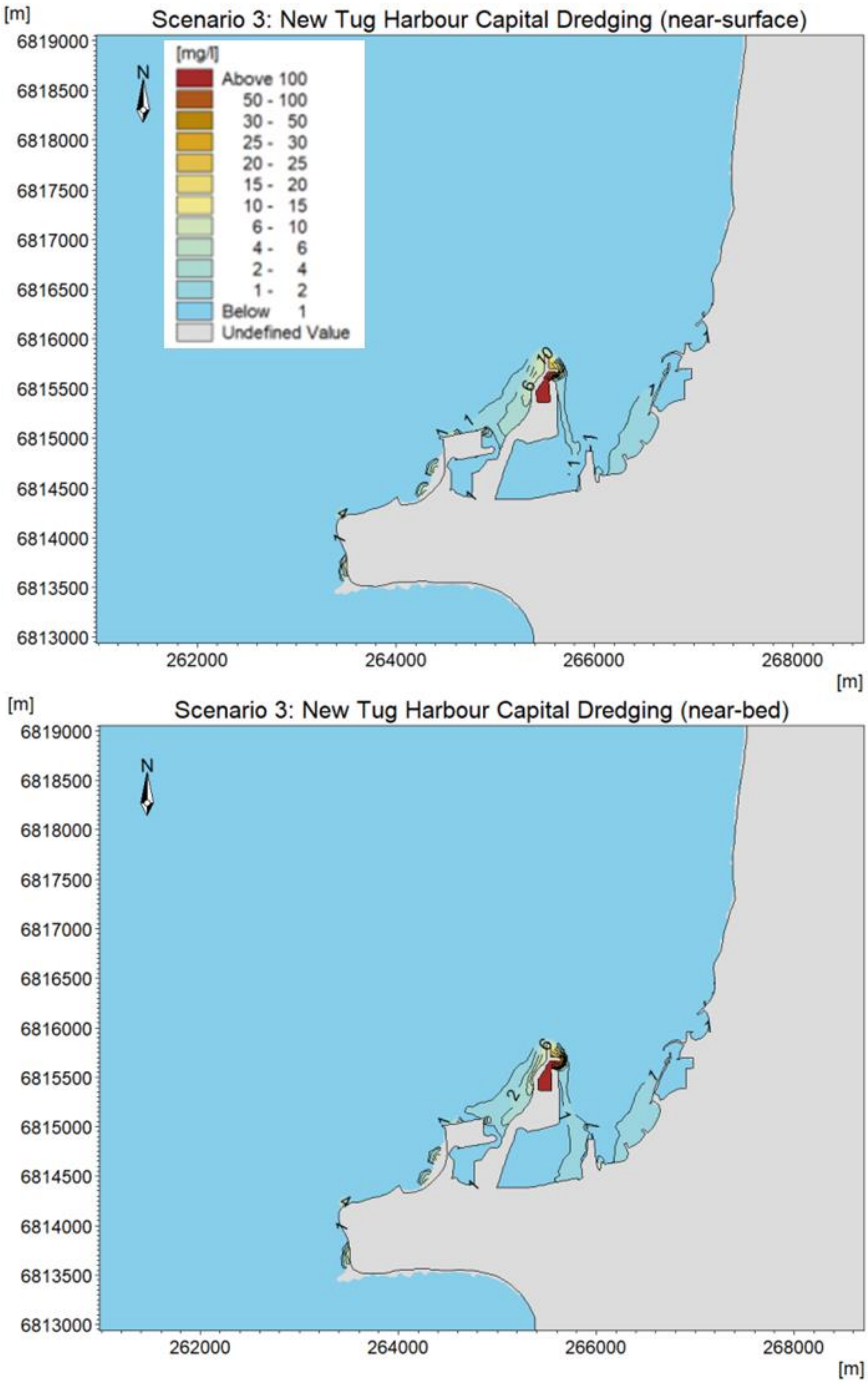


Figure 7-23 Scenario 3 - 50th percentile near-surface and near-bed SSC footprint in May

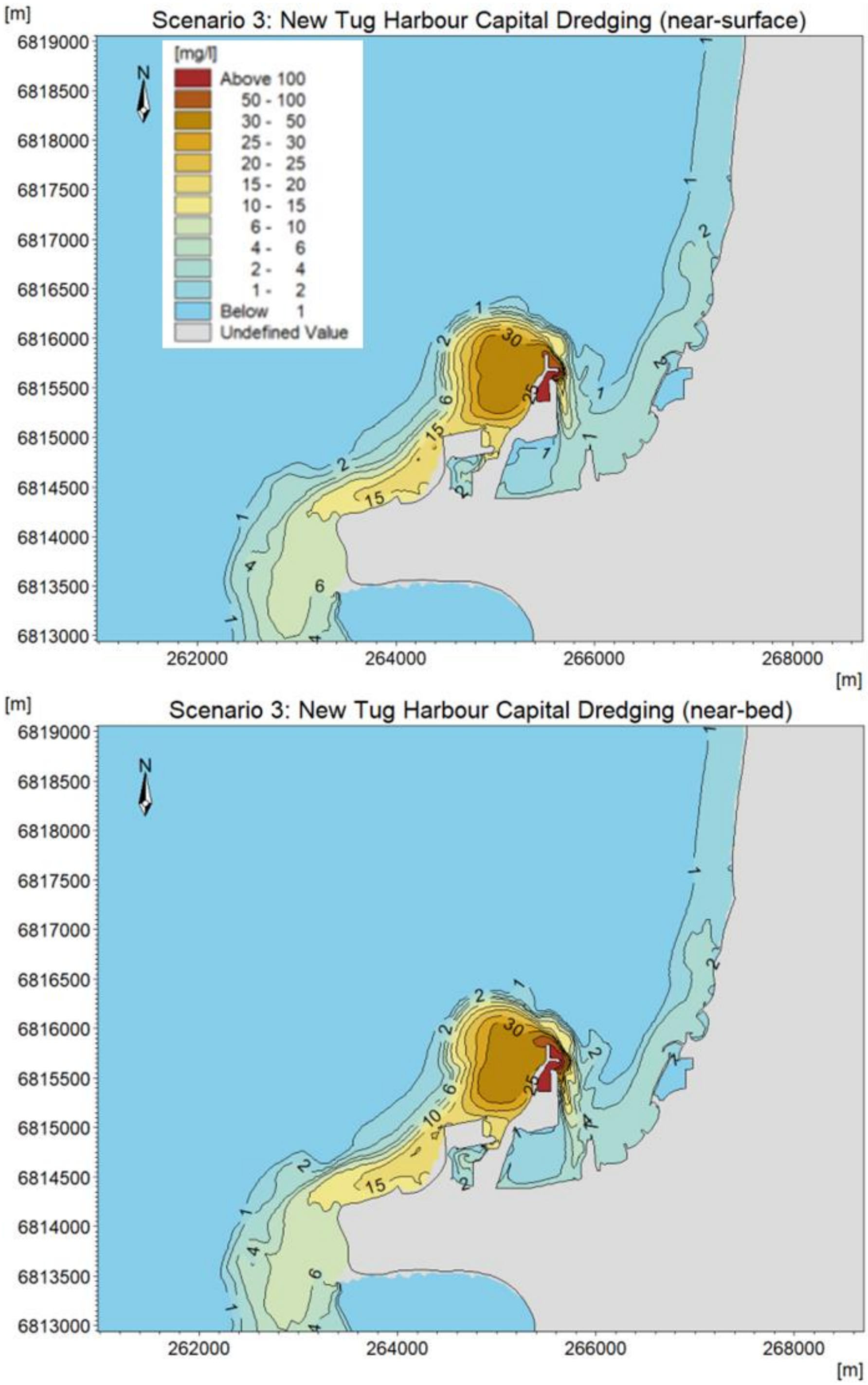


Figure 7-24 Scenario 3 - 95th percentile near-surface and near-bed SSC footprint in May

Dredging in April

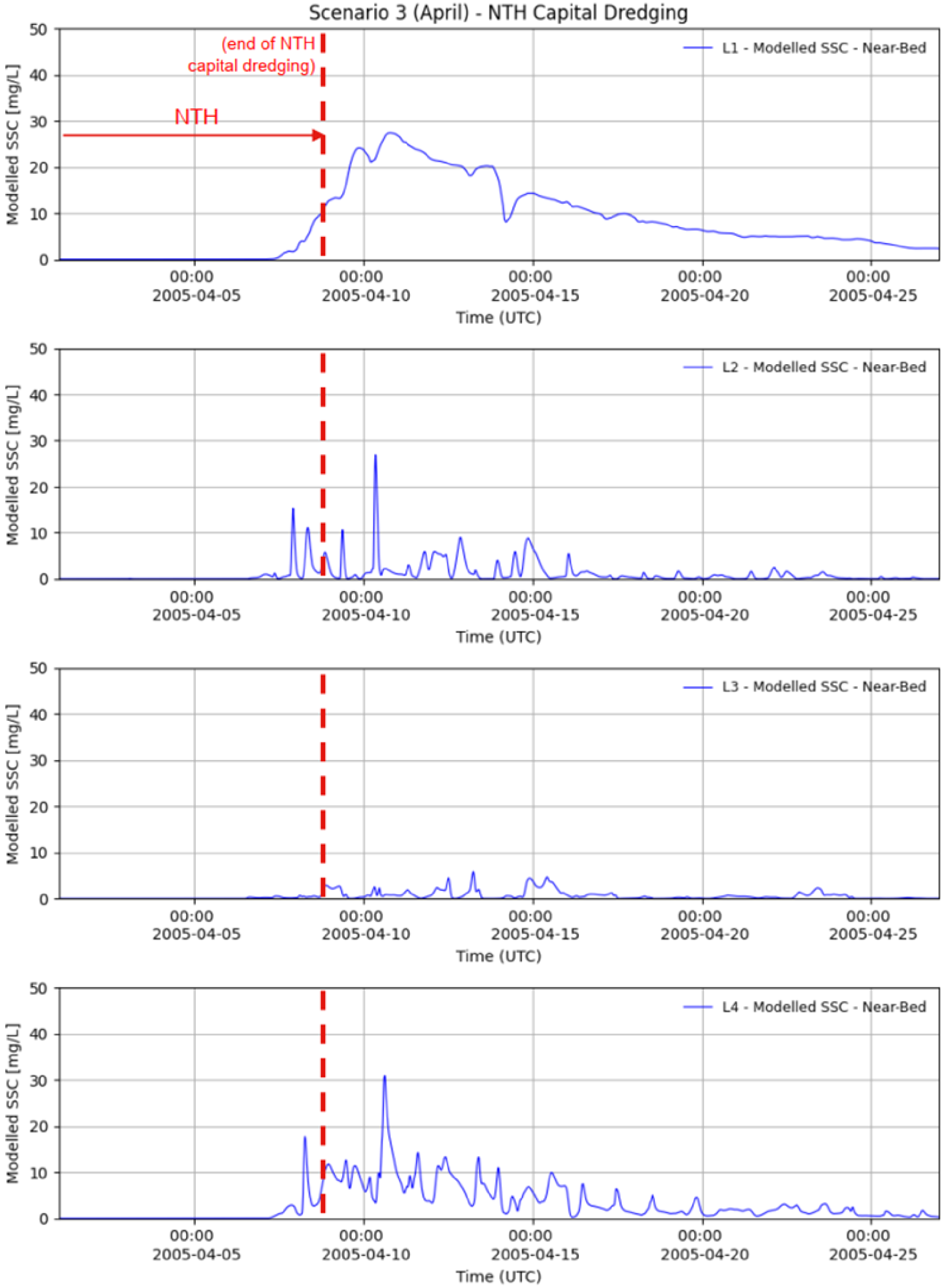


Figure 7-25 Time series of predicted SSC derived from Scenario 3 dredging at potential sensitive receptor locations L1 to L4 in April

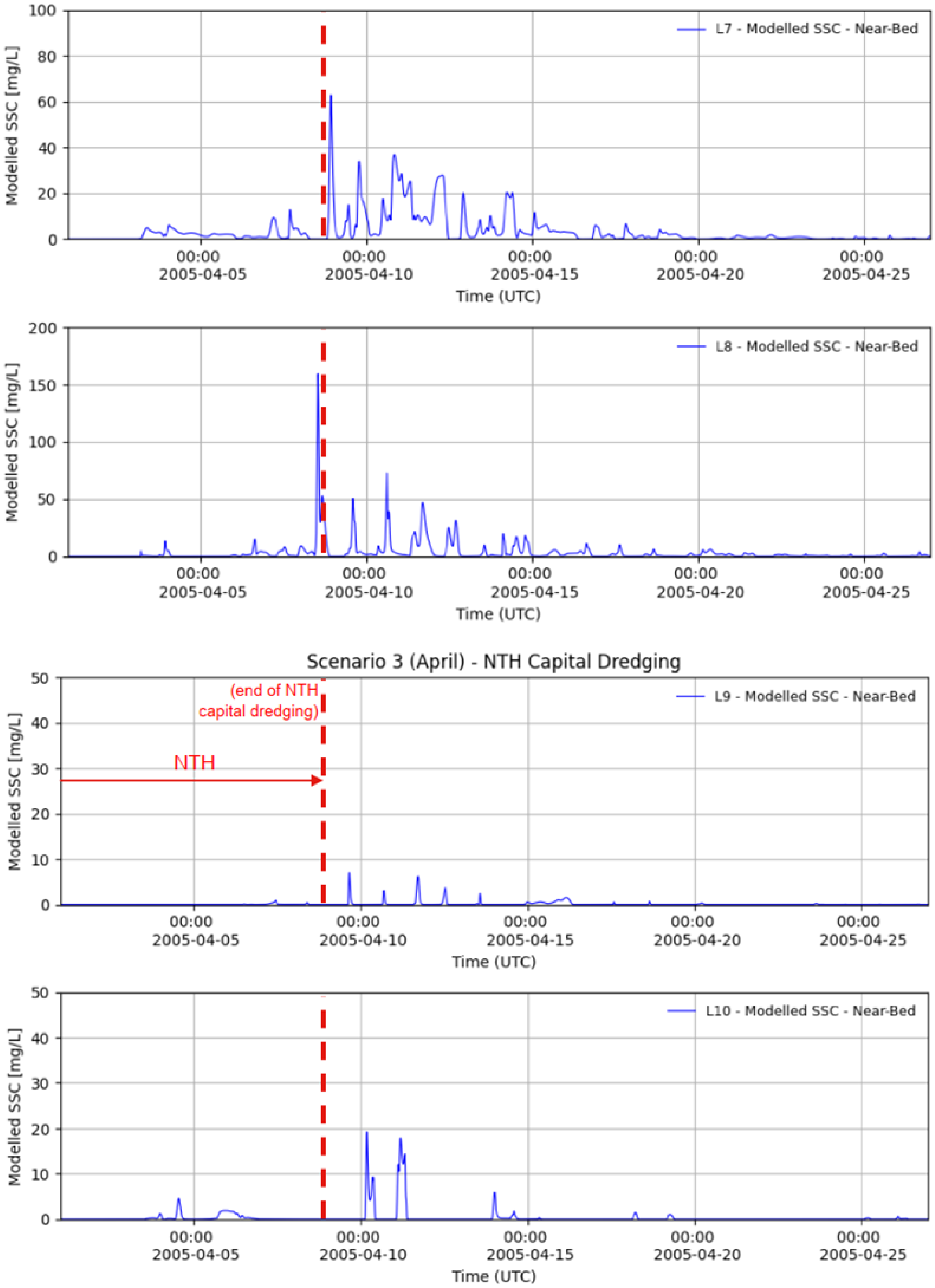


Figure 7-26 Time series of predicted SSC derived from Scenario 3 dredging at potential sensitive receptor locations L7 to L10 in April

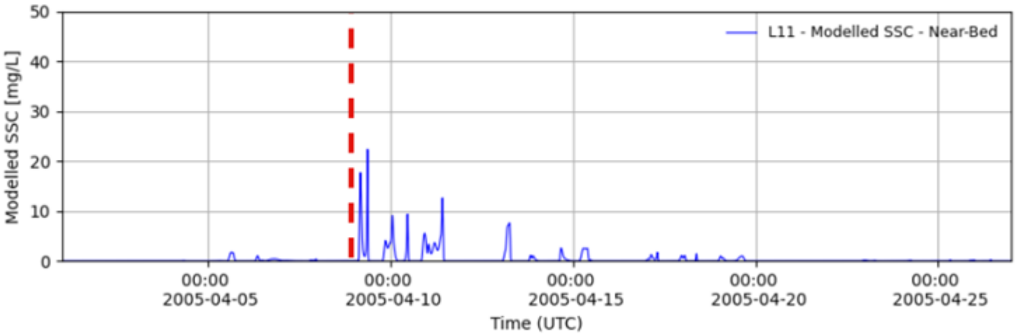


Figure 7-27 Time series of predicted SSC derived from Scenario 3 dredging at potential sensitive receptor location L11 in April

Dredging in May

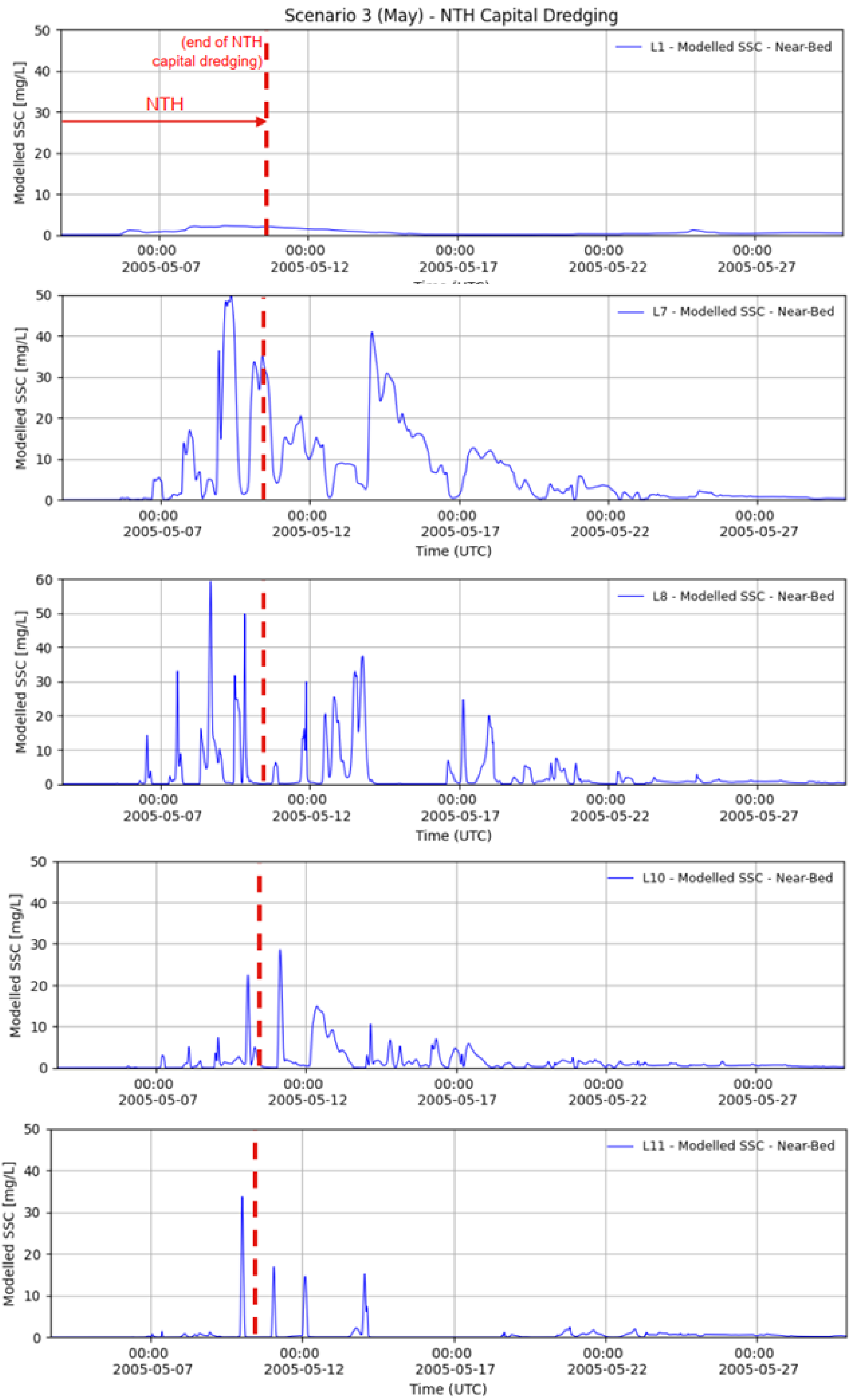


Figure 7-28 Time series of predicted SSC derived from Scenario 3 dredging at potential sensitive receptor locations L1, L7, L8, L10 and L11 in May

Dredging in April

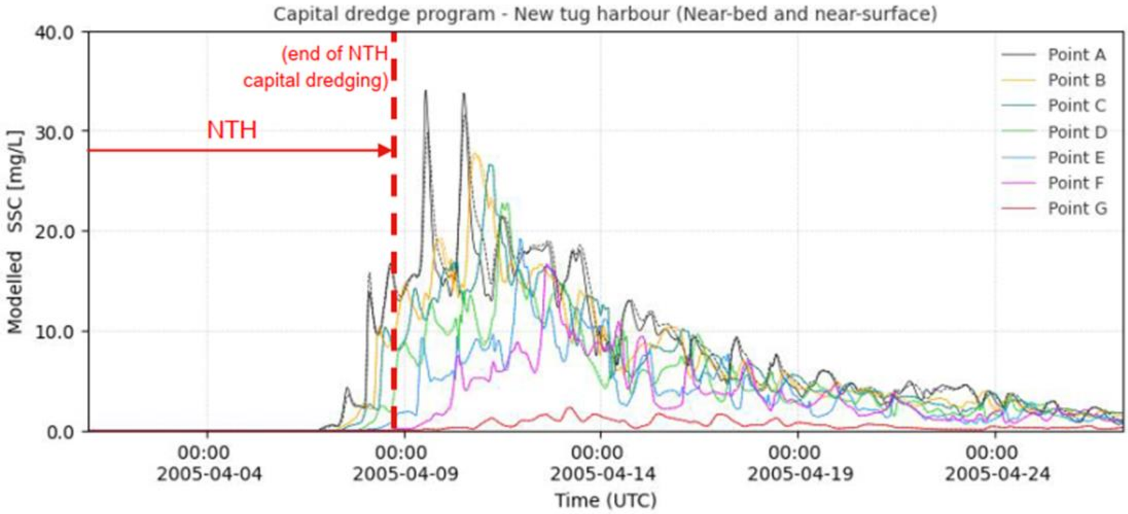


Figure 7-29 Time series of predicted SSC derived from Scenario 3 dredging at Point A to Point G northward along the coast from the Port in April.

Dredging in May

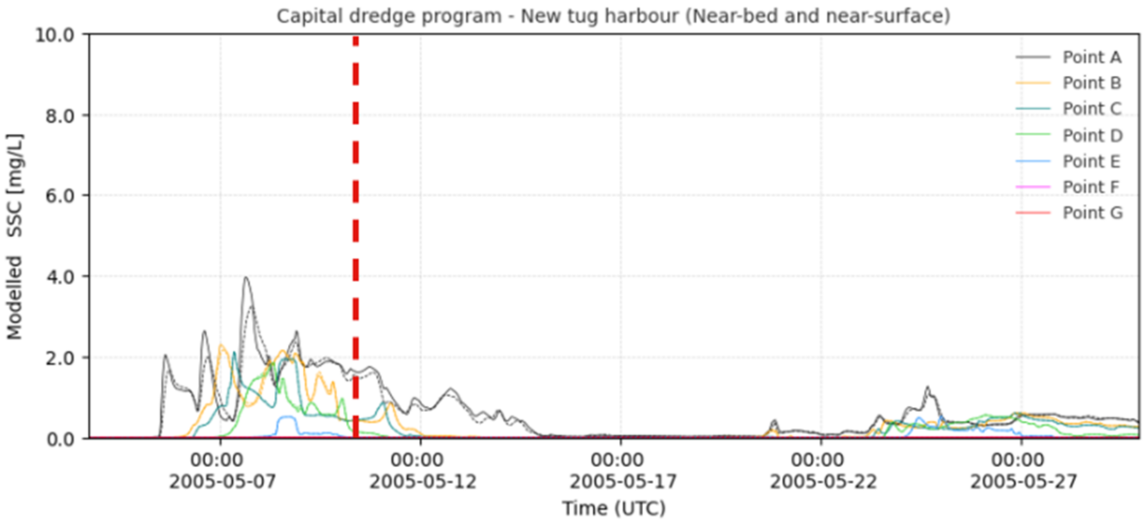


Figure 7-30 Time series of predicted SSC derived from Scenario 3 dredging at Point A to Point G northward along the coast from the Port in May.

7.3.1.2 Dredging and disposal resulting in the mobilisation of sediment contaminants

It is acknowledged that the dredging activities associated with PMaxP will mobilise sediments to the marine environment. The preceding sections describe the physical impacts expected from the mobilisation of sediments but do not address the potential chemical stressors that may be mobilised during dredging and disposal activities.

Dredge material from maintenance dredging campaigns that is considered unsuitable for ocean disposal is currently disposed in the existing Berth 7 reclamation area, with tail water return directly discharging to the Port harbour. The routine monitoring undertaken as part of Port operations confirms that the return water toxicant concentrations are commensurate with the adopted species protection criteria from relevant environmental protection areas.

A comprehensive sediment investigation was completed for sediments within the dredge areas at Berth 1, Berth 6, Berth 8/9 and the NTH. This investigation concluded that while nutrients and metal contaminants may desorb to the water column following sediment disturbance, they would not pose a risk to ecological receptors within the marine environment as the concentrations were below the relevant species protection level for the Port, based on water quality criteria derived using chronic toxicity testing (ANZG 2018). Further, it is likely that significant dilution will occur in the natural environment when compared to the concentrated laboratory testing methods employed to determine contaminant release to the water column (elutriate testing).

Bioavailability of metal contaminants within the sediments was assessed through dilute acid extraction and found to be within the applicable criteria for the level of species protection afforded to the Port, based on toxicant DGVs for sediments (ANZG 2018).

Based on the outcome of this investigation, it is considered that the disturbance of sediments within the capital and maintenance dredge areas, disposal within the nominated disposal areas and release of return water are unlikely to result in adverse impacts on human health and/or ecological receptors. However, a detailed DEMMP has been developed to define the monitoring and response actions required during dredging and disposal activities to confirm that the nominated levels of ecological protection are being met. The DEMMP details disposal area return water discharge monitoring at both the existing Berth 7 reclamation area and the proposed old tug harbour material disposal area discharge location within the Port harbour. The targeted monitoring during the PMaxP and ongoing routine monitoring under the MEMMP (O2M 2024) will ensure that any adverse impacts to the marine environment are detected and management strategies can be implemented to minimise environmental impact, if required. However, based on the outcomes of the current monitoring program, it is not expected that the continued disposal of dredge material within the onshore reclamation areas and resultant return water discharge will cause an unacceptable impact to the marine environment.

7.4 Mitigation Hierarchy

As some construction related impacts to MEQ cannot be avoided mitigation measures have focussed on minimisation of impacts to ensure that no significant impacts persist post PMaxP construction.

7.4.1 Minimise

The PEP (approved proposal; MS600) involved a capital dredge campaign using a large cutter suction dredge and hopper barge. This campaign resulted in significantly elevated turbidity in the marine environment from the mobilisation of “rock flour” which was discussed extensively during and post-dredging under the PEP.

A detailed dredge review by Royal HaskoningDHV (RHDHV) has been undertaken as part of the development of the PMaxP. This involved a review of the PEP dredge campaign and available geotechnical data with the objective of proposing a more suitable dredge method to minimise potential impacts to water quality and inadvertently marine fauna and benthic communities (RHDHV, 2023). Based on the findings of the review, the PMaxP capital dredging will be completed by rock breaking using a hydro-hammer and removal via a long arm excavator (BHD) to minimise the potential for generation of excess suspended fines.

The PMaxP dredge campaigns are also much shorter in duration than the capital dredging completed for the PEP, which further reduces potential impacts related to prolonged reduced water quality. The capital dredged material from Berth 1 and Berth 6 will be relocated to either the Berth 1 reclamation area or the OTH material disposal area, which is considered suitable due to material quality. The new tug harbour reclamation area will include a disposal location for the capital dredged material from the tug harbour and future maintenance dredge campaigns and will be partially lined as per the existing (approved) Berth 7 reclamation disposal area to minimise potential impacts to the marine environment.

All dredging campaigns have been modelled and will be undertaken as discrete packages of work (i.e. dredging from different modelled scenarios will not be undertaken concurrently).

The PMaxP also involves maintenance dredging adjacent Berth 1 and based on recent success with the Port maintenance dredge campaigns utilising a trailing suction hopper dredge, the same method will be used for the PMaxP maintenance dredge at Berth 1. This dredge method may also be utilised for the capital dredge required in the tug harbour because only the overlying sandy sediments are required to be dredged, not hard rock. Due to the timing of the campaign and construction schedule of PMaxP, the Berth 1 maintenance dredged material will be disposed to the existing Berth 7 reclamation area (approved in 2001 for disposal of potentially contaminated harbour sediments).

The PMaxP will employ best practicable measures to protect, enhance, avoid where possible, and otherwise abate, minimise, rehabilitate, monitor and manage impacts on the marine environment. A Marine Construction Environmental Management Plan (MCEMP; SLR 2025a) has been developed to define the required controls for the marine construction activities, including dredging, piling, and land reclamation. A DEMMP has also been developed with clear environmental objectives aimed at the protection of the marine environment. The DEMMP (SLR 2025b) details the water quality monitoring program to be undertaken during the dredging campaigns.

Rehabilitation and offsets are not applicable to this factor.

7.5 Significance of Residual Impacts

While temporary impacts to MEQ are expected through an increase in SSC as a result of dredging, the proposed dredge methodology is expected to minimise these impacts, both in the magnitude and extent of the resultant dredge plume. The detailed plume modelling undertaken for the project indicates that the plume is likely to dissipate and return to ambient conditions within weeks of the cessation of the main capital dredge activities (B1-B6-B8/9), with shorter recovery timeframes expected for the shorter duration capital (tug harbour) and maintenance (B1) dredge activities.

Residual impacts to other factors are considered under the relevant factor section.

Given the expected localised and temporary nature of the potential impacts, it is expected that residual impacts to the quality of the marine environment will not be significant.

7.6 Environmental Outcomes

With implementation of the revised dredge methodology and the controls detailed in the DEMMP and MCEMP, it is expected that the PMaxP can be implemented and managed to ensure the environmental quality objectives are achieved and hence the identified environment values are protected.

The key environmental outcome related to MEQ is ‘PMaxP will not result in a release of contaminants that can cause harm to the marine environment’.

8.0 Impact Assessment – Benthic Communities and Habitats

8.1 EPA Policy and Guidance

The policy documentation utilised to inform the assessment of this factor includes:

- Environmental Factor Guideline: Benthic Communities and Habitats (EPA, 2016c)
- Technical Guidance: Protection of Benthic Communities and Habitats (EPA, 2016d)
- Technical Guidance: Environmental impact assessment of marine dredging proposals (EPA, 2021)

The environmental objective for this factor is *to protect benthic communities and habitats so that biological diversity and ecological integrity are maintained*.

8.2 Receiving Environment

8.2.1 Regional Scale

The area in and around Geraldton is considered to have a high marine and terrestrial biodiversity value. The limestone substrate, which underlies the majority of Champion Bay and its surroundings, stands out as a prominent feature (AECOM, 2020). This substrate plays a crucial role in shaping the Bay's epibenthic communities. Factors such as the presence of limestone reefs, their relief and profile, and the depth of sand overlaying the reef all contribute to the ecological dynamics of the area.

Additionally, exposure to prevailing south-westerly swells and seas significantly influences sand movement within the Bay. Whether sand is deposited, eroded, or frequently resuspended due to wave and tidal water action, determines the specific types of epibenthic communities that thrive in different areas. Notably, habitats with similar depths, topography, and substrate slope exhibit distinct characteristics based on their varying levels of protection from swell and waves. The sand moves over seasonal and long-term timeframes in response to seasonal hydrodynamic influences and hence distribution of benthic communities in Champion Bay is highly variable over time in response to shifting sands and seagrass/macroalgae growth characteristics are variable on a seasonal basis due to variable turbulence and light availability (RHDHV 2023).

The marine habitats mapped for the PMaxP in February 2024 (SLR 2024b; Appendix E) are largely comparable to previous BCH mapping undertaken during technical studies for the PEP (approved proposal). URS (2001) identified no habitats or species that are confined in their distribution to the Champion Bay – Port Grey area, identifying their distributions as occurring widely throughout the Central West Coast Region. Whilst this is still the case, seagrasses, and to a lesser extent macroalgae, are still widely considered as important habitats as they provide a variety of ecological functions.

The DBCA Species and Communities Program has listed *Posidonia australis* meadows as a Priority 3(i) ecological community (PEC) for further survey, definition, and evaluation. P3(i) PECs are defined as:

"Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation." (DBCA 2023a)

The community consists of the assemblage of plants, animals and micro-organisms associated with seagrass meadows dominated by species from the *P. australis* complex and occurs as continuous to patchy seagrass meadows dominated by species from the *Posidonia australis* complex; *P. angustifolia*, *P. australis* and *P. sinuosa*.

This community is distributed in temperate Australian waters between Shark Bay (25°S) on the west coast, across southern Australia to Wallis Lake (32°S) on the east coast, around Bass Strait islands and along the north coast of Tasmania (DBCA 2023b). Lavery et. al. (2019) identifies seagrasses, including those within *P. australis* meadows, as offering the following ecological services:

- Contribute to the base of the marine food web;
- Provide habitats important for nursery areas for a variety of species;
- Provide foraging and shelter for a variety of species, including western rock lobster (*Panulirus cygnus*);
- Play an important role in recycling nutrients, filtering water and sequestering carbon;
- Protect the coastline form erosion; and
- Provide habitat for a variety of sand forming organisms, contributing vast amounts of sediments into the natural system.

Therefore, seagrasses warrant special protection during marine activities which may impact their ability to deliver these functions. The seagrass species identified have been widely mapped in their distribution, not only within Champion Bay, but also further north and south.

8.2.1.1 Local Assessment Unit

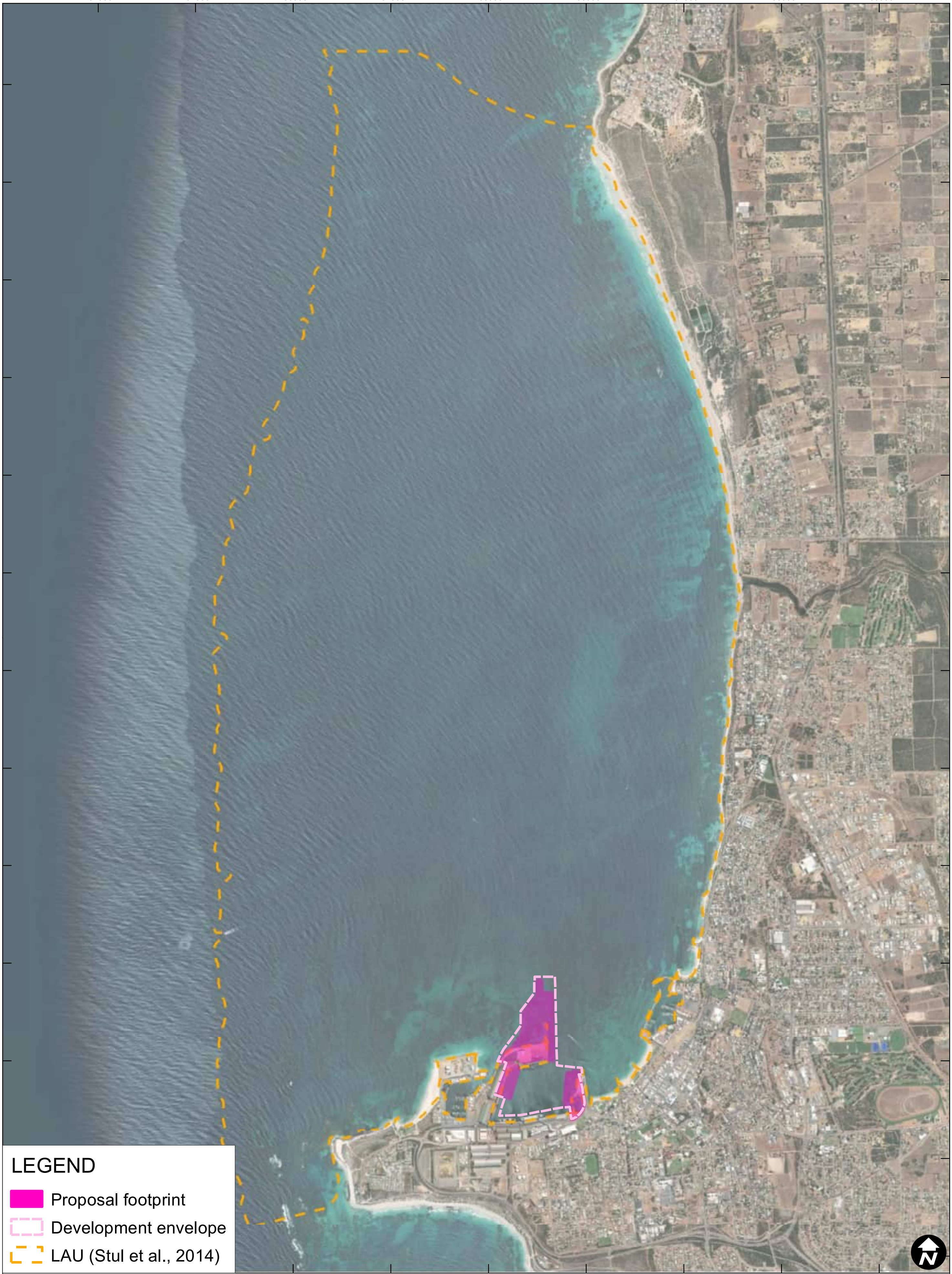
In accordance with Section 4.2 of *Technical Guidance: Protection of Benthic Communities and Habitats* (EPA, 2016d), the definition of local assessment units (LAUs) are required to determine cumulative losses of BCH. The LAUs are location specific, defined on a case-by-case basis and consider local physical and biological aspects of the marine environment and are typically ~5,000 ha in size.

The LAU considered suitable for the PMaxP has previously been defined based on a Department of Transport secondary sediment cell R07F15, defined for Point Moore to Glenfield Beach (Stul et. al., 2014) based on the following aspects:

- The spatial area of the sediment cell is approximately 48.3 km^2 (and hence aligned with the typical size of an LAU (see Section 14.6);
- The spatial boundary is comparable to the modelling domain and the habitat assessment work completed for the PMaxP;
- The sediment cell is defined by the offshore 15 m bathymetric depth which incorporates the high relief reef system extending north to south between Point Moore and Drummonds Point marking the western extent of Champion Bay; and
- The sediment cell classification considered reef systems, substrate types, water circulation, wave exposure and currents occurring when defining the boundary.

Sediment cells define natural units encompassing marine and terrestrial environments as an interactive system, promoting integrated coastal management where the component of each cell is considered holistically as an interactive system (O2 Marine 2022a).

The LAU is illustrated in **Figure 8-1**.



\\AU.SLR.Local\Corporate\Projects-SLR\675-PER\675-PER\675.072500.00001 MWPA PMaxP - Marine\06 SLR Data\01 CADGIS\GIS\640_30470_F022_LAU.mxd

Scale: 1:50,000 at A4
Coordinate System: GDA2020 MGA Zone 50

Date Drawn: 23-Aug-2024
Project Number: 675.072500

Data Source:
Nearmap, 23 February 2024

SLR

BCH LOCAL ASSESSMENT UNIT

FIGURE 8-1

There are no areas of marine conservation significance within the LAU. The closest areas of marine biological conservation significance include:

- Abrolhos Australian Marine Park, approximately 21 km south-west of the LAU to the closest corner of the marine park extent
- Abrolhos Islands Fish Habitat Protection Area[3], approximately 46 km west of the LAU
- Houtman Abrolhos Islands National Park[4], approximately 51 km west of the LAU
- Hutt Lagoon System[5], approximately 61 km north-west of the LAU.

The closest areas of marine heritage conservation significance include:

- Zuytdorp (1712/06/09), approximately 176 km north-west of the LAU.

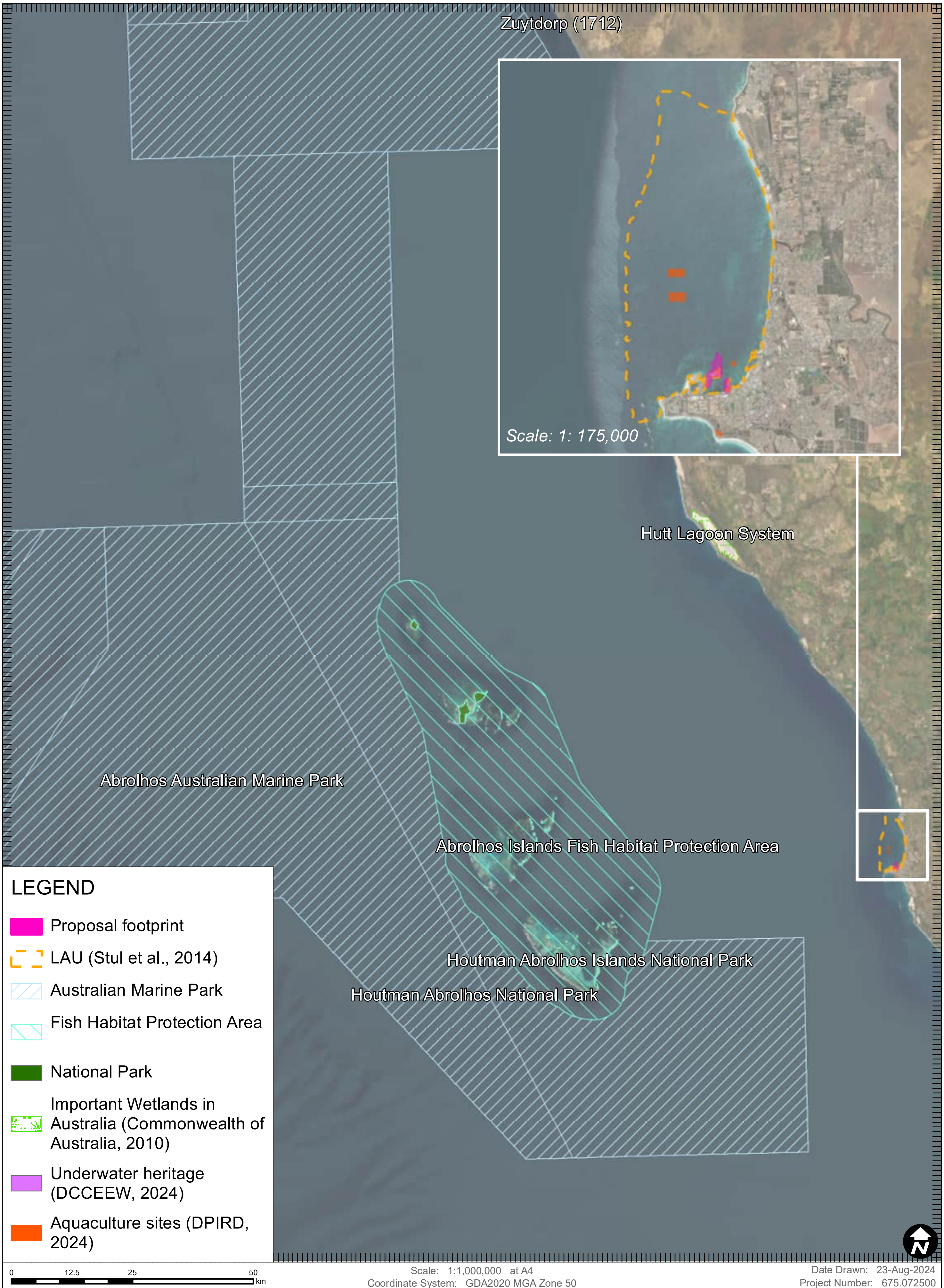
There are also three licensed aquaculture sites, two in Champion Bay, operated by Indian Ocean Fresh Australia Pty Ltd for a number of finfish species, and the Batavia Coast Maritime Institute (BCMI) at Separation Point on the southern side of the peninsula.

These areas are illustrated in **Figure 8-2**.

[3] Under the Western Australian *Fisheries Resources Management Act 1994*.

[4] Under the Western Australian *Reserves (National Parks and Conservation Parks) Act 2004*.

[5] Listed on the Directory of Important Wetlands Australia.



Data Source:
Nearmap, 23 February 2024

SLR

AREAS OF MARINE CONSERVATION SIGNIFICANCE

FIGURE 8-2

\\AU.SLR.Local\Corporate\Projects-SLR\675-PER\675-PER\675.072500.00001 MWPA PMaxP - Marine\06 SLR Data\01 CADGIS\GIS\640_30470_F023_ConservationTenure.mxd

8.2.2 Project Scale

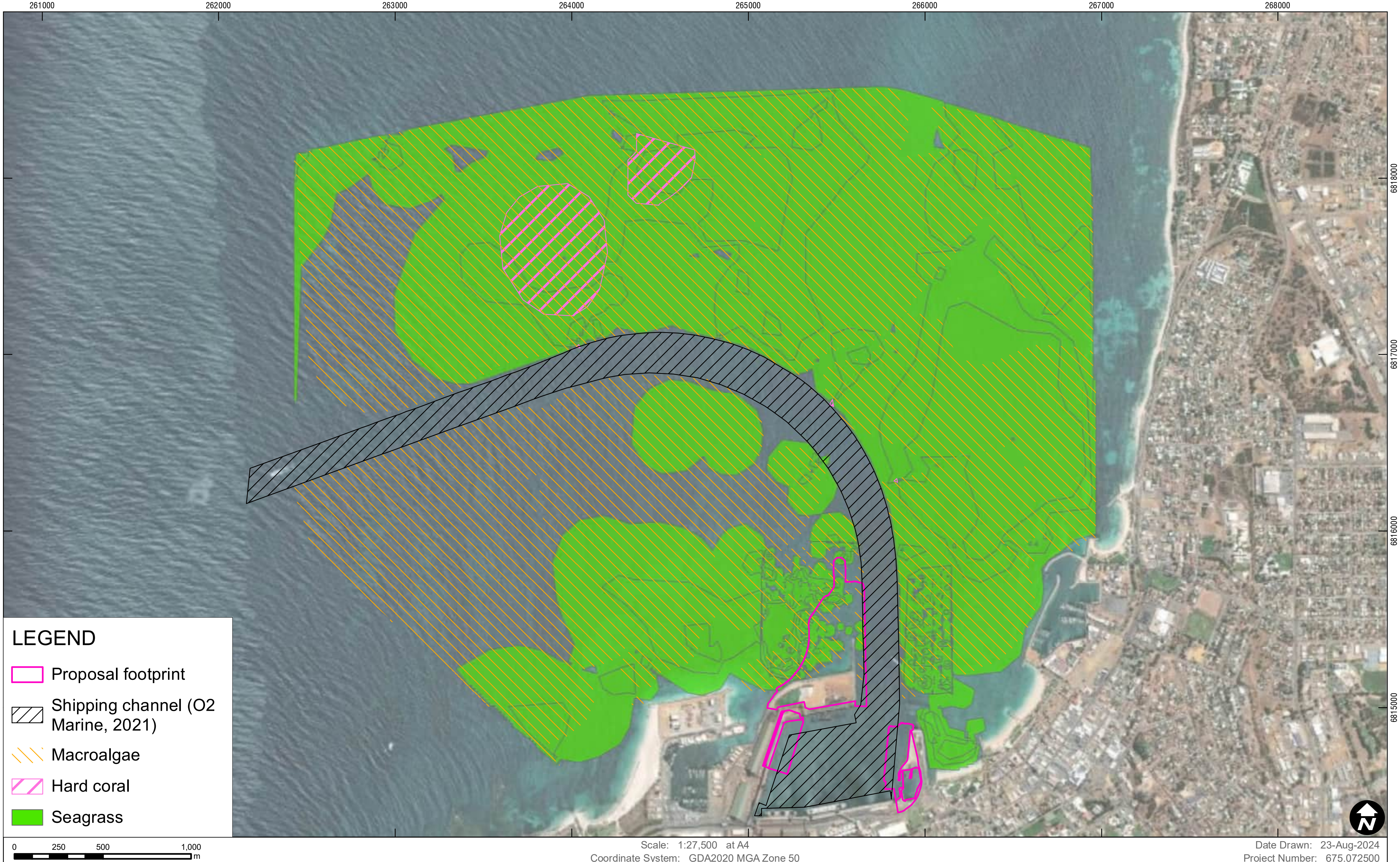
Historical studies of BCH that are relevant to the PMaxP are identified in **Table 8-1**. These studies were used to determine the pre-European extent and current extent of BCH in the LAU for the cumulative loss assessment (CLA; Appendix F).

Table 8-1 Historical BCH studies

Author (year)	Study
URS (2001)	Marine Habitats of Champion Bay, Port Grey and Geelvink Channel
AECOM (2020)	Benthic Habitat Mapping – Champion Bay and Surrounds
BMT (2021)	Seagrass Health Survey Report – Seagrass Communities in Champion Bay and Surroundings
BMT (2022)	Long Term Resilience of Seagrass Communities in Champion Bay
O2 Marine (2022b)	Benthic Communities and Habitat Assessment: MWPA Tourist Jetty

Contemporary mapping was conducted within the PMaxP footprint and wider Champion Bay during February 2024 to identify the type, extent and distribution of key BCH that have the potential to be directly or indirectly impacted by the PMaxP (SLR 2024b, Appendix E). The community assemblages recorded during the 2024 survey were similar to those reported in previous studies. The 2024 BCH mapping illustrated a more detailed distribution of these assemblages due to more extensive data coverage. The BCH Survey Report (SLR 2024b, Appendix E) presents the detailed methodology and descriptions of BCH. The distribution of BCH is illustrated in **Figure 8-3** and **Figure 8-4**.

The Port and shipping channel is considered void of benthic communities, and while there is soft sediment habitat, it is not feasible for these areas to support viable communities due to the nature of the regular, high degree of disturbance experienced in the Port and channel.



Scale: 1:27,500 at A4
Coordinate System: GDA2020 MGA Zone 50

Date Drawn: 23-Aug-2024
Project Number: 675.072500

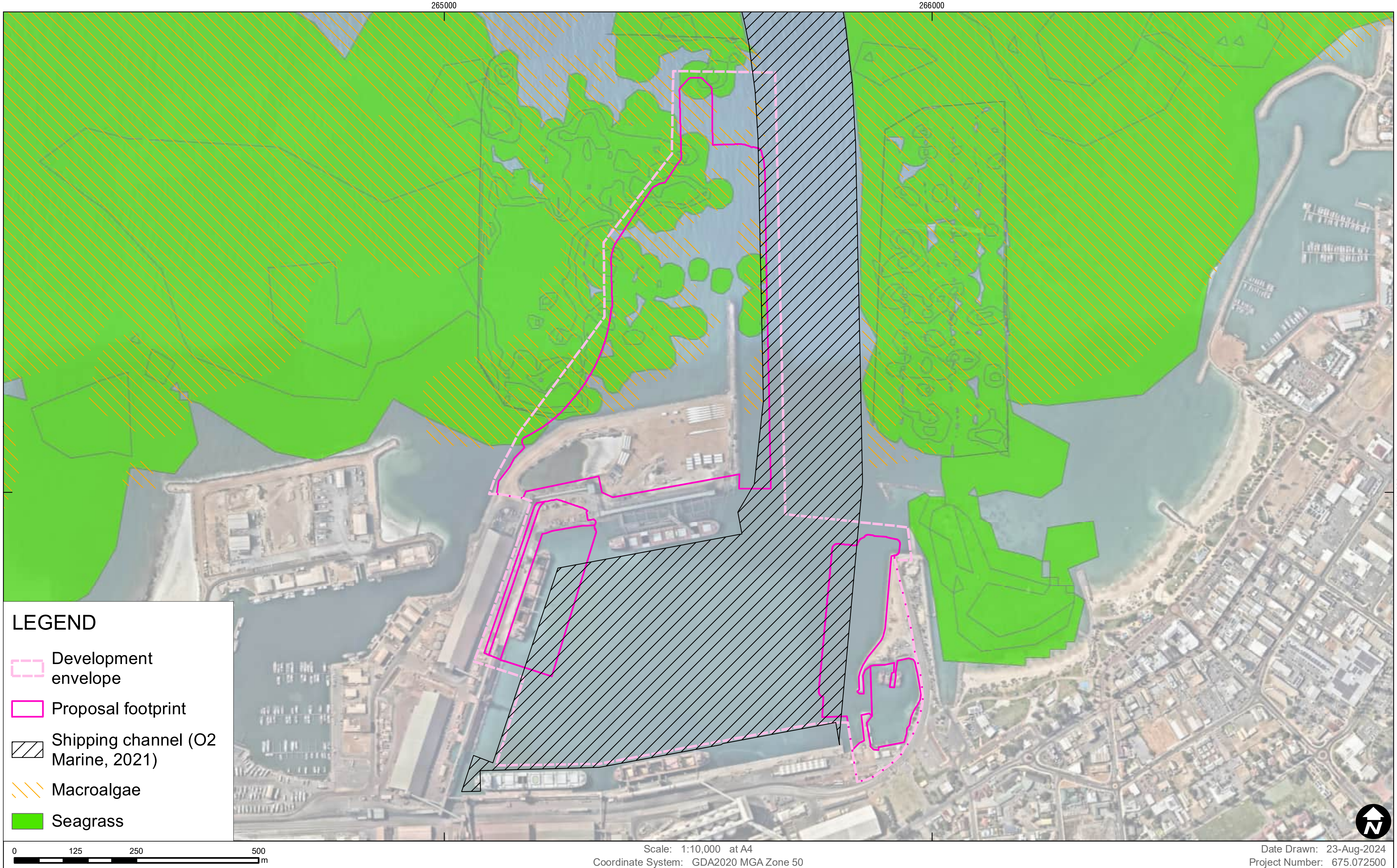
Data Source:
Esri, Maxar, Earthstar Geographics, and the GIS User Community

SLR

DISTRIBUTION OVERVIEW OF BCH MAPPED IN 2024

FIGURE 8-3

\\AU.SLR.Local\Corporate\Projects-SLR\675-PER\675-PER\675.072500.00001 MWPA PMaxP - Marine\06 SLR Data\01 CADGIS\GIS\640_30470_F026_BCHOverview.mxd



Scale: 1:10,000 at A4
Coordinate System: GDA2020 MGA Zone 50

Date Drawn: 23-Aug-2024
Project Number: 675.072500

Data Source:
Esri, Maxar, Earthstar Geographics, and the GIS User Community

SLR

BCH DISTRIBUTION IN THE PMAXP DEVELOPMENT ENVELOPE

FIGURE 8-4

\\AU.SLR.Local\Corporate\Projects-SLR\675-PER\675-PER\675.072500.00001 MWPA PMaxP - Marine\06 SLR Data\01 CADGIS\GIS\640_30470_F027_BCHinDE.mxd

8.3 Potential Environmental Impacts

Project activities and subsequent impacting pathways that have the potential to adversely affect BCH are presented in **Table 8-2**.

Table 8-2 Project activities that have the potential to affect BCH

Project activity	Impact pathway	Impact type
Dredging and infrastructure installation	Loss or permanent modification of BCH within the proposal footprint (i.e. dredge areas and NTH)	Direct (Section 8.3.1.1)
Dredging	Mobilisation of sediments leading to increased turbidity affecting BCH	Indirect (Section 8.3.2.1)
	Mobilisation of sediments leading to sedimentation affecting BCH	Indirect (Section 8.3.2.2)
Movement of vessel	Introduction/spread of marine pests that originate from project related vessel movements	Indirect (Section 8.3.2.3)

The direct and indirect BCH impacts been quantified in a CLA (refer Section 14.0 and Appendix F).

8.3.1 Direct Impact assessment

8.3.1.1 Dredging and infrastructure installation resulting in the loss or permanent modification of BCH within the proposal footprint (i.e. dredge areas and NTH)

The area of the PMaxP that has the potential to directly impact BCH is approximately 19 ha. This area of direct loss includes removal/disturbance of the seabed and shading of overhead structures. The construction of Berth 1 and extension of Berth 6 would only impact bare soft sediment habitat while the new tug harbour and Berth 8/9 would impact more diverse BCH, including low-medium density seagrass that are considered Priority 3(i) *P. australis* complex seagrass meadows.

Shading of BCH under the proposed wharf decks, physical dredging disturbance, elevated TSS and sedimentation within the ZoHI are assumed to result in the irreversible loss of all BCH except bare soft sediment/pavement with sand, no epibenthic macrobiota. Bare soft sediment in the following areas within the Proposal Footprint is not expected to be irreversibly impacted and will likely recover following construction completion:

- Under the wharf decks[6]
- In dredge footprints
- In areas between dredge footprints and the Tug Harbour seawall[7], and
- The ZoHI.

Bare soft sediment habitats generally lack the habitat complexity and biodiversity compared to other BCH, although infauna occurring in these habitats are closely linked to ecosystem functions by forming basal elements of many food webs (Gadd & Griffiths, 1977; Eyre &

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[6] Where wharf decks overly the seabed. We note that bare soft sediment/pavement with sand, no epibenthic macrobiota would be lost below the footprint of the piles however, these areas are considered proportionally negligible.

[7] These areas will not be dredged or have infrastructure installed but are included in the calculations conservatively as they are fragmented amongst disturbed areas.

Ferguson, 2005; Connell & Gillanders, 2007). Bare soft sediment communities are known to recover from physical disturbances as quickly as 64 days, depending on disturbance intensity and any subsequent sediment granulometry and organic content alterations (Dernie, et al., 2003a; Dernie, et al., 2003b). It is assumed bare soft sediment under the areas above would be recolonised and continue to be available following construction and will be considered in indirect impacts.

The direct impact on BCH has been outlined in **Table 8-3**. The equivalent legacy BCH category has been used to present this data in alignment with the CLA (Appendix F).

Table 8-3 Areas of directly impacted BCH within the Proposal Footprint and ZoHI

BCH category (SLR Consulting Pty Ltd, 2024)	Legacy BCH category (O2 Marine, 2022b)	(1) Pre-European extent (ha)	(2) Current extent (ha) [% pre-European extent]	(3) Historical loss/gain (ha)[8]	(4) (5) Irreversible loss/modification from PMaxP (ha) [% pre-European extent]	(6) Cumulative loss (ha) [% of pre-European extent][8]
Seagrass >1-25%	Pavement with sand, low density seagrass	175.42	158.62 [90.42]	-16.80	**2.00 [1.14]**	**-18.80 [10.72]**
Seagrass >25-50% Seagrass >50%	Pavement with sand, high density seagrass	559.69	328.15 [58.63]	-231.54	**0.54 [0.10]**	**-232.08 [41.46]**
Macroalgae >1-25% Macroalgae >25-50% Macroalgae >50%	Pavement with sand, macroalgae	244.55	209.94 [85.85]	-34.61	**3.84 [1.57]**	**-38.45 [15.72]**
Seagrass >25-50% and Macroalgae >1-25% Seagrass >50% and Macroalgae >1-25% Seagrass >50% and Macroalgae >25-50%	Pavement with shallow sand, seagrass dominant	860.40	830.33 [96.51]	-30.07	**0.65 [0.76]**	**-30.72 [3.57]**
Seagrass >1-25% and Macroalgae >1-25% Seagrass >1-25% and Macroalgae >25-50% Seagrass >25-50% and Macroalgae >25-50% Seagrass >1-25% and Macroalgae >50% Seagrass >25-50% and Macroalgae >50% Seagrass >50% and Macroalgae >50%	Low profile reef with sand, seagrass and macroalgae	807.22	806.99 [99.97]	-0.23	**4.47 [0.55]**	**-4.70 [0.58]**
Bare soft sediment	Pavement with sand, no epibenthic macrobiota	26.37	74.92 [284.11]	+48.55	**7.13 [27.03]**	**+41.42 [157.07][9]**
				TOTALS	**18.63 ha**	**-283.33 ha**

[8] Losses are expressed as negative areas while gains are expressed as positive areas.

[9] Approved historical disturbances on bare soft sediment/pavement with sand, no epibenthic macrobiota has resulted in an increase in area in the LAU compared to pre-European estimates.

8.3.2 Indirect impact assessment

8.3.2.1 Dredging resulting in the mobilisation of sediments leading to increased turbidity affecting BCH

Mixed communities of various seagrass species and corals exist throughout the LAU and proximal to the Port (SLR 2024b, Appendix E). The benthic communities present, particularly seagrass, can be negatively affected by increases in turbidity due to dredging activities primarily due to reduced light availability. Sufficient information to assess the potential impacts of dredge derived SSC on light attenuation was not available for this assessment. As a result, the areas within the LAU that could be influenced by increases in dredge derived SSC were identified based on the criteria outlined in **Table 8-4** which are conservatively derived from an assessment of the ambient data collected for the PMaxP and a literature review of the Western Australian Marine Science Institute (WAMSI) Dredge Science Node technical papers.

Table 8-4 Impact zone criteria for BCH within the LAU

Impact Zone~	Definition (as defined by EPA, 2016)	SSC criteria	Net sedimentation criteria
ZoI	The area within which changes in environmental quality associated with dredge plumes are predicted and anticipated during the dredging operations, but where these changes would not result in a detectible impact on benthic biota.	≥2 mg/L for at least one (1) time step during a scenario	≥0.4 cm and <2 cm
ZoMI	The area within which predicted impacts on benthic organisms are recoverable within a period of five years following completion of the dredging activities. This zone abuts, and lies immediately outside of, the zone of high impact.	≥2 mg/L over 18 continuous days	≥2 cm and <3 cm
ZoHI	The area where impacts on benthic communities or habitats are predicted to be irreversible. The term irreversible means 'lacking a capacity to return or recover to a state resembling that prior to being impacted within a timeframe of five years or less'. Areas within and immediately adjacent to proposed dredge and disposal sites are typically within zones of high impact.	≥2 mg/L for continuous 90 days	≥3 cm

~ZoI = Zone of Influence, ZoMI = Zone of Moderate Impact and ZoHI = Zone of High Impact

The potential increase in dredge derived SSC was assessed using a calibrated and validated numerical hydrodynamic and wave modelling tools, and suspended sediment transport tool (informed by the calibrated and validated hydrodynamic and wave modelling tools) (see Section 7.3.1.1 and Appendix D).

To assist in determining the potential impacts of dredging, numerical modelling was partitioned into the following dredge scenarios and associated timing and duration of each scenario based on dredge expert assessment of the methods to be used and volume of material to be dredged:

- Scenario 1: Maintenance dredging at the new Berth 1 (January - dredge duration approx. three (3) days)
- Scenario 2: Capital dredging at Berths 1, 6 and 8/9, (April commencement - dredge duration approx. 32 weeks)
- Scenario 3: Capital dredging at the New Tug Harbour (NTH) (April or May - dredge duration approx. seven (7) days).

A detailed description of the outcomes of these dredge scenarios are presented in Section 7.3.1.1 and Appendix D.

Based on the outcomes of the numerical modelling for each scenario, the areas within the LAU that were predicted to represent the ZoI, ZoMI and ZoHI as per criteria described in **Table 8-4** were identified as follows (noting these areas are derived purely as a function of changes to MEQ and not the dredge or marine infrastructure footprint):

- Scenario 1 (**Figure 8-5** and **Figure 8-6**)
- Scenario 2 (**Figure 8-7** and **Figure 8-8**)
- Scenario 3 (April - **Figure 8-9** and **Figure 8-10**, May – **Figure 8-11** and **Figure** 8-12).

The direct impact on BCH has been outlined in **Table 8-3**. The equivalent legacy BCH category has been used to present this data in alignment with the CLA (Appendix F).

Table 8-5 Areas of indirectly (reversibly) impacted BCH within the Proposal Footprint, ZoHI and ZoMI

BCH category (SLR Consulting Pty Ltd, 2024)	Legacy BCH category (O2 Marine, 2022b)	(1) Pre-European extent (ha)	(2) Current extent (ha) [% pre-European extent]	(3) Historical loss/gain (ha)[10]	(4) (5) Reversible impacts from PMaxP (ha) [% pre-European extent]
Seagrass >1-25%	Pavement with sand, low density seagrass	175.42	158.62 [90.42]	-16.80	**5.51 [3.14]**
Seagrass >25-50%	Pavement with sand, high density seagrass	559.69	328.15 [58.63]	-231.54	**4.70 [0.78]**
Seagrass >50%					
Macroalgae >1-25%	Pavement with sand, macroalgae	244.55	209.94 [85.85]	-34.61	**0.20 [0.01]**
Macroalgae >25-50%					
Macroalgae >50%					

[10] Losses are expressed as negative areas while gains are expressed as positive areas.

BCH category (SLR Consulting Pty Ltd, 2024)	Legacy BCH category (O2 Marine, 2022b)	(1) Pre-European extent (ha)	(2) Current extent (ha) [% pre-European extent]	(3) Historical loss/gain (ha)[10]	(4) (5) Reversible impacts from PMaxP (ha) [% pre-European extent]
Seagrass >25-50% and Macroalgae >1-25%	Pavement with shallow sand, seagrass dominant	860.40	830.33 [96.51]	-30.07	**0.00 [0.00]**
Seagrass >50% and Macroalgae >1-25%					
Seagrass >50% and Macroalgae >25-50%					
Seagrass >1-25% and Macroalgae >1-25%	Low profile reef with sand, seagrass and macroalgae	807.22	806.99 [99.97]	-0.23	**0.00 [0.00]**
Seagrass >1-25% and Macroalgae >25-50%					
Seagrass >25-50% and Macroalgae >25-50%					
Seagrass >1-25% and Macroalgae >50%					
Seagrass >25-50% and Macroalgae >50%					
Seagrass >50% and Macroalgae >50%					
Bare soft sediment	Pavement with sand, no epibenthic macrobiota	26.37	74.92 [284.11]	+48.55	**64.01 [242.74]**[11]
				TOTALS	**74.42 ha**

[11] Approved historical disturbances on bare soft sediment/pavement with sand, no epibenthic macrobiota has resulted in an increase in area in the LAU compared to pre-European estimates.

Figure 8-5 Zones of potential impact to BCH during Scenario 1 dredge activities based on SSC criteria proximal to the Port

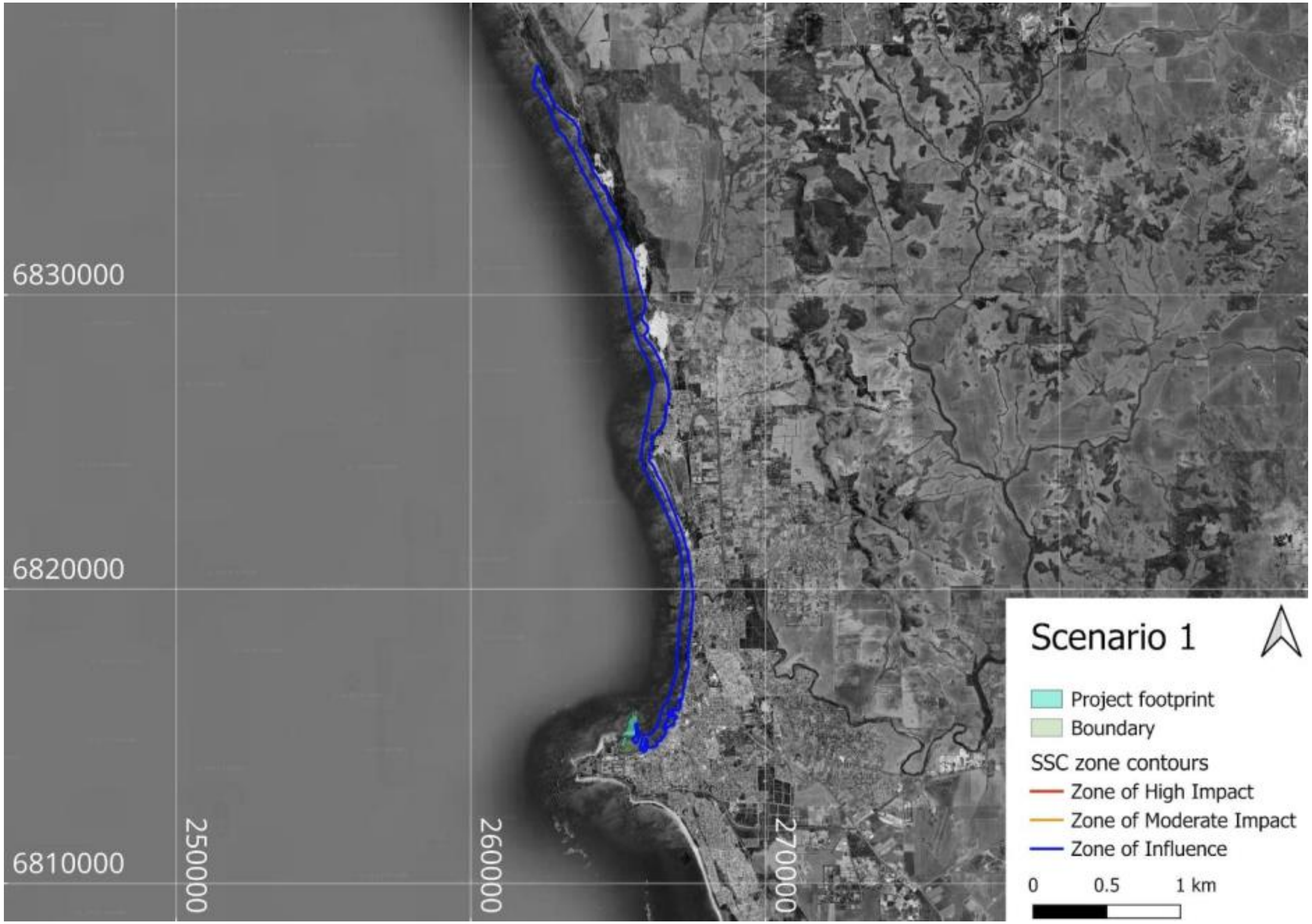


Figure 8-6 Zones of potential impact to BCH during Scenario 1 dredge activities based on SSC criteria

Figure 8-7 Zones of potential impact to BCH during Scenario 2 dredge activities based on SSC criteria proximal to the Port

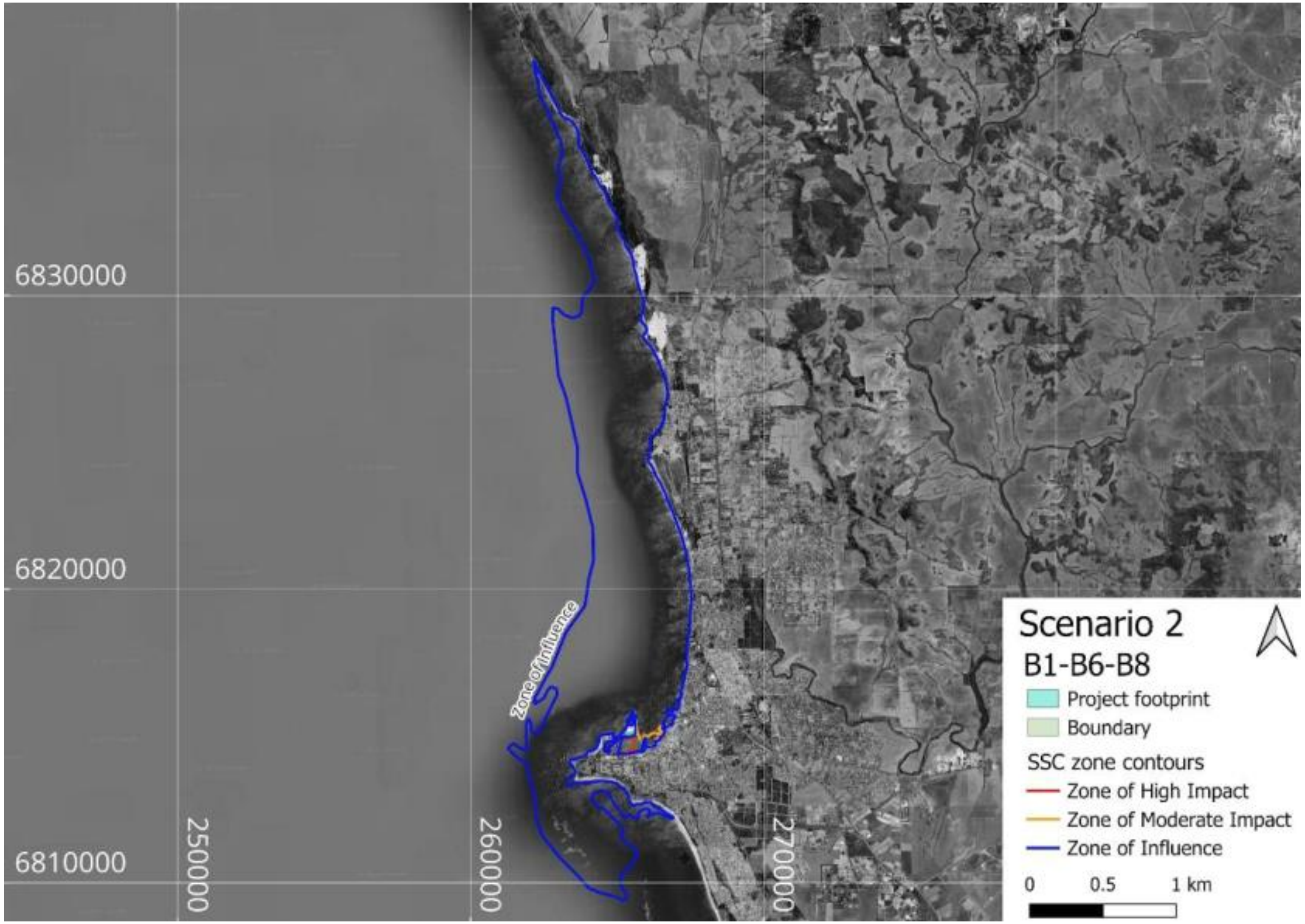


Figure 8-8 Zones of potential impact to BCH during Scenario 2 dredge activities based on SSC criteria

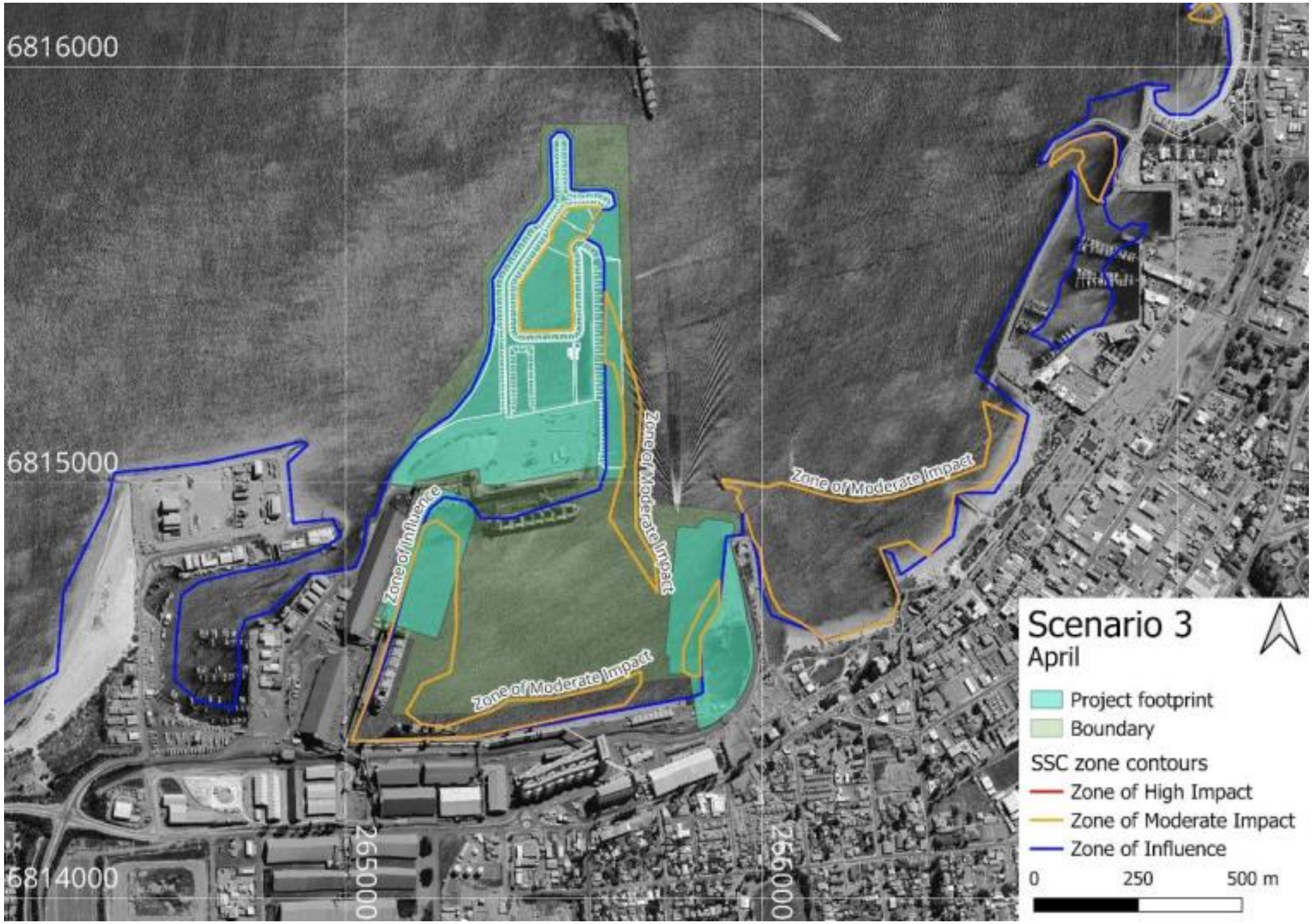


Figure 8-9 Zones of potential impact to BCH during Scenario 3 dredge activities in April based on SSC criteria proximal to the Port

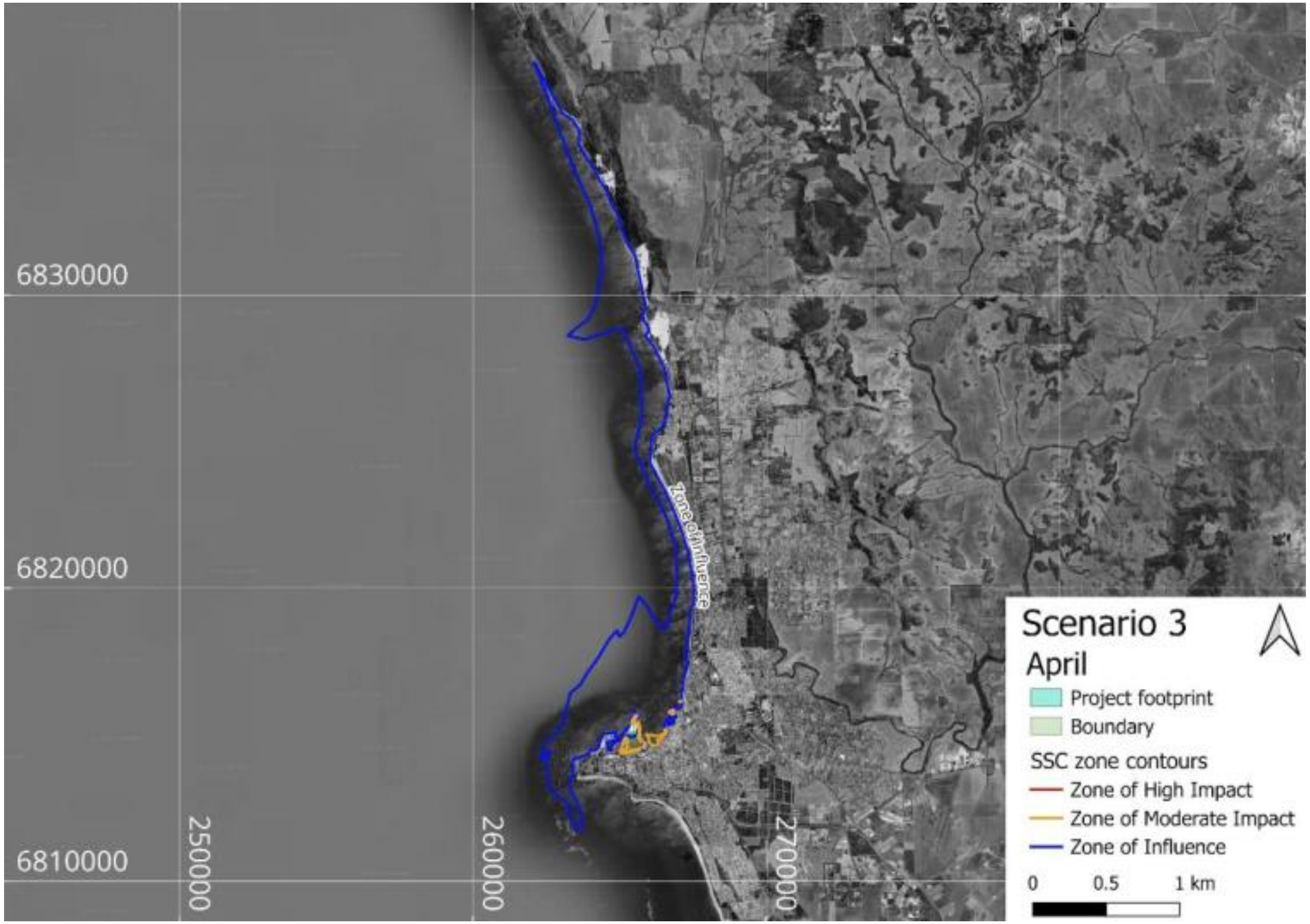


Figure 8-10 Zones of potential impact to BCH during Scenario 3 dredge activities in April based on SSC criteria

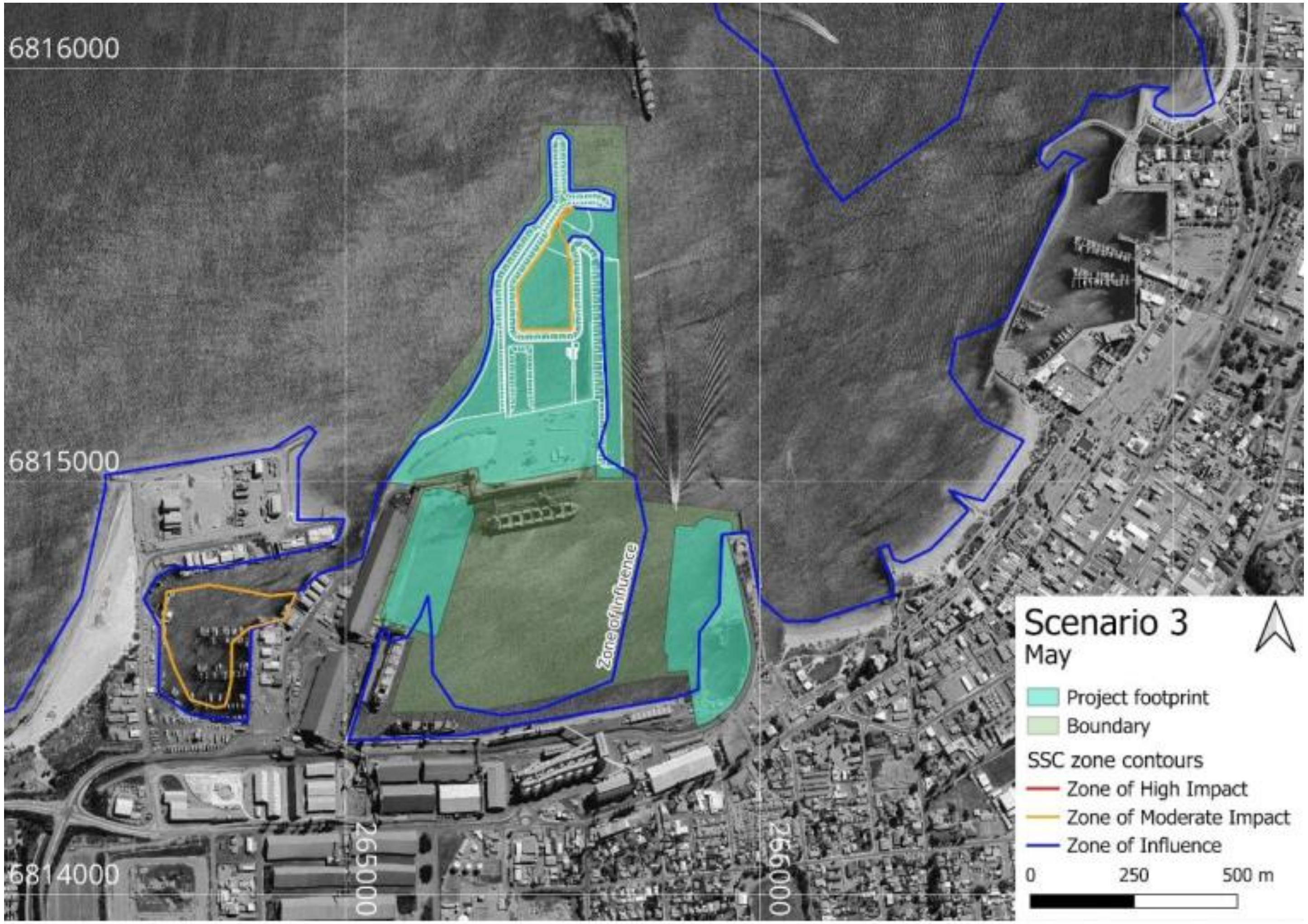


Figure 8-11 Zones of potential impact to BCH during Scenario 3 dredge activities in May based on SSC criteria proximal to the Port

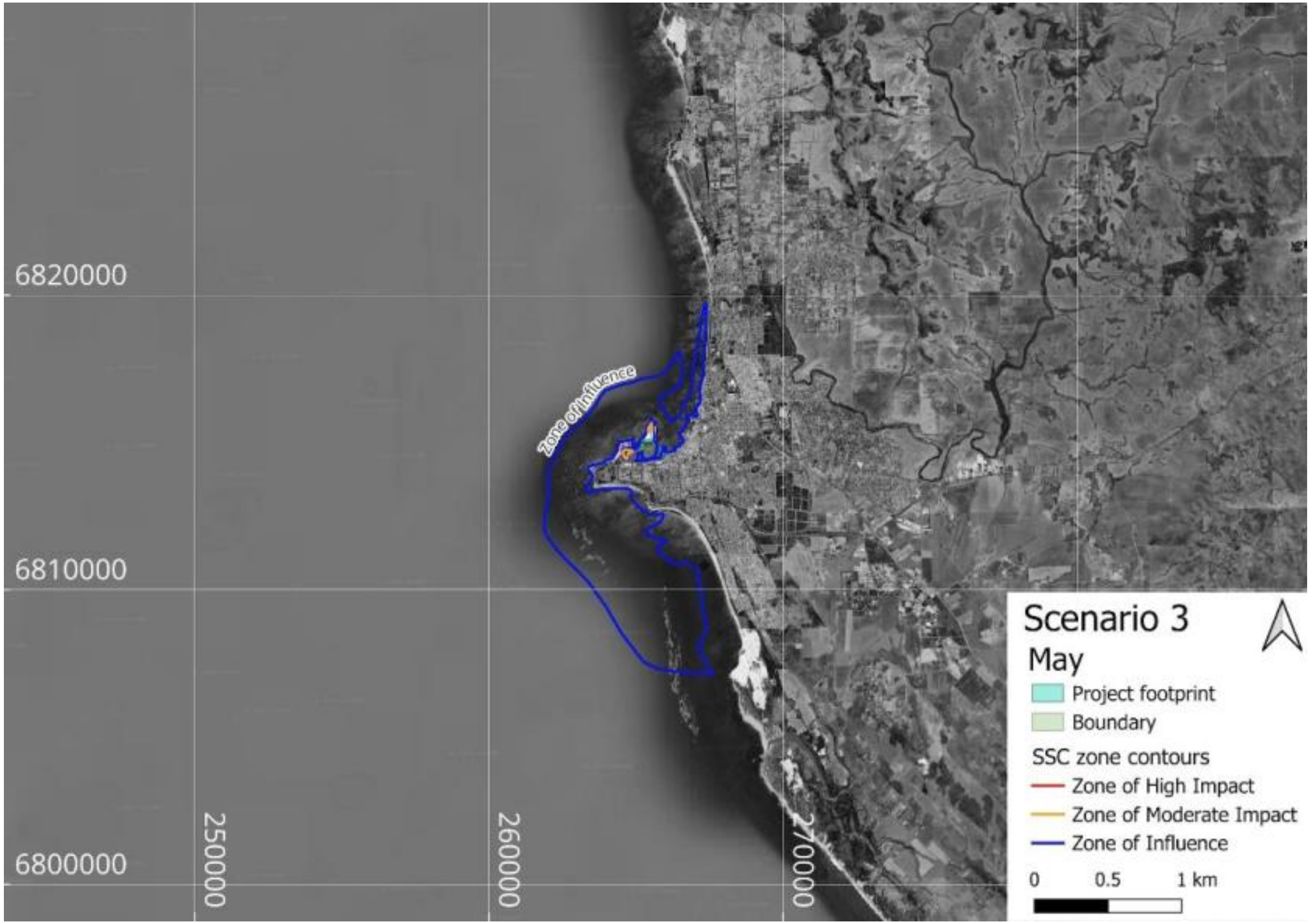


Figure 8-12 Zones of potential impact to BCH during Scenario 3 dredge activities in May based on SSC criteria

Scenario 1: Maintenance dredging at the new Berth 1 (January, dredge duration approximately three days)

During Scenario 1 dredging activities only a ZoI was identified based on the SSC criteria outlined in **Table 8-4**. This zone was predicted to occur in the vicinity of Berth 7, Berth 8/9 as well as around Berth 1 extending northward generally in the nearshore area past Batavia Coast Marina (**Figure 8-5**). BCH mapping indicates that seagrass is present within the area proximal to Seal Rocks and shoreward towards Town Beach within the predicted ZoI (SLR 2024b). Seagrass is likely to also occur in other areas of the ZoI based on aerial imagery and likely availability of potentially suitable habitats.

Detailed timeseries assessment of the dredge derived SSC within this ZoI at a two location L1 (see **Figure 7-9**) and Point A (see **Figure 7-10**) indicate that the although periods of increase SSC are predicted to occur during the Scenario 1 dredging activities, these are short in duration and typically less than that experienced naturally within Champion Bay (**Figure 7-13** and **Figure 7-14** respectively).

It is considered unlikely Scenario 1 dredging activities that increase SSC will represent a significant impact to BCH within the LAU.

Scenario 2: Capital dredging at Berths 1, 6, and 8/9 (April commencement, dredge duration approximately 32 weeks)

During Scenario 2 dredging activities, ZoHI, ZoMI and ZoI were predicted to occur within the LAU based on the criteria outlined in **Table 8-4**. The ZoHI was predicted to occur within the Port adjacent to Berth 6 and 7 as well as in the centre of the port turning basin (**Figure 8-7**). It is not anticipated that seagrass are present within the predicted ZoHI. Benthic infauna are likely to be present within the ZoHI however they are unlikely to be significantly impacted by the increase in SSC during the period of dredging and are likely to recolonise the area following cessation of dredging.

A ZoMI was predicted to occur within the remainder of the Port and extend into the NTH and along Berth 8/9. A ZoMI was also predicted to occur near Town Beach as well as within the Batavia Coast Marina. Seagrass is likely to be present within the ZoMI that is predicted to occur near Town Beach however it is unknown if seagrasses are present throughout Batavia Coast Marina. Detailed timeseries assessment of the dredge derived SSC within this ZoMI at Town Beach (**Figure 8-13**) indicate that although periods of increased SSC is predicted to occur above the ZoMI SSC criterion of ≥2 mg/L over 18 continuous days, this criterion has only been exceeded on two occasions at the beginning of the dredging of B1 and B6 and then at the beginning of B8 dredging over the estimated 32 week duration of the dredge activities. Each of these exceedances have been followed by a substantial reduction in predicted SSC for weeks or multiple days prior to periods of short-term episodic increases that do not exceed the ZoMI SSC criterion (**Figure 8-13**).

The timeseries predicted SSC for the Batavia Coast Marina generally mirror the results predicted for Town Beach (**Figure 8-14**). The ZoMI SSC criterion is predicted to be exceeded on two occasions at the beginning of the dredging of B1 and B6 and then at the beginning of B8 dredging over the estimated 32-week duration of the dredge activities. The predicted SSC within the ZoMI are generally comparable to natural conditions that have been recorded throughout Champion Bay (**Figure 7-13**).

Should the limited period of exposure to SSC that exceed the ZoMI SSC criterion result in impacts to seagrasses, it is anticipated that those seagrasses would likely recover following the cessation of dredging. As such it is considered unlikely Scenario 2 dredging activities that increase SSC will represent a significant irreversible impact to BCH within the LAU.

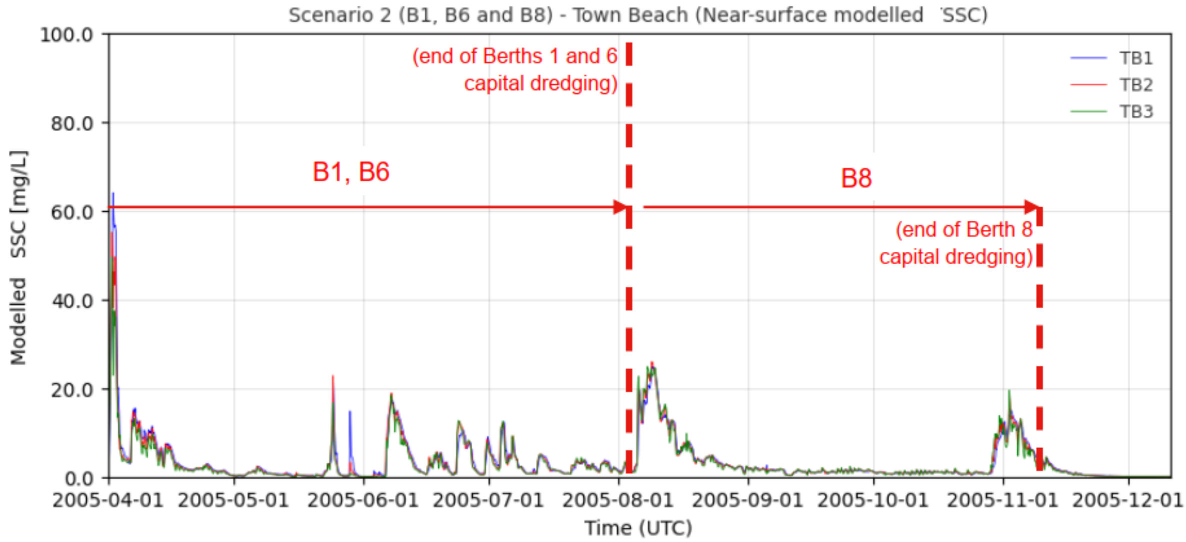


Figure 8-13 Time series of predicted SSC at Town Beach during Scenario 2 dredging

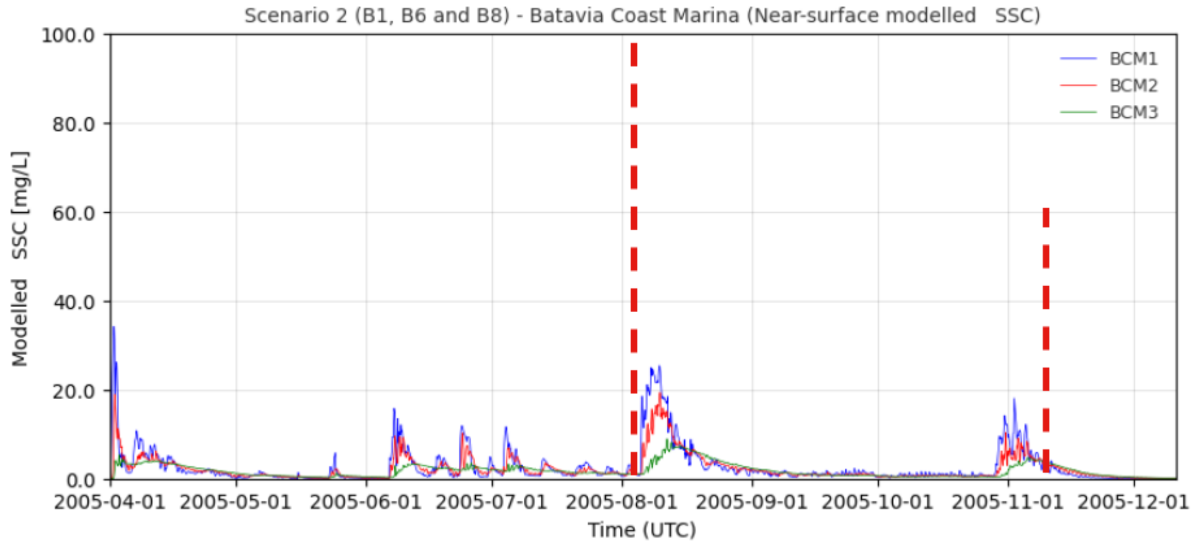


Figure 8-14 Time series of predicted SSC at Batavia Marina during Scenario 2 dredging

Scenario 3: Capital dredging at the New Tug Harbour (April or May, dredge duration approximately seven days)

During Scenario 3 dredging activities modelled to occur in April or May, ZoMI and ZoI were predicted to occur within the LAU based on the criteria outlined in **Table 8-4**. Outside the direct dredge footprint, no ZoHI was predicted to occur as a result of Scenario 3 dredging activities occurring during April or May (**Figure 8-9** and **Figure 8-11** respectively).

During the April Scenario 3 dredge period, it is predicted that a ZoMI would occur within the Port and Town Beach, at the entrance to Batavia Coast Marina and the northern end of AJ's Beach (**Figure 8-9**). Seagrass is likely to be present within the ZoMI that is predicted to occur near Town Beach and the northern end of AJ's Beach; however, it is unlikely seagrass is present adjacent to Batavia Coast Marina (although not confirmed). Detailed timeseries assessment of the dredge derived SSC within this ZoMI at Town Beach and AJ's Beach (**Figure 8-15**) indicate that the periods of increased turbidity exceeding the ZoMI SSC criterion occurs following the cessation of dredging when mobilised sediments dissipate

(**Figure** 8-15). Modelling predicts that SSC will return to below 10 mg/L five days following the initial increases experienced at both Town Bean and AJ's Beach.

During the May Scenario 3 dredge period, it is predicted that a ZoMI would occur within the NTH and FBH (**Figure 8-11**). Seagrass is unlikely to be present within the FBH (although not confirmed) and is expected to be removed from the NTH footprint. It is therefore unlikely there will be an impact to this receptor due to Scenario 3. Benthic infauna are predicted to recolonise the soft sediment following the cessation of Scenario 3 dredging.

It is considered unlikely Scenario 3 dredging activities that increase SSC will represent a significant irreversible impact to BCH within the LAU.

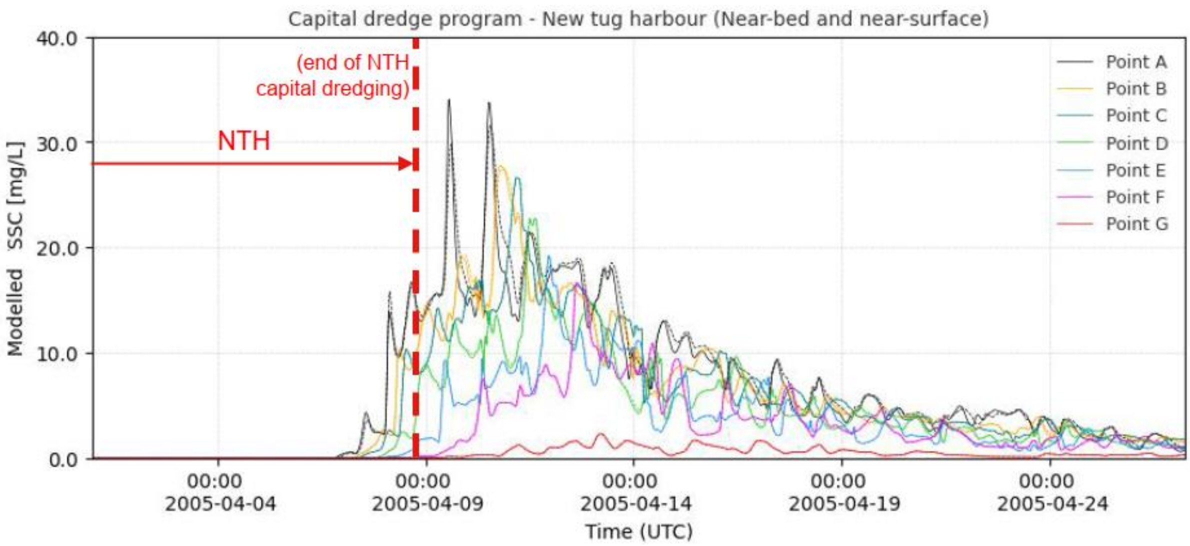


Figure 8-15 Time series of predicted SSC at Town Beach (Point B) and AJ's Beach (Point B) during Scenario 3 April dredging

8.3.2.2 Dredging resulting in the mobilisation of sediments leading to sedimentation affecting BCH

Sedimentation associated with the mobilisation of sediments during each of the dredging scenarios has the potential to negatively impact BCH through pathways such as (but not limited to) the physical burial of organisms, smothering that causes physiological stress and changes to the physical characteristics of the sediments present which can alter the diversity and abundance of infauna. Net sedimentation criteria to determine the area over which sedimentation may influence BCH are presented in **Table 8-4**.

Scenario 1: Maintenance dredging at the new Berth 1 (January, dredge duration approximately three days)

During Scenario 1 dredging activities, the models predict that high rates of sedimentation will occur near the dredging locations but will be spatially isolated to within the Port and the vicinity to the east of the Port entrance (within the Project DE). The total bed thickness of sedimentation is predicted to be high (above 2 m) to the southern portion of Berth 1, but sedimentation is isolated to the direct vicinity of dredging and the majority of the Port is predicted to have dredging induced sedimentation of less than 0.03 m (**Figure 8-16**). Sedimentation of between 0.004 m greater than 0.02 m which based on criteria presented in **Table 8-4** is considered a ZoI is predicted to occur outside the Port except to the northeast of the Berth 1 maintenance dredging area and extend eastward past Seal Rocks (**Figure** 8-17). The predicted ZoMI from sedimentation during Scenario 1 dredging activities extends to the northeast of the dredge area while a ZoHI is predicted to occur within the dredge area (**Figure 8-17**). Within the ZoHI the area is dominated by bare soft sediment habitat while some seagrass is likely to be present within the ZoMI and ZoI (SLR 2024). It is not predicted that dredging will result in irreversible impacts to BCH.

Scenario 2: Capital dredging at Berths 1, 6, and 8/9 (April commencement, dredge duration approximately 32 weeks)

During Scenario 2 dredging activities the models predict that sedimentation will occur near the dredging locations and will be spatially isolated to within the Port and New Tug Harbour and their immediate vicinity (within the Project DE). The total bed thickness of sedimentation is typically predicted to be less than 0.5 m (**Figure 8-18**). Sedimentation of between 0.004 and 0.02 m representing a ZoI for the Scenario 2 dredge activities is predicted to occur throughout the majority of the Port and DE as well as in the vicinity of and marginally east Seal Rocks (**Figure 8-19**). ZoMI and ZoHI are predicted to occur close to each of the dredge areas (**Figure 8-19**). The BCH within the ZoMI and ZoHI likely consists of bare soft sediments and therefore sedimentation in these areas is unlikely to substantially change the habitats present following the cessation of dredging. Based on the distribution of habitats likely to be susceptible to sedimentation (i.e. seagrass and coral) it is not predicted that Scenario 2 dredge activities dredging will result in irreversible impacts to BCH.

Scenario 3: Capital dredging at the New Tug Harbour (April or May, dredge duration approximately seven days)

During Scenario 3 dredging activities the models predict that sedimentation will occur within the NTH (within the Project DE). The total bed thickness of sedimentation is predicted to be between 0.0004 and 0.02 m (**Figure 8-20**). Sedimentation is not predicted to exceed 0.004 m within other areas of Champion Bay as a result of Scenario 3 dredging activities no BCH outside the DE will be impacted by sedimentation (**Figure 8-21**).

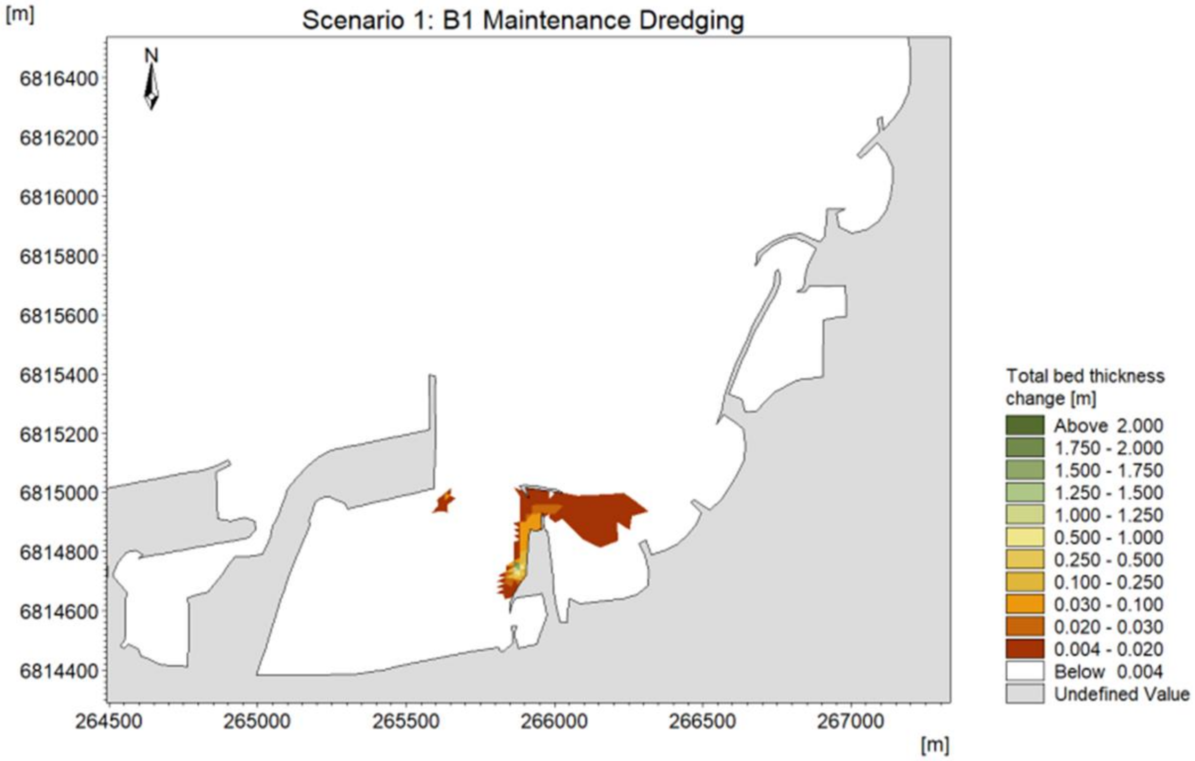


Figure 8-16 Sedimentation thickness of fine sediments for Scenario 1 at the completion of Berth 1 maintenance dredging

Figure 8-17 Scenario 1 predicted zones of impact associated with dredge derived sedimentation within Champion Bay

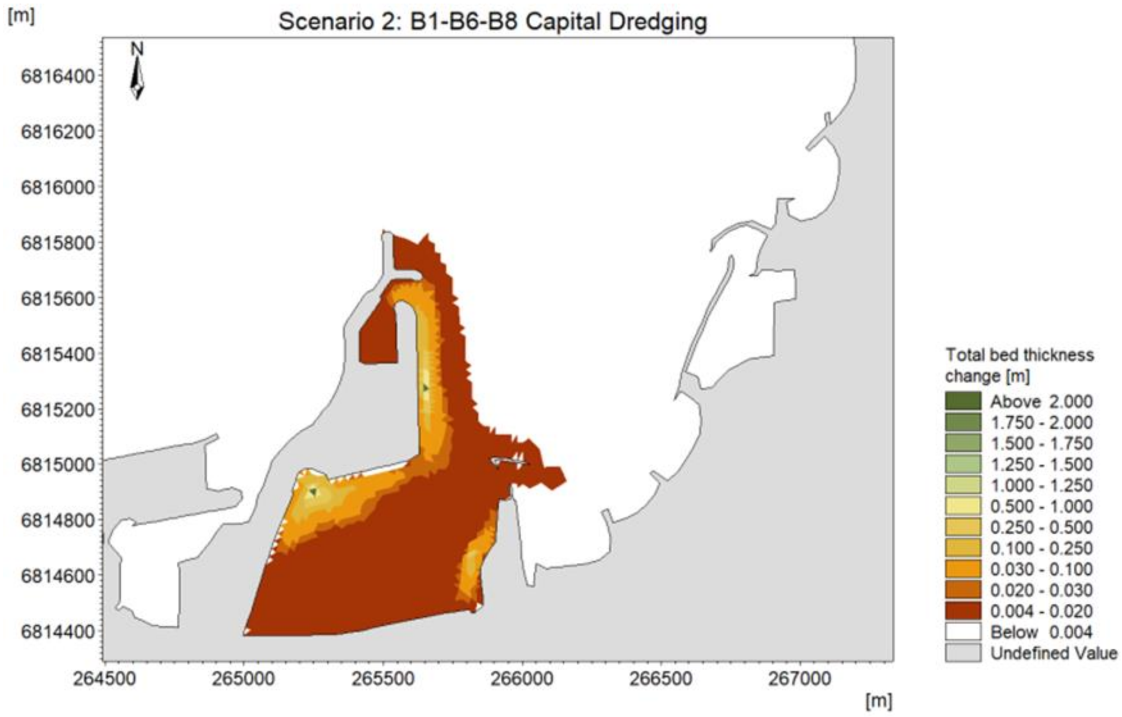


Figure 8-18 Sedimentation thickness of fine sediments for Scenario 2 at the completion of Berth 1, 6 and 8 dredging

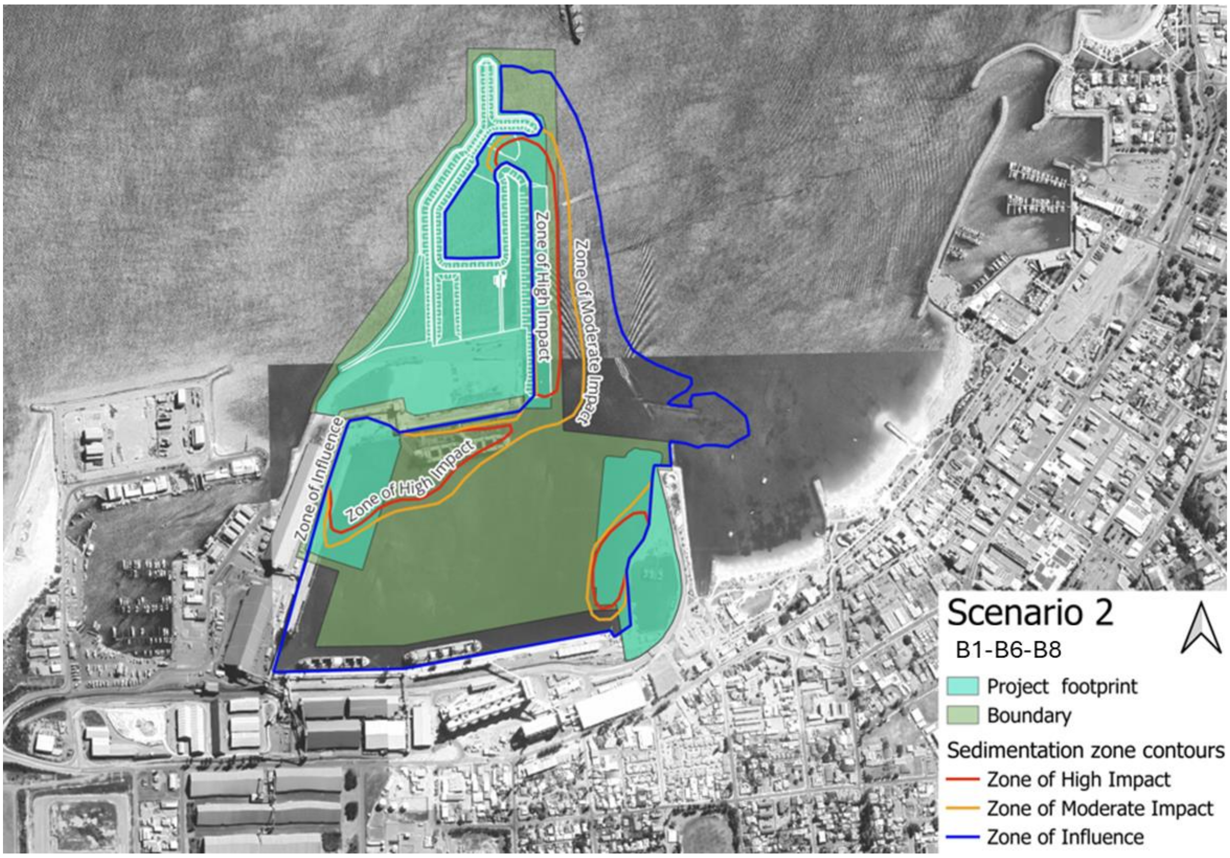


Figure 8-19 Scenario 2 predicted zones of impact associated with dredge derived sedimentation within Champion Bay

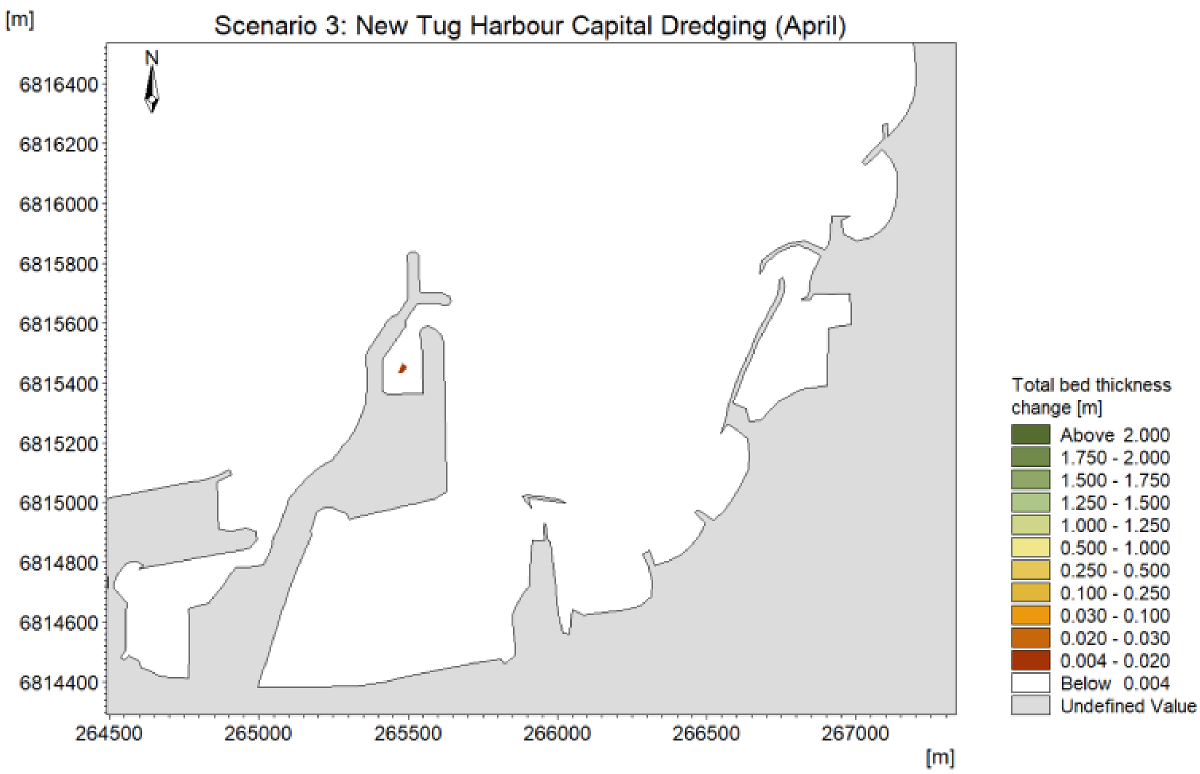


Figure 8-20 Sedimentation thickness of fine sediments for Scenario 3 at the completion of New Tug Harbour dredging in April.

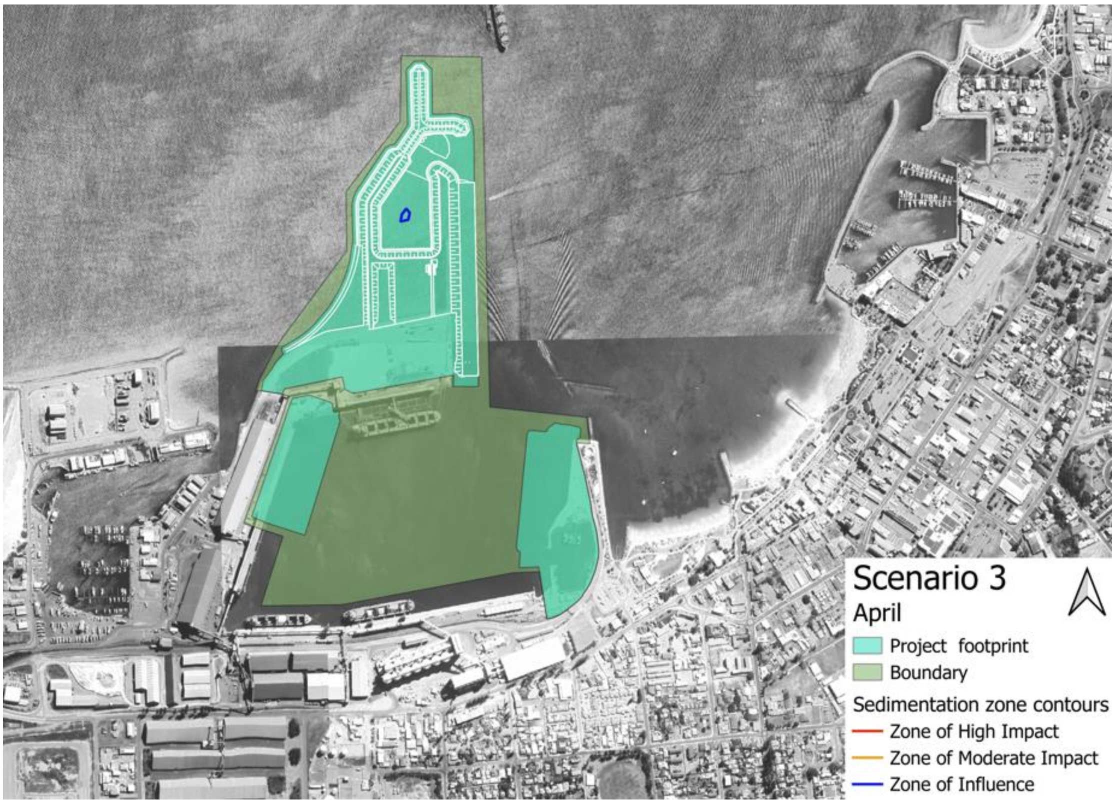


Figure 8-21 Scenario 3 predicted zones of impact associated with dredge derived sedimentation within Champion Bay

8.3.2.3 Vessel movement resulting in the introduction/spread of marine pests

The PMaxP increases the risk of the introduction/spread of marine pests that may modify BCH in and around the Port, as construction vessels may be required to enter WA waters from other jurisdictions.

However, the implementation of PMaxP management actions including biofouling risk assessment and direct consultation with the WA Department of Primary Industry and Regional Development (DPIRD) Vessel Management team on each vessel intended to undertake works, is considered effective in reducing this risk. These actions have offered protection to the Port and are in accordance with the *Biosecurity Act 2015*.

Furthermore, routine monitoring at the Port is also conducted under the DPIRD led Marine Pest Statewide Array Surveillance Program (SWASP), enabling early detection of (and response to) potential marine pest incursions.

Thus, it is not expected that the PMaxP would introduce/spread marine pests that would result in a significant impact to BCH.

8.4 Mitigation Hierarchy

8.4.1 Avoid

The optimised tug harbour footprint avoids areas of high-density seagrass and macroalgae, where possible; however, there will be an unavoidable direct loss to facilitate construction of the breakwater and dredging.

8.4.2 Minimise

Indirect impacts to BCH may result from sediment deposition and/or reduced light availability because of activities that would disturb the seabed, such as dredging. The PEP (approved proposal; MS600) completed a capital dredge campaign using a large cutter suction dredge and hopper barge, which resulted in elevated turbidity in the marine environment and could have had resultant impacts on BCH due to the reduced light availability. The detailed dredge review undertaken as part of the development of the PMaxP involved a review of the PEP dredge campaign and geotechnical data with the objective of adopting a more suitable dredge method to reduce potential impacts to water quality and inadvertently marine fauna and benthic communities (RHDHV, 2023). Based on the findings of the review, the PMaxP capital dredging will be completed by hydro-hammer (rock-breaker) and long arm excavator to minimise the potential for generation of excess suspended sediments and hence reducing potential impacts to BCH beyond the Proposal Footprint.

The PMaxP also involves maintenance dredging adjacent Berth 1 and based on recent success with the Port maintenance dredge campaigns utilising a suction hopper dredge, the same method will be used for the PMaxP maintenance dredge at Berth 1. This dredge method may also be utilised for the capital dredge required in the tug harbour because only the overlying sandy sediments are required to be dredged, not hard rock.

A Dredge Environmental Monitoring and Management Plan (DEMMP; SLR 2025c) has been developed to define controls to manage and minimise impacts on BCH and include a monitoring program to determine if the environmental outcomes are met. The DEMMP also details the demarcation of exclusion zones to preserve BCH in retained areas, restrictions on seabed disturbing activities during inclement weather and sea conditions, dredge scheduling to allow plume dispersion, restrictions on vessel anchoring and speeds, marine pest control measures and other adaptive management to mitigate any potential impacts to BCH.

A Coastal Processes Management Plan (CPMP; MWPA 2025) developed as part of this proposal, also includes a BCH management target of “no loss of BCH attributable to Port induced changes in sediment transport". Incorporating this BCH management target in the CPMP aims to ensure that there are negligible resultant impacts from alterations in longshore sediment movement due to PMaxP infrastructure.

It is expected, based on the outcomes of the modelling, that the indirect impacts that extend beyond the Proposal Footprint will be temporary and impacts to BCH would be recoverable within a three-year period with no residual impacts to BCH outside the defined footprint.

8.5 Significance of Residual Impacts

As the PMaxP is a significant amendment to the PEP (MS600) the residual impacts to BCH include the losses related to both, however the PEP BCH loss is already captured in the consideration of the current extent of BCH within the LAU in the PMaxP CLA (Appendix F).

Some soft sediment habitat areas may be modified to include subtidal and intertidal infrastructure that may form a colonising surface for reef communities (e.g. macroalgae and filter feeders). Furthermore, additional design measures, such as the material selection and surface rugosity are also being considered to facilitate the natural colonisation process. This modification is likely to retain at least some or improve the biodiversity and ecological integrity of BCH in these areas.

Areas of BCH beyond the DE that may be temporarily impacted by elevated turbidity, reduced light availability and/or deposited sediments are expected to undergo natural rehabilitation without the need for intervention. The recolonisation of BCH, in particular seagrass, in areas of elevated turbidity from dredging has been observed previously in the Geraldton area (CSIRO Marine and Atmospheric Research, 2008). Other more recent post-dredge monitoring of seagrass reported that remaining meadows were in good health, albeit some areas experienced alterations to community assemblages, which were difficult to attribute to the dredging campaign based on similar observations at reference locations and more likely attributable to natural variation (BMT, 2022).

The PMaxP has demonstrated the application of the avoid, minimise and mitigate hierarchy in addressing impacts to BCH by avoiding areas of high-quality BCH, selecting a less-impacting dredge method and the development of the DEMMP. This would restrict irreversible impacts to the predicted areas and promote the recovery of reversibly impacted BCH. The BCH categories expected to be irreversibly impacted are widely distributed in the LAU, with likely higher condition areas outside the predicted impact areas.

Thus, the PMaxP is not expected to impact BCH such that the ecosystem function, integrity and biodiversity will be impaired.

8.6 Environmental Outcomes

The predicted environmental outcomes of the PMaxP for BCH are:

- Permanent (irreversible) BCH loss limited to Zone of High Impact (ZoHI; 19 ha); and
- Temporary (reversible) BCH impact limited to Zone of Moderate Impact (ZoMI; 75 ha).

Based on the WA Environmental Offsets Policy, offsets are not expected for the PMaxP as the residual impacts to BCH are not expected to be significant.

With the implementation of the mitigation hierarchy, PMaxP is not expected to have a significant impact on BCH such that biological diversity and ecological integrity would be lost. In consideration of the proposed design and management of the PMaxP, it is considered that the EPA's objective for BCH can be met.

9.0 Impact Assessment – Marine Fauna

9.1 Policy and Guidance

The policy documentation utilised to inform the assessment of this factor includes:

- Environmental Factor Guideline: Marine Fauna (EPA, 2016e)
- Technical Guidance: Environmental impact assessment of marine dredging proposals (EPA, 2021)

The environmental objective for this factor is *to protect marine fauna so that biological diversity and ecological integrity are maintained*.

9.2 Receiving Environment

The marine environment in the Study Area[12] consists of the natural and modified foreshores of the Port and coastal waters of the West Coast Bioregion. Many marine fauna species have an affinity for particular marine habitats, and the presence of this habitat can indicate a potential presence of a particular species where there are limited records.

The marine habitats in the Study Area and their associated fauna are outlined in **Table 9-1**. Subtidal benthic habitats (i.e. bare subtidal soft sediment, seagrass meadows, reef complex) are described in the PMaxP BCH Survey Report (SLR 2024b, Appendix E).

Table 9-1 Marine habitats in the Study Locality and their associated fauna

Marine habitat	Associated marine fauna
Intertidal soft sediment (sandy beaches)	Shore/wading birds, pinnipeds, epifauna and infauna.
Intertidal rocky reef (natural or artificial)	Shore/wading birds, pinnipeds and epifauna
Bare subtidal soft sediment	Epifauna and infauna
Seagrass meadows	Marine mammals, bony fish (superclass Osteichthyes), cartilaginous fish (superclass Condrichthyes), epifauna and infauna
Reef complex (macroalgae, seagrass, filter feeders and/or hard coral)	Marine mammals, bony fish (superclass Osteichthyes), cartilaginous fish (superclass Condrichthyes), epifauna and infauna
Coastal waters	Marine mammals, bony fish (superclass Osteichthyes), cartilaginous fish (superclass Condrichthyes) and plankton

'Seal Rocks' was originally an outer breakwater constructed in the 1920's and has become important and well-utilised haul out habitat for the Australia Sea Lion (*Neophoca cinerea)*. 'Seal Rocks' was modified under the PEP (approved proposal; MS600) to widen the shipping channel, but also to enhance/retain sea lion habitat.

The Study Area is situated within three Biologically Important Areas (BIAs) of conservation significant species, as outlined in **Table 9-2** and illustrated in **Figure** 9-1. There are no critical habitats declared in the Register of Critical Habitat under the EPBC Act within or adjacent to the Study Locality.

[12] Study Area defined for the purpose of the marine fauna assessment and illustrated in **Figure** 9-1.

Table 9-2 Biologically Important Areas Species

Species	BC Act status	Life cycle	Time of the year
Caspian Tern *Hydroprogne caspia*	Migratory	Foraging (provisioning young)	-
Humpback Whale *Megaptera novaengliae*	Migratory Conservation dependent	Migration (north and south) Can be up to 30 nm offshore on northern migration and close inshore on southern migration.	Northbound peak mid-June to mid-July Southbound peak late September to mid-October
Australian Sea-lion *Neophoca cinerea*	Endangered	Foraging (male)[13]	All year

A review of data sources revealed 62 conservation-listed species (herein referred to as 'significant marine fauna species') with the potential to occur within the Study Locality (within a 5 km radius around the Proposal footprint). Of the 62 significant marine fauna species, seven are key species, likely to occur within the Study Area based on a likelihood assessment considering recent records and/or distribution and habitat availability (**Table 9-4**). The likelihood of occurrence assessment criteria is outlined in **Table 9**.

Table 9-3 Likelihood of occurrence assessment criteria

Rank	Criteria*
High (Likely to occur)	• There are existing records of the species in close proximity to the site and: o The species is strongly linked to a specific habitat, which is present in the site; or o The species has more general habitat preferences, and suitable habitat is present.
Medium (May occur)	• There is suitable habitat within the site, but the species is recorded infrequently in the locality; or • There are existing records of the species within the locality, however: o The species is linked to a specific habitat, of which only a small amount is present within the site; or o The species has more general habitat preferences, but only some suitable habitat is present.
Low (Unlikely to occur)	• The species is linked to a strongly specific habitat, which is absent from the site; or • Suitable habitat is present, however there are no existing records of the species from the locality; or • There is some suitable habitat within the site, however the species is infrequently recorded in the locality.

*"The site" refers to the Study Area

These species, their respective conservation status under the BC Act, and the relevant habitat in the Study Area, are:

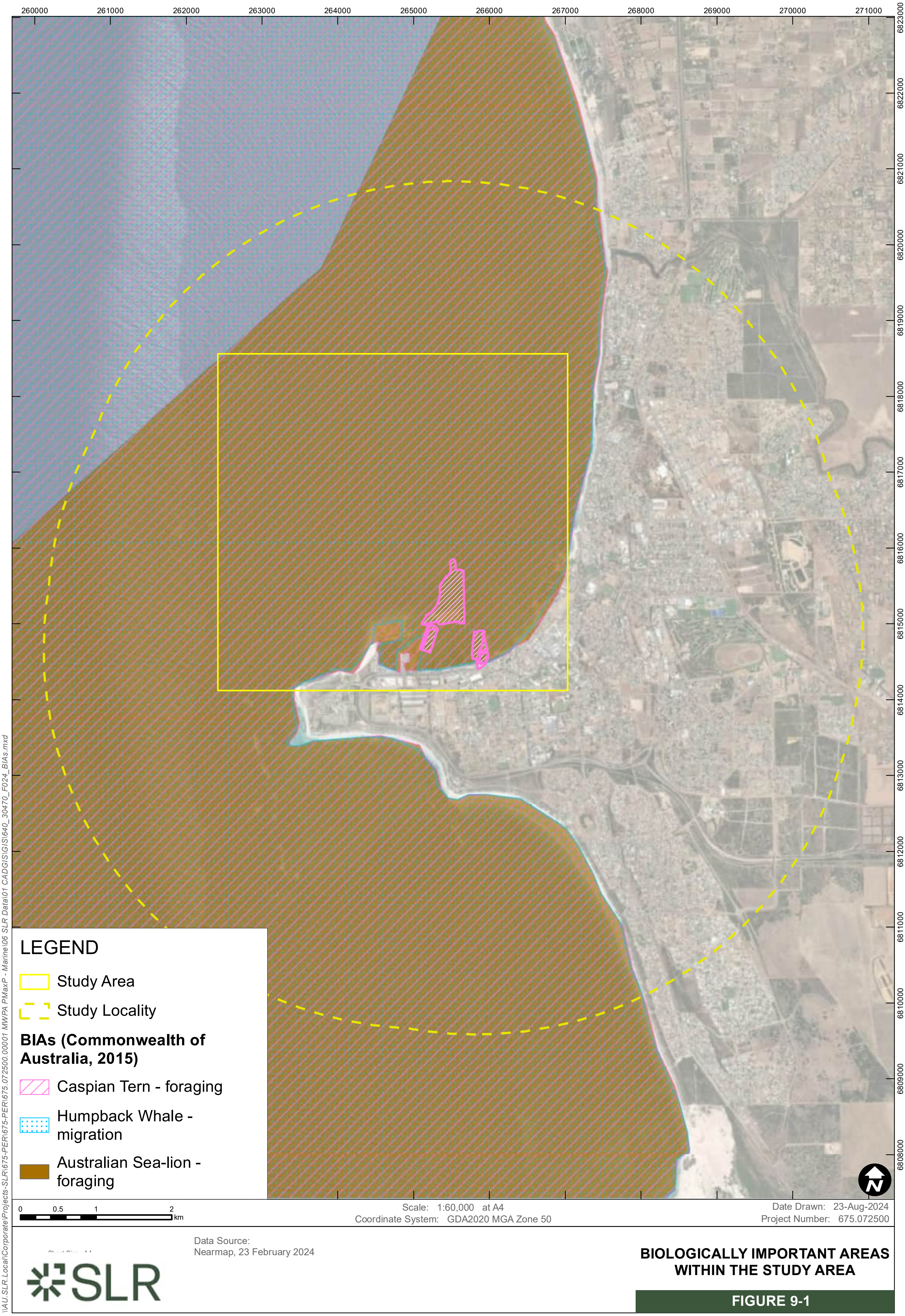
[13] Advice received from DBCA indicates that the area may be utilised by females too.

- Caspian Tern (*Hydroprogne caspia*) – migratory[14], foraging habitat
- Osprey (*Pandion haliaetus*) – migratory, breeding, and foraging habitat
- Roseate Tern (*Sterna dougallii*) – migratory, potential foraging habitat
- Crested Tern (*Thalasseus bergii*) – migratory, potential foraging habitat
- Humpback Whale (*Megaptera novaeangliae*) – migratory, conservation dependent[15], migration passage
- Australian Sea-lion (*Neophoca cinerea*) – endangered[16], haul-out and potential foraging habitat, and
- Indo-Pacific Bottlenose Dolphin (*Tursiops aduncus*) – migratory, potential foraging habitat.

[14] Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth. These species are published under Schedule 5 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.

[15] Species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened and published under Schedule 6 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.

[16] Threatened species considered to be facing a very high risk of extinction in the wild in the near future and published under Schedule 2 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.



Scale: 1:60,000 at A4
Coordinate System: GDA2020 MGA Zone 50

Date Drawn: 23-Aug-2024
Project Number: 675.072500

Data Source:
Nearmap, 23 February 2024

SLR

BIOLOGICALLY IMPORTANT AREAS WITHIN THE STUDY AREA

FIGURE 9-1

Table 9-4 Conservation significant species likelihood of occurrence assessment

Scientific name	Common name	EPBC Act	Distribution, habitat, foraging and breeding*	Likelihood of occurrence
Threatened birds				
Anous tenuirostris melanops	Australian Lesser Noddy	V	The Australian lesser noddy is only known to breed in the Houtman Abrolhos, where colonies on Pelsaert (four colonies, total area 3.0 ha), Wooded (0.7 ha) and Morley (0.8 ha) Islands occupy a total of 5 ha. Birds appear to remain near the breeding islands all year. The oceanic range of the Australian lesser noddy is largely unknown. Gales can displace birds many hundreds of kilometres. Although numbers vary considerably among years and colonies, the population is considered to be decreasing. Total numbers early in the 20th Century were possibly as low as 20,000 pairs. Fluctuations in abundance of their prey species may explain the variation in breeding numbers. Breeding colonies on Pelsaert, Wooded and Morley Islands have been observed since the early 19th Century.	Low Although breeding colonies of this species occupy the Houtman Abrolhos, this species has not been recorded in the Study Area. It may occasionally forage in the Study Area, but foraging habitat is ubiquitous and higher quality, preferred habitat occurs outside the Study Area.
Calidris acuminata	Sharp-tailed Sandpiper	V, M	The Sharp-tailed Sandpiper spends the non-breeding season in Australia with small numbers occurring regularly in New Zealand. Most of the population migrates to Australia, mostly to the south-east and are widespread in both inland and coastal locations and in both freshwater and saline habitats. Many inland records are of birds on passage. Prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation.	Low This species does not breed in Australia. It is unlikely to use the available resources in the Study Area for foraging as this species is sensitive to disturbance and suitable foraging areas in the Study Area are subject to frequent, anthropogenic disturbances.

Scientific name	Common name	EPBC Act	Distribution, habitat, foraging and breeding*	Likelihood of occurrence
Calidris canutus	Red Knot, Knot	V, M	Common in all the main suitable habitats around the coast of Australia. Mainly inhabit intertidal mudflats, sandflats and sandy beaches of sheltered coasts, in estuaries, bays, inlets, lagoons and harbours; sometimes on sandy ocean beaches or shallow pools on exposed wave-cut rock platforms or coral reefs.	Low This species does not breed in Australia. It is unlikely to use the available resources in the Study Area for foraging as this species is sensitive to disturbance and suitable foraging areas in the Study Area are subject to frequent, anthropogenic disturbances.
Calidris ferruginea	Curlew Sandpiper	CE, M	The breeding range of the Curlew Sandpiper is mainly restricted to the Arctic of northern Siberia, including Yamal Peninsula east to Kolyuchiskaya Gulf, Chokotka Peninsula, and also New Siberian Island. Curlew Sandpipers mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms.	Low This species does not breed in Australia. It is unlikely to use the available resources in the Study Area for foraging as this species is sensitive to disturbance and suitable foraging areas in the Study Area are subject to frequent, anthropogenic disturbances.
Charadrius leschenaultii	Greater Sand Plover, Large Sand Plover	V, M	The Greater Sand-plover breeds in central Asia from Armenia to Mongolia, moving further south for winter. In Australia the species is commonly recorded in parties of 10-20 on the west coast, with the far northwest being the stronghold of the population. Roosts during high tide on sandy beaches and rocky shores; begin foraging activity on wet ground at low tide, usually away from the edge of the water; individuals may forage and roost with other waders.	Low This species does not breed in Australia. It is unlikely to use the available resources in the Study Area for foraging as this species is sensitive to disturbance and suitable foraging areas in the Study Area are subject to frequent, anthropogenic disturbances.

Scientific name	Common name	EPBC Act	Distribution, habitat, foraging and breeding*	Likelihood of occurrence
Diomedea amsterdamensis	Amsterdam Albatross	E, M	A non-resident visitor to Australia and may occur in south-west and south Australian waters. The Amsterdam Albatross is a marine, pelagic seabird. It breeds on Amsterdam Island (territory of France), in the southern Indian Ocean. It mainly forages in the Southern Hemisphere in the ocean surrounding this island. It nests in open patchy vegetation (among tussocks, ferns or shrubs) near exposed ridges or hillocks. It sleeps and rests on ocean waters when not breeding.	Low This species does not breed in Australia and is purely oceanic. It is unlikely to venture into the Study Area.
Diomedea epomophora	Southern Royal Albatross	V, M	During the non-breeding season, the Southern Royal Albatross has a wide and possibly circumpolar distribution, ranging north to about 35°S. The Southern Royal Albatross is moderately common throughout the year in offshore waters of southern Australia, mostly off southeastern NSW, Victoria and Tasmania.	Low This species does not breed in Australia and is purely oceanic. It is unlikely to venture into the Study Area.
Diomedea exulans	Wandering Albatross	V, M	The Wandering Albatross breeds on Macquarie Island. A single breeding pair has also been recorded on Heard Island. The Territory of Heard Island and McDonald Islands are an Australian external territory and volcanic group of barren Antarctic islands, about two-thirds of the way from Madagascar to Antarctica. It feeds in Australian portions of the Southern Ocean.	Low This species does not breed on mainland Australia and is purely oceanic. It is unlikely to venture into the Study Area.

Scientific name	Common name	EPBC Act	Distribution, habitat, foraging and breeding*	Likelihood of occurrence
Limosa lapponica menzbieri	Northern Siberian Bar-tailed Godwit, Russkoye Bar-tailed Godwit	E	During the non-breeding season, the distribution of L. l. menzbieri is predominantly in the north of WA and in south-eastern Asia. In WA it is widespread around the coast, from Eyre to Derby. This species breeds in eastern Siberia (northern Yakutia) and northwest Chukotka, Russia between the Khatanga River and the delta of the Kolyma River. Bar-tailed godwits usually forage near the edge of water or in shallow water within tidal estuaries and harbours. Like most shorebird species, bar-tailed godwits exhibit substantial site-specific differences in their foraging behaviours. Feeding mostly occurs on exposed sandy or muddy substrates on intertidal flats, banks, and beaches. Populations spend disproportionately large amounts of time foraging on the upper tidal flats. This is a combined result of the upper zone's longer exposure time, allowing for prolonged periods of feeding, and the shorebirds' preference for it. Their diet consists primarily of molluscs, crustaceans, worms, aquatic insects, and some plant material. They forage in groups outside of the breeding season. Feeding parties usually number up to 30 or more individuals and include non-breeding migrants and young birds that remain all year round. Occasionally, they aggregate into huge flocks of several hundreds or thousands of individuals at favoured sites. Bar-tailed godwits generally feed during the day, but sometimes by moonlight. Local-scale movements within areas of suitable habitat are often tide-driven. Bar-tailed godwits tend to forage on intertidal flats at lower tides, and roost in supratidal areas at higher tides, sometimes in very large aggregations. Roosting tends to occur on large intertidal sandflats, spits, and banks. Less frequently, roosting occurs within mudflats, estuaries, coastal lagoons, and bays. These sites are often located near beds of seagrass, and sometimes near saltmarshes. Occasional reports have identified the bird roosting in areas of sandy ocean beach, rock platforms and coral reef flats. During periods of cyclonic activity, individuals often move to sheltered areas to avoid high winds and heavy rain. Like most other shorebird species, bar-tailed godwits may use anthropogenic wetlands such as aquaculture, saltwork, port, power and wastewater sites as alternative coastal roosting or stopover habitats.	Low This species does not breed in Australia. It is unlikely to use the available resources in the Study Area for foraging as this species is sensitive to disturbance and suitable foraging areas in the Study Area are subject to frequent, anthropogenic disturbances.

Scientific name	Common name	EPBC Act	Distribution, habitat, foraging and breeding*	Likelihood of occurrence
Macronectes giganteus	Southern Giant-Petrel, Southern Giant Petrel	E, M	The Southern Giant Petrel has a circumpolar pelagic range from Antarctica to approximately 20° S and is a common visitor off the coast of NSW. Over summer, the species nests in small colonies amongst open vegetation on Antarctic and subantarctic islands, including Macquarie and Heard Islands and in Australian Antarctic territory.	Low This species does not breed on mainland Australia and is purely oceanic. It is unlikely to venture into the Study Area.
Macronectes halli	Northern Giant Petrel	V, M	The Northern Giant-Petrel has a circumpolar pelagic distribution, usually between 40-64ºS in open oceans. Their range extends into subtropical waters (to 28ºS) in winter and early spring. Breeding in Australian territory is limited to Macquarie Island and occurs during spring and summer. Adults usually remain near the breeding colonies throughout the year (though some do travel widely) while immature birds make long and poorly known circumpolar and trans-oceanic movements.	Low This species does not breed on mainland Australia and is purely oceanic. It is unlikely to venture into the Study Area.
Numenius madagascariensis	Eastern Curlew, Far Eastern Curlew	CE, M	Within Australia, the Eastern Curlew has a primarily coastal distribution. The species is found in all states, particularly the north, east, and south-east regions including Tasmania. The Eastern Curlew is most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass.	Low This species does not breed in Australia. It is unlikely to use the available resources in the Study Area for foraging as this species is sensitive to disturbance and suitable foraging areas in the Study Area are subject to frequent, anthropogenic disturbances.

Scientific name	Common name	EPBC Act	Distribution, habitat, foraging and breeding*	Likelihood of occurrence
Phaethon rubricauda westralis	Red-tailed Tropicbird (Indian Ocean), Indian Ocean Red-tailed Tropicbird	E	The subspecies has a wide range across eastern Indian Ocean when not breeding; current breeding areas occur on the following islands: • Christmas Island • Cocos (Keeling) Islands • Bedwell Island, Rowley Shoals • West, Middle and East Islands of Ashmore Reef, and • Rottnest Island The Indian Ocean red-tailed tropicbird is pelagic and can be found in tropical and subtropic parts of the Indian Ocean. Birds prefer regions with water salinities of less than 35‰, and surface temperature of 24 to 30 °C. They feed on fish and cephalopods, foraging by plunging into the water, or capturing flying fish in flight.	Low This species does not breed on mainland Australia and is purely oceanic. It is unlikely to venture into the Study Area.
Pterodroma mollis	Soft-plumaged Petrel	V	The Soft-plumaged Petrel is generally found over temperate and subantarctic waters in the South Atlantic, southern Indian and western South Pacific Oceans. The species is a regular and common visitor to southern Australian seas but is more common in the west than in the south and south-east. In the southern Indian Ocean, the species is most numerous between 30° and 50°S from the South African to the west Australian coasts. The species is possibly common in seas south-west of Australia. Soft-plumaged Petrels breed on Maatsuyker Island off southern Tasmania. The Soft-plumaged Petrel is a marine, oceanic species. Soft-plumaged Petrels are mainly subantarctic but occur over a wide range of sea surface-temperatures.	Low This species does not breed in WA, is most common in latitudes south of the Study Area and is generally oceanic. It is unlikely to venture into the Study Area.
Rostratula australis	Australian Painted Snipe	E	Most records are from the southeast, particularly the Murray Darling Basin, with scattered records across northern Australia and historical records from around the Perth region in WA. Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds. The Australian Painted Snipe generally inhabits shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans.	Low The Study Area does not contain preferred habitat for the species.

Scientific name	Common name	EPBC Act	Distribution, habitat, foraging and breeding*	Likelihood of occurrence
Sternula albifrons	Little Tern	V, M	Migrating from eastern Asia, the Little Tern is found on the north, east and south-east Australian coasts, from Shark Bay in WA to the Gulf of St Vincent in SA. Almost exclusively coastal, preferring sheltered environments; however, may occur several kilometres from the sea in harbours, inlets and rivers (with occasional offshore islands or coral cay records). Nests in small, scattered colonies in low dunes or on sandy beaches just above high tide mark near estuary mouths or adjacent to coastal lakes and islands.	Low This Study Area is unlikely to form preferred breeding habitat for this species. Individuals may fly over or forage in the Study Area on occasion.
Sternula nereis nereis	Australian Fairy Tern	V	Within Australia, the Fairy Tern occurs along the coasts of Victoria, Tasmania, SA and WA; occurring as far north as the Dampier Archipelago near Karratha. The Fairy Tern (Australian) nests on sheltered sandy beaches, spits and banks above the high tide line and below vegetation. The subspecies has been found in embayments of a variety of habitats including offshore, estuarine or lacustrine (lake) islands, wetlands and mainland coastline. The bird roosts on beaches at night.	Low Although suitable habitat occurs in the Study Area, it is highly disturbed and unlikely to be preferred by this species. Higher quality habitat occurs outside of the Study Area.
Thalassarche carteri	Indian Yellow-nosed Albatross	V, M	The Indian Yellow-nosed Albatross forages mostly in the southern Indian Ocean where it is particularly abundant off WA. It is a marine bird, located in subtropical and warmer subantarctic waters. The Indian Yellow-nosed Albatross has been observed over waters of surface temperature 10° to 23°C but is most abundant over the warmer parts of the subtropical zone. In breeding and non-breeding seasons, the species concentrates over the productive waters of continental shelves, often at coastal upwellings and the boundaries of currents. Birds breeding south of the Subtropical Convergence may be pelagic and travel far to subtropical feeding grounds. In the Australasian region, the species occupies inshore and offshore waters, particularly where there are calm seas and light winds. The birds fly low or at medium heights over the sea, using air currents rising off swells for lift. The Indian Yellow-nosed Albatross breeds on islands of the southern Indian Ocean. The southern limit of breeding may be determined by the distance to subtropical waters used for feeding. The Indian Yellow-nosed Albatross takes cephalopods (squid) and fish. The species frequently follows fishing boats, leading to it being caught in considerable numbers on longline fishing gear.	Low This species does not breed on mainland Australia but may use the Study Area for foraging. However, high quality, less disturbed and more preferred foraging habitat occurs outside of the Study Area.

Scientific name	Common name	EPBC Act	Distribution, habitat, foraging and breeding*	Likelihood of occurrence
Thalassarche cauta	Shy Albatross	E, M	This species is circumpolar in distribution, occurring widely in the southern oceans. Islands off Australia and New Zealand provide breeding habitat. Known breeding locations include Albatross Island off Tasmania, Auckland Island, Bounty Island and The Snares, off New Zealand, where nesting colonies of 6-500 nests occur and may contain other species such as the Australian Gannet. In Australian waters, the Shy Albatross occurs along the east coast from Stradbroke Island in Queensland along the entire south coast of the continent to Carnarvon in WA. This pelagic or ocean-going species inhabits subantarctic and subtropical marine waters, spending the majority of its time at sea. Occasionally the species occurs in continental shelf waters, in bays and harbours.	Low This species does not breed on mainland Australia but may use the Study Area for foraging. However, high quality, less disturbed and more preferred foraging habitat occurs outside of the Study Area.
Thalassarche impavida	Campbell Albatross, Campbell Black-browed Albatross	V, M	The Campbell Albatross is a non-breeding visitor to Australian waters. Non-breeding birds are most commonly seen foraging over the oceanic continental slopes. They breed only on sub-Antarctic Campbell Island (New Zealand), south of New Zealand. After breeding, birds move north and may enter Australia's temperate shelf waters.	Low This species does not breed in Australia and is purely oceanic. It is unlikely to venture into the Study Area.
Thalassarche melanophris	Black-browed Albatross	V, M	The Black-browed Albatross has a circumpolar range over the southern oceans and are seen off the southern Australian coast mainly during winter. This species migrates to waters off the continental shelf from approximately May to November. It inhabits Antarctic, subantarctic, subtropical marine and coastal waters over upwellings and boundaries of currents. Can tolerate water temperatures between 0 ºC and 24 ºC. Spends most of its time at sea, breeding on small, isolated islands.	Low This species does not breed on mainland Australia but may use the Study Area for foraging. However, high quality, less disturbed and more preferred foraging habitat occurs outside of the Study Area.
Thalassarche steadi	White-capped Albatross	V, M	Breeding colonies occur on islands south of New Zealand. The White-capped Albatross is a marine species and occurs in subantarctic and subtropical waters. The White-capped Albatross is a marine species and occurs in subantarctic and subtropical waters. It is unknown what sea-surface temperatures this subspecies prefers; however, in the southern Indian Ocean it has been observed in waters of 6.4–13.5 °C.	Low This species does not breed on mainland Australia but may use the Study Area for foraging. However, high quality, less disturbed and more preferred foraging habitat occurs outside of the Study Area.

Scientific name	Common name	EPBC Act	Distribution, habitat, foraging and breeding*	Likelihood of occurrence
Tringa nebularia	Common Greenshank, Greenshank	E. M	The Common Greenshank does not breed in Australia; however, the species occurs in all types of wetlands and has the widest distribution of any shorebird in Australia. The Common Greenshank is found in a wide variety of inland wetlands and sheltered coastal habitats of varying salinity. It occurs in sheltered coastal habitats, typically with large mudflats and saltmarsh, mangroves or seagrass. Habitats include embayments, harbours, river estuaries, deltas and lagoons and are recorded less often in round tidal pools, rock-flats and rock platforms. The species uses both permanent and ephemeral terrestrial wetlands, including swamps, lakes, dams, rivers, creeks, billabongs, waterholes and inundated floodplains, claypans and salt flats. It will also use artificial wetlands, including sewage farms and saltworks dams, inundated rice crops and bores.	Low This species does not breed in Australia. It is unlikely to use the available resources in the Study Area for foraging as this species is sensitive to disturbance and suitable foraging areas in the Study Area are subject to frequent, anthropogenic disturbances.
Threatened mammals				
Balaenoptera musculus	Blue Whale	E, M	Oceanic within Southern Hemisphere between 20° to 70° S. However, much of the Australian continental shelf and coastal waters have no particular significance to the whales and are only used for migration and opportunistic feeding. The only known areas of significance to the blue whale are feeding areas around the southern continental shelf, notably Perth Canyon, in WA and the Bonney Upwelling and adjacent upwelling areas of SA and Victoria. Preferring open seas rather than coastal waters. While breeding areas have not yet been identified, it is likely that they occur in tropical areas of high localised biological production. The Blue Whale has a thin blubber layer, which implies that they cannot fast during the winter season. This is supported by the occurrence of this species in tropical upwelling areas in the eastern tropical Pacific Ocean, such as the Costa Rica Dome and the waters west of the Galapagos Islands. Wintering areas, where some sightings have been reported, include the Indonesian archipelago and the waters adjacent to the Solomon Islands and other island groups of the south-west Pacific.	Low This species is unlikely to venture into coastal waters. The ambient noise and vibrations in the Study Area are likely to deter any individuals.

Scientific name	Common name	EPBC Act	Distribution, habitat, foraging and breeding*	Likelihood of occurrence
Eubalaena australis	Southern Right Whale	E, M	This species occurs in temperate and subpolar waters of the Southern Hemisphere, with a circumpolar distribution between about 20° S and 55° S with some records further south to 63° S. This species migrates between summer feeding grounds in Antarctica and winter breeding grounds around the coasts of southern Australia, New Zealand, South Africa and South America. This species feeds in the open oceans in summer and move inshore in winter for calving and mating with calving females usually remaining very close to the coast. This species is not believed to feed in Australian waters at all. It is constrained in their ability to colonise unused areas of potentially suitable habitat due to a high degree of site fidelity (individuals returning to the same breeding site each year).	Low The Study Area does not form a BIA for this species. The Study Area is on the edge of this species distribution. Although individuals may stray into the Study Area, this is considered rare.

Neophoca cinerea	Australian Sea-lion, Australian Sea Lion	E	The Australian Sea-lion is the only pinniped endemic to Australia. The breeding range extends from the Houtman Abrolhos, WA, to The Pages Island, east of Kangaroo Island, SA. The species has also been recorded at Shark Bay, WA; the New South Wales coast; southern Tasmania; and Victoria. Breeding colonies occur on islands or remote sections of coastline. Lone or small numbers of animals will regularly visit known haul-out sites and occasionally visit other locations. The Australian Sea-lion exhibits high site fidelity and little movement of females between colonies has been observed. Australian Sea-lions use a wide variety of habitats for breeding sites (called rookeries) and, during the non-breeding season, for haul-out sites (rest stops, which are also useful for predator avoidance, thermal regulation and social activity). Onshore habitats used include exposed islands and reefs, rocky terrain, sandy beaches and vegetated fore dunes and swales. They also use caves and deep cliff overhangs as haul-out sites or breeding habitats. Most colonies occur on islands; however, several small colonies occur on the mainland, including: • Point Labatt, SA (King & Marlow 1979) • Baxter Cliffs, west of Twilight Cove, WA (referred to as Thundulda) • Bunda Cliffs, Great Australian Bight, SA and WA borders (nine small breeding colonies discovered at the base) Australian Sea-lions feed on a wide variety of prey, including cephalopods, fish, sharks, rock lobsters and sea birds. There is little quantitative information on their diet as only a few hard parts are normally found in the faeces of this species, although the species is known to 'feed' at fishing boats on scraps or by taking fish off lines. Australian Sea-lions in western WA spend more time foraging compared to those in SA due to the less productive conditions of the Leeuwin Current. Dispersal of young appears to be self-limited in this species, as females show strong natal site fidelity to maximise breeding potential due to the asynchronous nature of their breeding cycles. Females' movements appear to be no greater than 60 km from their natal site. Males disperse approximately 200 km from natal sites. Dispersal mode is reflected in the high levels of genetic differentiation found in colonies of Australian Sea-lions over relatively short distances.	High There is a known non-breeding colony in Geraldton. Individuals are likely to be seen in the water and the foreshore.

Scientific name	Common name	EPBC Act	Distribution, habitat, foraging and breeding*	Likelihood of occurrence
Threatened reptiles				
Caretta caretta	Loggerhead Turtle	E, M	The loggerhead turtle has a worldwide distribution in coastal tropical and subtropical waters. In Australia, loggerheads occur in coral reefs, bays and estuaries in tropical and warm temperate waters off the coast of Queensland, Northern Territory, WA and New South Wales.	Low This species reportedly forages between Shark Bay and Arnhem Land and is not known to breed in or near the Study Area; there are no recent records of this species in or near the Study Area (ALA 2025).
Chelonia mydas	Green Turtle	V, M	Widely distributed in tropical and sub-tropical seas. Usually found in tropical waters around Australia but also occurs in coastal waters, where it is generally seen on the north or central coast, with occasional records from the south coast. Ocean-dwelling species spending most of its life at sea. Carnivorous when young but as adults they feed only on marine plant material. Green turtles occur in seaweed-rich coral reefs and coastal seagrass pastures in tropical and subtropical areas of Australia. Usually ocean-dwelling but also occurs in coastal waters on the north or central coast with some straying south of the central coast. Green Turtles spend their first five to ten years drifting on ocean currents. During this pelagic (ocean-going) phase, they are often found in association with drift lines and rafts of *Sargassum* (a floating marine plant that is also carried by currents). Once Green Turtles reach 30 to 40 cm curved carapace length, they settle in shallow benthic foraging habitats such as tropical tidal and sub-tidal coral and rocky reef habitat or inshore seagrass beds. The shallow foraging habitat of adults contains seagrass beds or algae mats on which Green Turtles mainly feed.	Low Individuals have been observed in the shallows of the Houtman Abrolhos. This flotilla is unlikely to venture into the Study Area as the latter is of substantially lower habitat value and at the edge of the species distribution.

Scientific name	Common name	EPBC Act	Distribution, habitat, foraging and breeding*	Likelihood of occurrence
Dermochelys coriacea	Leatherback Turtle, Leathery Turtle, Luth	E, M	Throughout the world's tropical and temperate seas and in all coastal waters of Australia. Most sightings are in temperate waters. Occurs in inshore and offshore marine waters. Rarely breeds in Australia, with the nearest regular nesting sites being the Solomon Islands and Malayan Archipelago. The leatherback turtle has the widest distribution of any marine turtle, occurring in tropical, temperate and sub-polar waters from the North Sea and Gulf of Alaska in the Northern Hemisphere, to Chile and New Zealand in the Southern Hemisphere. Leatherback turtles occur in tropical and temperate waters of Australia. Large numbers of leatherback turtles feed off the southern Queensland and NSW coasts and off WA's coast, south of Geraldton, but they are less abundant in the tropical waters of northern Australia. Most sightings are along the more heavily populated eastern seaboard of Australia where large adults are found year-round in larger bays, estuaries and rivers. The frequency of sightings suggests that the species actively seeks out temperate feeding grounds, rather than simply straying to the south.	Low This species is a mostly oceanic species, foraging over continental shelf waters and predicted to only come inshore during breeding season. There are no known breeding sites on the mainland or islands of WA.
Natator depressus	Flatback Turtle	V, M	The flatback turtle is only found in the tropical waters of northern Australia, Papua New Guinea and Irian Jaya and is one of only two species of sea turtle without a global distribution. Post-hatchling and juvenile flatback turtles do not have the wide dispersal phase in the oceanic environment like other sea turtles. Adults inhabit soft bottom habitat over the continental shelf of northern Australia, extending into Papua New Guinea and Irian Jaya although the extent of their range is not fully known. Hatchling to subadult flatback turtles lack a pelagic life stage and reside on the Australian continental shelf. Flatback turtles require sandy beaches to nest. Sand temperatures between 25 °C and 33 °C are needed for successful incubation. Beaches free from light pollution are required to prevent disorientation, disturbance, and to allow nesting females to come ashore.	Low The Western Australian distribution of this species is reported to be between Exmouth and the Kimberley coast. This is some distance from the Study Area thus, it is unlikely this species would venture into the Study Area.
Threatened elasmobranchs				

Scientific name	Common name	EPBC Act	Distribution, habitat, foraging and breeding*	Likelihood of occurrence
Carcharias taurus (west coast population)	Grey Nurse Shark (west coast population)	V	The grey nurse shark is known to occur on the continental shelf mostly from the surf zone down to at least 190 m in depth. At sites where they aggregate, they are often observed near the bottom at depths of 10-40 m in or near steep-sided gutters with sandy substrata, or in rocky caves. Grey nurse sharks have also been observed congregating in mid-water adjacent to, or above pinnacles or wrecks at depths of 5-30 m. Within Australia there are two populations of grey nurse shark - one is found in coastal waters of Queensland and New South Wales, and the other in WA. The population of Grey Nurse Shark (west coast population) is predominantly found in the south-west coastal waters of WA and has been recorded as far north as the Northwest Shelf.	Low There are no aggregate sites in close proximity to the Study Area. This species may transit through and forage in the Study Area on occasion.
Carcharodon carcharias	White Shark, Great White Shark	V, M	In Australia, white sharks have been recorded from central Queensland around the south coast to north-west WA but may occur further north on both coasts. White sharks are widely, but not evenly, distributed in Australian waters. This species can be found from close inshore around rocky reefs, surf beaches and shallow coastal bays to outer continental shelf and slope areas. The majority of recorded white shark movements occur between the coast and 100 m in depth but have been recorded to dive to depth of over 1,200 m. Individuals may travel long distances in a relatively short time but can remain in the same areas for weeks to months. In NSW, the Stockton Beach / Hawks Nest areas are identified as primary residency areas for juvenile white sharks.	Low The Study Area is not known as a primary residency location for this species. This species may transit through and forage in the Study Area on occasion.

Pristis pristis	Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish	V, M	The Freshwater Sawfish may potentially occur in all large rivers of northern Australia from the Fitzroy River, WA, to the western side of Cape York Peninsula, Queensland. It is mainly confined to the main channels of large rivers. The species is known from several drainages of northern Australia including the Fitzroy River, Durack River and Ord River in WA; the Adelaide River, Victoria River and Daly River of the Northern Territory; and the Gilbert River, Mitchell River, Norman River and Leichhardt River of Queensland. The species is also recorded from the McArthur River, Northern Territory. In the Fitzroy River catchment it is probably confined to the main Fitzroy River; in the Durack River catchment it probably only occurs in the main Durack River; in the Ord River catchment it occurs only in the Main Ord Channel below Kununurra Dam and in the Pentecost River; and in the Victoria River catchment it is probably restricted to the main Victoria River and possibly Fitzmaurice River. The name Freshwater Sawfish is a misnomer. It is a marine/estuarine species that spends its first three–four years in freshwater growing to about half its adult size (4 m+). Juveniles and sub-adult Freshwater Sawfish predominantly occur in rivers and estuaries, while large mature animals tend to occur more often in coastal and offshore waters up to 25 m depth. A study on the movement patterns of other sawfish species, *P. clavata* and *P. zijsron*, showed that the species had a high fidelity to an area, with movements restricted to only a few square kilometres within the coastal fringe, and influenced by tides. The species tends to move up rivers during flood periods. Small specimens, mostly less than 150 cm, have been caught in remote ponds where they have been isolated for several years between floods. The preferred habitat of this species is mud bottoms of river embayments and estuaries, but they are also found well upstream. They are not found near riparian vegetation. They are usually found in turbid channels of large rivers over soft mud bottoms more than 1 m deep, but they will move into shallow waters when travelling upstream or while hunting prey. The Freshwater Sawfish feeds on fishes and benthic invertebrates. The saw is used to stun schooling fish, such as mullet, and for extracting molluscs and small crustaceans from the benthic sediment. There are few reports of adult individuals at sea, with only a few records of fish greater than 3 m in total length from the Pilbara coast, and one individual from Cape Naturaliste (south-WA).	Low The Study Area is not located close to a known important nursery site however; adult individuals may transit through and forage in the Study Area on occasion.

Scientific name	Common name	EPBC Act	Distribution, habitat, foraging and breeding*	Likelihood of occurrence
			The species possibly breeds in fresh water. Reproduction is viviparous (the young are nourished by a primitive placenta) and young are born at about 50 cm in length approximately five months after copulation, with litter sizes likely to range between one and 12. In the Mitchell River on western Cape York Peninsula, Queensland, spawning generally occurs at the beginning of the wet season in November or December. In the Fitzroy River, WA, pupping is correlated to higher water levels in the late wet season. The Fitzroy River has been identified as a likely important nursery site for the Freshwater Sawfish, as all individuals captured as part of a radio-tagging program were small, immature individuals.	
Rhincodon typus	Whale Shark	V, M	In Australia, the whale shark is known from NSW, Queensland, Northern Territory, WA and occasionally Victoria and SA, but it is most commonly seen in waters off northern WA, Northern Territory and Queensland. The whale shark is an oceanic and coastal, tropical to warm-temperate pelagic shark. It is often seen far offshore but also comes close inshore and sometimes enters lagoons of coral atolls. The whale shark is generally encountered close to or at the surface, as single individuals or occasionally in schools or aggregations of up to hundreds of sharks. This species is generally found in areas where the surface temperature is 21–25 °C, preferably with cold water of 17 °C or less upwelling into it, and salinity of 34 to 34.5 parts per thousand.	Low The Study Area does not form preferred habitat for this species due to the level of disturbance from the movement of vessels.
Migratory birds				
Actitis hypoleucos	Common Sandpiper	M	Found along all coastlines of Australia and in many areas inland, the Common Sandpiper is widespread in small numbers. The species utilises a wide range of coastal wetlands and some inland wetlands, with varying levels of salinity, and is mostly found around muddy margins or rocky shores and rarely on mudflats.	Low This species does not breed in Australia. It is unlikely to use the available resources in the Study Area for foraging as this species is sensitive to disturbance and suitable foraging areas in the Study Area are subject to frequent, anthropogenic disturbances.

Scientific name	Common name	EPBC Act	Distribution, habitat, foraging and breeding*	Likelihood of occurrence
Anous stolidus	Common Noddy	M	It mainly occurs in the ocean off the Queensland coast. Breeds on or near islands, on rocky islets and stacks with precipitous cliffs, or on shoal or cays or coral or sand. This species feeds mainly on fish but is known to take squid, molluscs and aquatic insects in offshore areas.	Low This species is rarely seen from the mainland.
Apus pacificus	Fork-tailed Swift	M	In WA, there are sparsely scattered records of the Fork-tailed Swift along the south coast, ranging from near the Eyre Bird Observatory and west to Denmark. They are widespread in coastal and subcoastal areas between Augusta and Carnarvon, including some on nearshore and offshore islands. They are scattered along the coast from south-west Pilbara to the north and east Kimberley region, near Wyndham. There are sparsely scattered inland records, especially in the Wheatbelt, from Lake Annean and Wittenoom. They are found in the north and north-west Gascoyne Region, north through much of the Pilbara Region, and the south and east Kimberley. They are also recorded in the Timor Sea, both at sea and around islands such as the Ashmore Reef. Isolated records occur at Neale Junction in the Great Victoria Desert and on the Nullarbor Plain. The Fork-tailed Swift is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground and probably much higher. In Australia, they mostly occur over inland plains but sometimes above foothills or in coastal areas. They often occur over cliffs and beaches and also over islands and sometimes well out to sea.	Low This species is almost exclusively aerial and although may be observed in flight in the Study area, is unlikely to land or forage in the Study Area. This species is not known to breed in or around the Study Area.
Ardenna carneipes	Flesh-footed Shearwater, Fleshy-footed Shearwater	M	Ranges throughout the Pacific and Indian Oceans. There are two main breeding areas in the world: one in the South West Pacific includes Lord Howe Island (**LHI**) and New Zealand; the other along the coast of WA. Nest on LHI on sandy soils from Ned's Beach to Clear Place, with smaller colonies below Transit Hill and at Old Settlement Beach. Eggs are laid at the end of a burrow 1-2 metres in length.	Low The Study Area is some distance away from the known breeding locations for this species. Individuals may flyover and forage in the Study Area on occasion however, high quality, less disturbed foraging habitat occurs outside of the Study Area.

Scientific name	Common name	EPBC Act	Distribution, habitat, foraging and breeding*	Likelihood of occurrence
Ardenna pacifica	Wedge-tailed Shearwater	M	The Wedge-tailed Shearwater breeds on the east and west coasts of Australia and on offshore islands. The Wedge-tailed Shearwater is a pelagic, marine bird known from tropical and subtropical waters.	Low This species does not breed in Australia and is purely oceanic. It is unlikely to venture into the Study Area.
Calidris melanotos	Pectoral Sandpiper	M	In WA, the species is rarely recorded. It has been observed at the Nullarbor Plain, Reid, Stoke's Inlet, Grassmere Lake, Warden Lake, Dalyup and Yellilup Swamp, Swan River, Benger Swamp, Guraga Lake, Wittecarra, Harding River, coastal Gascoyne, the Pilbara and the Kimberley. Prefers shallow fresh to saline wetlands. The species is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands.	Low This species is rarely observed in WA.
Hydroprogne caspia	Caspian Tern	M	Within Australia, the Caspian Tern has a widespread occurrence and can be found in both coastal and inland habitat. The Caspian Tern breeds on variable types of sites including low islands, cays, spits, banks, ridges, beaches of sand or shell, terrestrial wetlands and stony or rocky islets or banks. This species usually forages in open wetlands, including lakes and rivers.	High Resident populations of this species are known in the Geraldton area.
Limosa lapponica	Bar-tailed Godwit	M	The Bar-tailed Godwit has been recorded in the coastal areas of all Australian states. The Bar-tailed Godwit is found mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays.	Low This species does not breed in Australia. It is unlikely to use the available resources in the Study Area for foraging as this species is sensitive to disturbance and suitable foraging areas in the Study Area are subject to frequent, anthropogenic disturbances.

Scientific name	Common name	EPBC Act	Distribution, habitat, foraging and breeding*	Likelihood of occurrence
Onychoprion anaethetus	Bridled Tern	M	In Australia, Bridled Terns are widespread, breeding on offshore islands in western, northern and north-eastern Australia, extending from Cape Leeuwin in the south-west, around northern Australia to north-eastern and mid-eastern Queensland, extending through the Great Barrier Reef and Coral Sea as far south as Lady Elliott Island. This species breeds on islands and island groups in Australia with colonies recorded in Western Australia, Northern Territory and Queensland. The closest breeding colony occurs on the Houtman Abrolhos. Bridled Terns occupy tropical and subtropical seas, breeding on islands, including vegetated coral cays, rocky continental islands and rock stacks. Bridled Terns are only rarely found in inshore continental waters and along mainland coastlines, though the species is reported to breed on the mainland of far southern Western Australia. During the breeding season in south-western Australia, birds forage over offshore, mid- and outer continental shelf waters, usually within approximately 70 km of breeding colonies but mostly within 20–40 km of a colony.	Low Although the Study Area is within the foraging range of the Houtman Abrolhos breeding colony, this species is mostly an offshore forager thus, the Study Area does not constitute preferred habitat for this species.

Scientific name	Common name	EPBC Act	Distribution, habitat, foraging and breeding*	Likelihood of occurrence
Pandion haliaetus	Osprey	M	The breeding range of the Osprey extends around the northern coast of Australia (including many offshore islands) from Albany in WA to Lake Macquarie in NSW; with a second isolated breeding population on the coast of SA, extending from Head of Bight east to Cape Spencer and Kangaroo Island. The total range (breeding plus non-breeding) around the northern coast is more widespread, extending from Esperance in WA to NSW, where records become scarcer towards the south, and into Victoria and Tasmania, where the species is a rare vagrant. The distribution of the species around the northern coast (south-western WA to south-eastern NSW) appears continuous except for a possible gap at Eighty Mile Beach. Ospreys occur in littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands. They are mostly found in coastal areas but occasionally travel inland along major rivers, particularly in northern Australia. They require extensive areas of open fresh, brackish or saline water for foraging. They frequent a variety of wetland habitats including inshore waters, reefs, bays, coastal cliffs, beaches, estuaries, mangrove swamps, broad rivers, reservoirs and large lakes and waterholes. They exhibit a preference for coastal cliffs and elevated islands in some parts of their range, but may also occur on low sandy, muddy or rocky shores and over coral cays. They may occur over atypical habitats such as heath, woodland or forest when travelling to and from foraging sites. In Australia, Ospreys mainly feed on fish, especially mullet where available, and rarely take molluscs, crustaceans, insects, reptiles, birds and mammals. Ospreys usually forage diurnally but have also been observed hunting prey at night. Adult Ospreys are mostly resident or sedentary around breeding territories. They forage more widely but continue to make at least intermittent visits to their breeding grounds in the non-breeding season.	High Resident breeding pairs are known in the Geraldton area. Breeding posts have been erected around the Port and Point Moore area and breeding pairs have been observed to use these in recent years.

Scientific name	Common name	EPBC Act	Distribution, habitat, foraging and breeding*	Likelihood of occurrence
Phaethon lepturus	White-tailed Tropicbird	M	The white-tailed Tropicbird can be found over pelagic waters and the coast of tropical and subtropical seas. It feeds on small fish, especially flying-fish, squid and some crustaceans (especially crabs). Its diet varies locally, for example taking mostly fish in the Seychelles. Most prey is caught by plunge-diving, but flying-fish can be taken on the wing. Breeding is seasonal in places but elsewhere can be more or less continuous. It is loosely colonial, nesting in rocky crevices or sheltered scrape on the ground on small-remote islands preferring inaccessible spots on cliffs where take-off is relatively easy.	Low This Study Area is unlikely to form preferred breeding habitat for this species. Individuals may fly over or forage in the Study Area on occasion.
Migratory mammals				
Balaenoptera edeni	Bryde's Whale	M	Bryde's whales occur in temperate to tropical waters, both oceanic and inshore, bounded by latitudes 40° N and 40° S, or the 20 °C isotherm. Bryde's whales have been recorded from all Australian states except the Northern Territory, including one sighting each in Victoria and NSW and 11 reported strandings in SA (7), NSW (2), Victoria (1) and Queensland (1). Bryde's whales are found year-round primarily in temperatures exceeding 16.3 °C. The coastal from of Bryde's whale appears to be limited to the 200 m depth isobar, moving along the coast in response to availability of suitable prey. The offshore form is found in deeper water (500 m to 1000 m). Dive times are relatively short, averaging 1.27 minutes but potentially lasting 9 minutes. This suggests that Bryde's whales use the upper layers of the ocean and can therefore be considered pelagic.	Low This species unlikely to venture into coastal waters. The amount of ambient noise and vibrations in the Study Area is likely to deter any individuals.

Scientific name	Common name	EPBC Act	Distribution, habitat, foraging and breeding*	Likelihood of occurrence
Megaptera novaeangliae	Humpback Whale	M	Occurs in oceanic and coastal waters worldwide. The population of Australia's east coast migrates from summer, cold-water feeding grounds in Subantarctic waters to warm-water winter breeding grounds in the central Great Barrier Reef. The western population tend to migrate further offshore during their northward migration. The migration pathway for the Western Australian population is generally within 200 km from shore (Double et al. 2010). Important resting areas have been identified during the southern migration and include: • Augusta; • Geographe Bay; • Shark Bay, Exmouth Gulf; and • the southern Kimberley region. There are additional areas of potential importance as resting areas around the Houtman Abrolhos, Montebello and Barrow islands, although this is still to be determined conclusively.	Medium The waters around the Houtman Abrolhos, which may include the Study Area, are potentially considered important resting areas for this species
Orcinus orca	Killer Whale, Orca	M	In Australia, orcas are recorded from all states, with concentrations reported around Tasmania. Sightings are also frequent in SA and Victoria. A sighting at Yirrkala in April 1999 provides evidence that they also occur in Northern Territory waters. Orcas are frequently seen in the Antarctic south of 60° S and have been recorded from Heard and Macquarie Islands. Macquarie Island appears to be a key locality, with orcas regularly reported there. The preferred habitat of orcas includes oceanic, pelagic and neritic (relatively shallow waters over the continental shelf) regions, in both warm and cold waters. They may be more common in cold, deep waters, but off Australia, orcas are most often seen along the continental slope and on the shelf, particularly near seal colonies. Orcas have regularly been observed within the Australian territorial waters along the ice edge in summer.	Low There are no known resident populations in the Study Area. Pods/individuals are unlikely to swim close to shore and into the Study Area.

Scientific name	Common name	EPBC Act	Distribution, habitat, foraging and breeding*	Likelihood of occurrence
Migratory elasmobranchs				
Carcharhinus longimanus	Oceanic Whitetip Shark	M	Widespread in tropical and warm temperate waters (usually in waters above 20 °C) of all oceans - usually well offshore beyond the continental shelf between about 30°N and 35°S, or around oceanic islands. The species occurs at depths from the surface to 150 m. Oceanic Whitetip Sharks rarely come close to land. In Australia, the species occurs mostly in oceanic areas off northern Australia (rare or absent in the Arafura Sea and Gulf of Carpentaria); recorded off SA but usually rare off the southern coast. Feeds mostly on a variety of pelagic bony fishes, as well as on squid. Prey also includes crustaceans, stingrays, turtles, sea birds and carrion (dead whales and dolphins).	Low This species is mostly an oceanic species and rarely swim inshore.
Lamna nasus	Porbeagle, Mackerel Shark	M	The Porbeagle is wide-ranging and inhabits temperate, subarctic and subantarctic waters of the North Atlantic and Southern Hemisphere. The Porbeagle primarily inhabits oceanic waters and areas around the edge of the continental shelf. They occasionally move into coastal waters, but these movements are temporary. The Porbeagle utilises a broad vertical range of the water column and is known to dive to depths exceeding 1300 m. The Porbeagle is thought to be reasonably flexible in the types of habitats used for foraging.	Low This species is mostly an oceanic species and rarely swim inshore.
Mobula alfredi	Reef Manta Ray, Coastal Manta Ray	M	Distributed in the Indo-West Pacific: Red Sea, South Africa, Thailand to WA; north to Japan (Yaeyama Island), to Solitary Island, Australia as far east as French Polynesia and the Hawaiian Islands. Reported in the Atlantic (Canary and Cape Verde islands) but this species may be restricted more or less to the Indian and Western Pacific only. Adults are commonly sighted inshore, within a few kilometres of land; found around coral and rocky reefs as well as along productive coastlines with consistent upwelling, tropical island groups, atolls and bays.	Low The Study Area does not contain preferred habitat for this species.

Scientific name	Common name	EPBC Act	Distribution, habitat, foraging and breeding*	Likelihood of occurrence
Mobula birostris	Giant Manta Ray	M	Widespread, although relatively uncommon in Australian waters; also, Cocos (Keeling) Islands and Christmas Island in the eastern Indian Ocean. Elsewhere the species is circumglobal - usually offshore, often around oceanic islands, sometimes coastal, and most common in tropical waters. Giant Manta Rays aggregate around Ningaloo Reef during autumn and winter. This species has been found off Ecuador feed in surface waters, along with the mesopelagic zone.	Low The Study Area does not contain preferred habitat for this species.

* Distribution, habitat, foraging and breeding information is extracted from:

- Australian Government Department of the Environment and Energy http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl, and
- Fishes of Australia https://fishesofaustralia.net.au/.

Key:

CE = critically endangered; E = endangered; V = vulnerable; M = migratory

There is an artificially erected nesting post near Port Berth 2, and the waters in and around the Port are considered valuable breeding and foraging habitat for the Osprey (*Pandion haliaetus*), which is listed as migratory under the BC Act. No other conservation-listed species are likely to breed or use the habitats in the Study Area for critical life stages, based on the likelihood of occurrence assessment.

Seasonal sensitivities are periods of the year when significant marine fauna exhibit behaviours that relate to lifecycle milestones. These have been defined in **Table 9-5** for the key marine fauna and are specific to the life stage known to occur in the Study Locality and Study Area.

Table 9-5 Seasonal sensitivities of key marine fauna

Species	Lifecycle	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Caspian Tern (*Hydroprogne caspia*)	Foraging												
Opsrey (*Pandion haeliatus*)	Breeding	*	*	*	*	*	*	*	*	*	*	*	*
Roseate Tern (*Sterna dougallii*)	Foraging												
Crested Tern (*Thalasseus bergii*)	Foraging												
Humpback Whale (*Megaptera novaeangliae*)	Migration							^	^	^			
Australian Sea-lion (*Neophoca cinerea*)	Foraging Haul-out	*	*	*	*	*	*	*	*	*	*	*	*
Indo-Pacific Bottlenose Dolphin (*Tursiops aduncus*)	Foraging												

*Known to occur in Study Area all months of the year
^Peak activity
NB: shaded cells indicate when the lifecycle would occur in the Study Area; source: DCCEEW 2024

The Study Area also lies within the boundaries of several managed fisheries. These fisheries target invertebrates including, but not limited to, abalone (*Haliotis* spp.), common octopus (*Octopus djinda*), western rock lobster (*Panulirus cygnus*), finfish, and elasmobranchs. The West Coast Bioregion for recreational fishing also encompasses the Study Area and recreational fishermen target some of the commercially important species as well as other invertebrates and finfish species.

The Study Area may also provide permanent or temporary habitat for several other non-significant, or recreationally or commercially important marine fauna. Shore/wading birds and raptors may fly over and/or forage in the waters and foreshores, fish, elasmobranchs, marine mammals and reptiles may transit, forage and/or breed in the subtidal waters, sessile and mobile invertebrates likely colonise benthic habitats, and plankton are likely adrift in the water column. However, most of these habitats are ubiquitous in the wider region and currently experience localised disturbance related to Port activities.

9.3 Potential Environmental Impacts

A marine fauna risk assessment was undertaken as part of the development of the PMaxP Marine Fauna Management Plan (MFMP; SLR 2025d). The implementation of the PMaxP has the potential to result in the following impacts to marine fauna:

- Permanent loss or modification of BCH (as habitat for marine fauna; see **Section 8.0**) from dredging, piling and the installation of marine infrastructure;
- Permanent loss of Australian sea lion haul-out habitat;

Elevated turbidity and increased sedimentation (Project activities and subsequent impacting pathways that have the potential to adversely affect marine fauna are presented in **Table 9-6**.

Table 9-6 Project activities that have the potential to affect Marine Fauna

Project activity	Impact pathway	Impact type
Dredging and infrastructure installation	Loss or permanent modification of BCH that is habitat for marine fauna	Direct (Section 9.3.1.1)
	Permanent loss of haul out habitat for Australian sea lion	Direct (Section 9.3.1.2)
Dredging	Mobilisation of sediment contaminants	Indirect (Section 9.3.2.1)
Piling	Exposure to underwater noise and vibrations causing permanent or temporary hearing loss to marine fauna	Direct (Section 9.3.1.3)
	Exposure to above-water noise and vibrations causing potential permanent or temporary hearing loss to the Australian Sea-lion	Direct (Section 9.3.1.4)
Movement of vessel	Vessel collision/strike and interactions with equipment (i.e. entanglement or entrapment), causing injury or mortality	Direct (Section 9.3.1.5)
	Introduction/spread of marine pests that degrade habitat, increasing competition and predation on marine fauna	Indirect (Section 9.3.2.2)
General construction activities	Artificial lighting associated with construction impacting marine fauna	Indirect (Section 9.3.2.3)

9.3.1 Direct impact assessment

The PMaxP is not expected to have any direct impacts to the conservation significant Humpback Whale, with the only consideration being underwater noise. Hence the impacts to this species has only been discussed in that section.

9.3.1.1 Dredging and infrastructure installation resulting in the loss or permanent modification of BCH that is habitat for marine fauna

The PMaxP would result in the loss/modification of up to 19 ha of BCH from dredging and the installation of structures. This comprises seagrass, macroalgae and bare soft sediment and constitutes ~0.4% of the BCH LAU.

These habitats may be unavailable during construction (temporary); however, they will continue to be available to marine fauna following construction completion, albeit modified. The newly installed marine infrastructure would be suitable haul-out habitat and the newly operational Port waters would constitute potential foraging habitat for other marine fauna species.

The PMaxP DE represents <0.01% of the foraging BIA for the Australian sea-lion and Caspian tern and hence modifications to BCH within the DE are not expected to substantially or materially impact the foraging activities of these, or other marine fauna, species.

The PMaxP DE represents <0.01% of the migration BIA for the humpback whale. Not only is this a small proportion of the BIA, the current depths in the Disturbance Footprint (where habitat will be lost) are too shallow for most individuals to navigate (ranging between ~1 mCD and ~8 mCD (Precision Hydrographic Services 2021, i-Boating 2025) It is unlikely this section of the coastline is important to Humpback Whale migration which traditionally follow the 38 m isobath, some 10 km offshore (LeProvost, et al. 2007).

9.3.1.2 Dredging and infrastructure installation resulting in permanent loss of haul out habitat for Australian sea lion

The PMaxP will involve the temporary exclusion of individuals from existing haul-out areas in the Port (i.e. existing northern breakwater and underneath Berth 6) during construction. These temporary exclusions would be staged based on the area of works such that not all haul-out habitat would be concurrently unavailable. However, these habitats will be reinstated.

The construction of the new tug harbour breakwater has specifically included the requirement for the provision of sufficient flat rock surfaces between +1m AHD to +3m AHD to create haul out sites for sea lions, with an aim to increase total haul-out habitat area in the Port during detailed design.

9.3.1.3 Piling resulting in exposure to underwater noise and vibrations causing permanent or temporary hearing loss to marine fauna

Cumulative exposure to underwater noise can result in temporary threshold shifts (TTS) and permanent threshold shifts (PTS) in marine fauna. Potential impacts to marine fauna due to major underwater noise sources associated with the PMaxP were assessed by completing a standalone Sound Transmission Loss Modelling (STLM) study (Appendix G). The study modelled PTS and TTS impacts to all marine fauna classes from all potentially high-risk noise activities, including piling (impact and vibratory), rock breaking (hydro-hammer), and dredging (backhoe and trailing suction hopper dredge, depending on location). The modelling produced impact zones relevant to physiological and behavioural responses resulting from impulse (immediate impact from a single pulse) and cumulative (impact from exposure over an entire event to impulsive and continuous noise) noise exposure.

Underwater noise modelling predicted maximum PTS and TTS distances for each type of marine fauna, as relevant to the PMaxP. The underwater acoustic modelling was completed based on the 50% design to inform the piling and dredging source terms. As the design has progressed there have been some minor amendments to the approach, including the piles required for the two jetties in the new tug harbour. The modelling was completed based on 40 piles at 610 mm diameter but as the design has progressed it is now proposed that 20 piles of 914 mm diameter are used. For completeness, the implications of the new design were assessed by the underwater acoustic specialists who completed the original modelling scope. This review confirmed that although there would be a 3 dB increase in source level of the impact hammer (at 1 m) representing a doubling of the sound energy, this would not translate to double the maximum distances for PTS and TTS. Given the management zones adopted for marine fauna (as detailed in the MFMP; SLR 2025d) were adopted for the most conservative scenario, the zones adopted for the new tug harbour activities (piling or dredging) are already more than double the distance for the original piling scenario. Hence, the change to piling design is not expected to result in a material difference to the management actions defined in the MFMP. Further, due to the larger pile size, the number of piles is reduced by half and hence the duration of piling is also halved.

It is acknowledged that in the absence of management strategies that there is a real risk to temporary and permanent impacts to marine fauna and hence these modelled distances informed a number of controls and procedures, as detailed in the Marine Fauna Management Plan (MFMP; SLR 2025d) and summarised as follows:

- Effective communication of expectations and positive communication during construction
- Implementation of conservative Shutdown and Observation zones
- Pre-start observations and soft starts
- Trained marine fauna observations dedicated to sighting and communicating sightings
- A warning and stop-work procedure
- Explicit instructions on when piling can commence or recommence, and
- Limiting piling to daylight hours only where visibility is the best for observations.

These management actions have been demonstrated to be effective in managing underwater noise and vibration impacts to marine fauna on other projects, hence underwater noise and vibration impacts to marine fauna are unlikely to be significant.

9.3.1.4 Piling resulting in exposure to above-water noise and vibrations causing potential permanent or temporary hearing loss to the Australian Sea-lion

Noise and vibrations during construction also have the potential to affect individuals above the water level. Due to the proximity of known haul-out habitat (Seal Rocks) to PMaxP construction activities, an assessment of modelled in-air noise levels and thresholds for the Australian sea-lion was undertaken by species' experts at Curtain University (Appendix H).

The assessment concluded that exposure to air-borne noise from construction activities, such as piling, is not expected to impact the Australian Sea-lion at any distance. Hence, the shutdown and observations zones implemented for underwater noise exposure would be more than sufficient to protect these fauna utilising habitats adjacent the PMaxP activities.

9.3.1.5 Movement of vessels resulting in collision/strike and interactions with equipment (i.e. entanglement or entrapment), causing injury or mortality

Increased vessel activity will increase the risk of vessel strikes on marine fauna swimming in and around the Port. The Port of Geraldton Australian Sea Lion Management Plan (Mid West Ports Authority 2025) currently manages vessel strike risks from activities associated with the Port and no vessel strike incidents have been recorded in the Port to date. The MFMP has been developed to manage this potential impact during PMaxP construction (SLR Consulting Australia Pty Ltd 2025b). Actions include:

- Effective communication of expectations and positive communication during construction
- Trained marine fauna observations dedicated to sighting and communicating sightings
- Implementation of appropriate approach distances and vessel manoeuvres to avoid collision
- Strict vessel speeds, and

- Adherence to the mandatory separation distances outlined in the WA *Biodiversity Conservation Regulations 2018* (BC Reg).

These management actions have been demonstrated to be effective in managing vessel strike impacts to marine fauna on other projects, hence increased vessel activity is unlikely to result in negative interactions with marine fauna related to PMaxP activities.

9.3.2 Indirect impact assessment

9.3.2.1 Dredging resulting in the mobilisation of sediment contaminants

Contaminants in the sediments may be mobilised during dredging and piling and accidental spills can distribute contaminants harmful to marine fauna.

There is limited information on the impacts of specific contaminants to the identified marine fauna species of significance but the bioavailable metal concentrations were below the sediment DGVs (ANZG 2018; Section 7.2.4, Appendix B).

The risk of accidental spills is considered to be low following the implementation of management actions, including appropriate fuel and chemical refilling and storage management as detailed in the MCEMP, and currently successfully implemented as part of the ongoing operations of the Port.

Thus, it is unlikely that the contaminants from sediment mobilisation during dredging and piling or accidental spills would result in any impacts to marine fauna.

9.3.2.2 Movement of vessels resulting in the introduction/spread of marine pests that degrade habitat, increasing competition and predation on marine fauna

The PMaxP increases the risk of the introduction/spread of marine pests that may modify marine fauna habitats in and around the Port, as construction vessels may be required to enter WA waters from other jurisdictions.

However, the implementation of PMaxP management actions including biofouling risk assessment and direct consultation with the WA Department of Primary Industry and Regional Development (DPIRD) Vessel Management team on each vessel intended to undertake works, is considered effective in reducing this risk. These actions have offered protection to the Port and are in accordance with the *Biosecurity Act 2015*. Furthermore, routine monitoring at the Port is also conducted under the DPIRD led Marine Pest Statewide Array Surveillance Program (SWASP), enabling early detection of (and response to) potential marine pest incursions.

Thus, it is not expected that the PMaxP would introduce/spread marine pests that would result in a significant impact to marine fauna or their habitats.

9.3.2.3 Artificial lighting associated with construction impacting marine fauna

The PMaxP is not expected to significantly alter the existing light environment at the Port. The Port and the surrounding town of Geraldton are currently well-lit and hence any minor artificial light alterations due to PMaxP are not expected to impact marine fauna. **Figure 9-2** depicts the baseline condition with significant artificial light spill attributed to the Geraldton townsite.

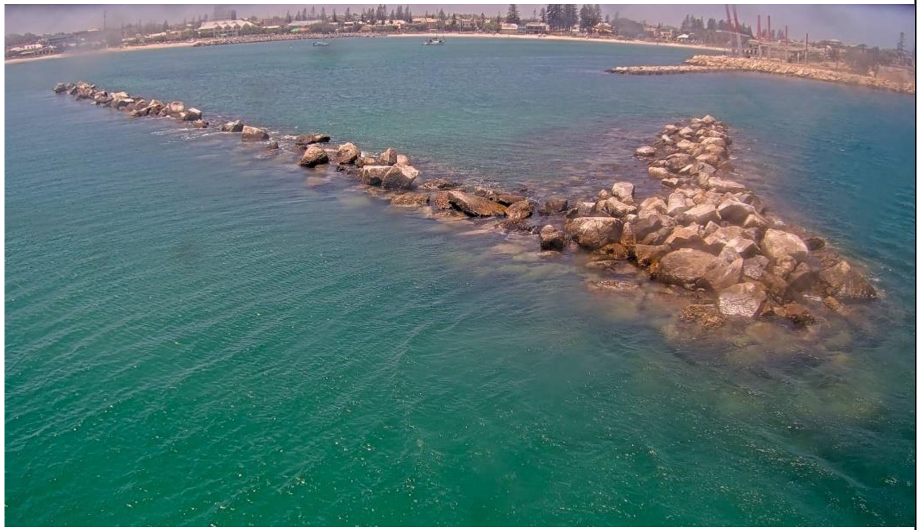
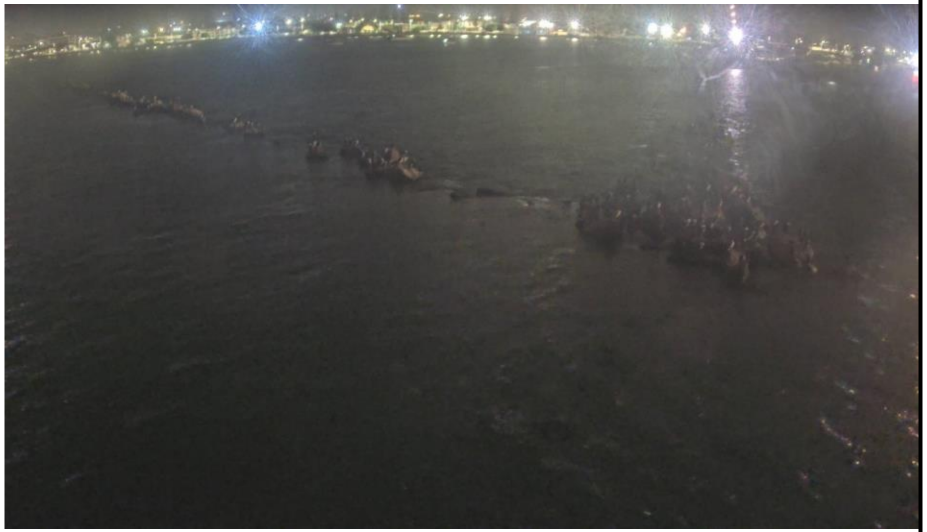
	
31 January 2025 12pm	31 January 2025 12am

Figure 9-2 View from Seal Rocks to Geraldton townsite (day and night)

9.4 Mitigation Hierarchy

Efforts to avoid and minimise impacts on marine fauna habitats, including management of water quality and minimising the risk or the introduction of marine pests are discussed in Section 7.4 and Section 8.4. Additional mitigation measures have focussed on the minimisation of impacts to marine fauna.

9.4.1 Minimise

Acoustic modelling was used to inform management zones for marine fauna to ensure protection of these species from undergoing noise-induced threshold shifts because of noisy activities such as rock breaking and piling. The management zones (observation and shutdown) are detailed in the PMaxP MFMP (SLR 2025d) which also details other procedures (soft start, stop work etc.) and controls aimed at ensuring the protection of marine fauna within and adjacent to the Port.

The protection afforded to the Port by the new tug harbour breakwater will also result in a reduction of the required design strength for much of the PMaxP-proposed infrastructure (e.g. wharf decks). This will reduce the volume of materials required, reduce the number and size of piles, and hence minimise the potential impact to the environment by optimising the disturbance footprint and reducing acoustic impacts to marine fauna during piling works.

Modification of intertidal habitat utilised for hauling out by Australian sea-lions has been avoided and/or minimised where possible. Whilst temporary disturbance to existing habitat is unavoidable, the PMaxP design includes a net increase of viable haul-out habitat at the new tug harbour seawall and Berth 1 and Berth 8/9 areas.

Any increased risk of vessel strike and interactions with equipment would be managed through the development and implementation of the PMaxP MFMP (SLR 2025d) during construction. Any operational impacts would be addressed by the MWPA Port Operational Management Plan currently implemented for operations at the Port. Industry-approved management measures have been developed and successfully implemented in other ports to manage vessel strikes and these would be considered into the MFMP.

Two osprey species experts – Dr Ronald Johnstone, the retired Curator of Ornithology (now a Research Associate in Ornithology) at the Western Australian Museum and a co-author of the *Handbook of West Australian Birds* (Johnstone and Storr 1998), and Dr Allan Burbidge, Principal Research Scientist at the DBCA – both agree that the breeding pair at the Port is not an ecologically significant proportion of the Osprey population (R. Johnstone 2024, Burbidge 2025). Midwest Birdlife routinely monitor the Osprey nest and breeding pair at berth 2 and this monitoring effort will be continued through the PMaxP implementation to determine any potential impacts, particularly during the breeding season. Ospreys are faithful to the same nest year after year. A human-made nesting platform was established in the Port on Berth 2 over 22 years ago. This platform has been an active breeding and nesting location for the resident Ospreys, successfully rearing young most years, despite its location within an active operational Port. Furthermore, the nest at the Port will not be unlawfully removed or modified by PMaxP without consultation and approval from DBCA. This species is known to be adapted to anthropogenic disturbances where breeding sites are located in urban areas (Birdlife Australia 2023).

Rehabilitation and offsets are not expected to be applicable to this factor.

9.5 Significance of Residual Impacts

Given the limited loss/modification of BCH as a proportion of the extent of BCH outside the potential impact area, the loss/modification of BCH is unlikely to have a significant impact on marine fauna. Further, the current management practices to avoid the introduction of marine pests and adverse interactions between vessels/equipment and marine fauna are being successfully implemented at the Port following the PEP and shall continue with PMaxP.

There may be temporary disruptions to foraging habitat and haul-out sites (for the Australian Sea-lion) during construction that would be managed through the MFMP. The area under berth 6 is currently occupied as a haul-out site, and the modified areas are likely to have similar attributes. The EPA Report (1050) on the PEP stated the project was unlikely to have a significant overall effect on the Australian Sea-lion population. The Australian Sea-lion population is reasonably stable, and population numbers are unlikely to be affected. It is recognised, however, that there may be temporary disturbances to Australian Sea-lions within the project area. If the Australian Sea-lions were to remain at the site, then disturbance and impact from Port activities would be appropriately managed such that permanent impacts to individuals are unlikely. This remains applicable to the PMaxP, and impacts will be managed through controls detailed in the PMaxP MFMP (SLR 2025d).

The piles and other subtidal or intertidal marine structures would introduce habitat complexity to existing soft sediment areas and provide colonising habitat for several macroalgae and filter feeder species. This is likely to create reef-like habitat and subsequently attract associated fish and mobile invertebrate species.

The PMaxP MFMP (SLR 2025d) would also manage the impacts of vessel strike and interactions with equipment, noise and vibrations on marine mammals and reptiles, while the MCEMP would manage the risk of the introduction/spread of marine pests. Hence these PMaxP activities are not expected to impact the biodiversity or marine fauna populations such that ecological integrity is compromised.

Based on the modelled underwater noise results, permanent and temporary impacts on some fish species are inevitable and difficult to manage through the implementation of mitigation measures. However, these areas are small, impacts are temporary, and the number of individuals potentially impacted is not expected to be a substantial proportion of any population. Furthermore, the habitat in the Study Area is unlikely to support a substantial proportion of any population of recreationally and/or commercially important marine species.

9.6 Environmental Outcomes

The predicted environmental outcomes of the PMaxP related to marine fauna are:

- No significant impacts to key marine fauna or commercially and recreationally important marine species as a result of PMaxP.

Based on the WA Environmental Offsets Policy, offsets are not expected for the PMaxP as the residual impacts to marine fauna are not expected to be significant.

With the implementation of the mitigation hierarchy, PMaxP is not expected to have a significant impact to marine fauna such that biological diversity and ecological integrity would be lost. In consideration of the proposed design and management of the PMaxP, it is considered that the EPA's objective for marine fauna can be met.

10.0 Impact Assessment – Coastal Processes

10.1 EPA Policy and Guidance

The policy documentation utilised to inform the assessment of this factor includes:

- Environmental Factor Guideline: Coastal Processes (EPA 2016f)

The environmental objective for this factor is *to maintain the geophysical processes that shape coastal morphology so that the environmental values of the coast are protected*.

10.2 Receiving Environment

The coastal environment is naturally dynamic, and its morphology is determined by the interaction between its structures (e.g. rocky cliffs or unconsolidated sand), and the intensity and degree of exposure to key geophysical processes (e.g. wind strength, wave height, currents speed and direction). These processes occur everywhere along the coastline, moving sand laterally along the coast (longshore sediment transport or littoral transport) as well as on- and off-shore (cross-shore sediment transport), and they vary in intensity and relative importance.

The processes can be cyclic and occur on a daily or seasonal basis, or episodic (e.g. storm events), and can change the shape of the seabed and beach profiles at varying rates and by varying degrees. The physical action of water and wind can alter beach profiles over short timescales, while cliffs and rocky platforms will erode and change over longer timescales. Coastal processes also influence the type and distribution of BCH in sub-tidal and inter-tidal zones. For example, seagrass communities thrive in bays and lagoons that are sheltered from wave energy by offshore reefs or islands. The types and distribution of benthic communities can also influence coastal morphology by moderating the effects of coastal processes.

Along most of the Western Australian coast, including the area adjacent the Port, the combination of swell waves and strong sea-breeze wind fields drive the prevailing northward longshore sediment transport. Significant year-round swell waves coming from the south–southwest are attenuated and refracted by coastal limestone ridges, which are common in the study area at ~4km from the shore. Close-to-shore wind waves generated by the strong prevailing south–south-westerly winds are superimposed on the swell. The net longshore sediment transport direction is determined by the relative energies of swell and wind-sea waves and the angle between the local shoreline and dominant incident waves. There are seasonal reversals of sediment moving to the south driven by episodic events such as strong NW winds associated with the passage of fronts and storms in winter. Further, due to refraction, the incident wave direction is not from the south (for example, where waves refract and diffract around shallow fringing reefs). However, the predominant sediment movement is from south to north (RHDHV 2023b).

The Geraldton coastline is unique compared to other continental coastlines due to a relatively shallow nearshore reef system that runs from south of Greenough River to north of Oakajee and extends ~5 km from the coast in vicinity of the Port. The nearshore reef systems appear to play a key role in the evolution of the sandy beaches along the Geraldton coastline. These bathymetric features, clearly visible in aerial imagery, dissipate wave energy and promote the growth of tombolo features on both large (e.g. Point Moore) and small (e.g. around Oakajee) scales. In addition, they set up complex nearshore currents and circulation patterns which dictate local sediment transport pathways (RHDHV 2023b). They also provide relatively protected areas for seagrass meadows which are a source of sediment from biogenic processes.

Three fundamental mechanisms can transport sand towards, away from or along the beach;

- Longshore sediment transport (Littoral transport);
- Cross-shore sediment transport; and
- Wind-blown losses.

The Geraldton coastline is characterised by longshore sediment transport, with a net northwards transport of sand. The wind-blown mechanism can move sand from the beach to nearby dunes, forming a natural buffer to accommodate erosion during severe storms.

The main sources of the sediment that moves into the Geraldton sediment cells include:

- Long-shore drift of sand coming into the local sediment cells from areas further south;
- Southgates Dunes;
- Seagrass-derived sediment (Biogenic); and
- Chapman River.

In summary, most of the sand in the southern embayment (from Southgates around Point Moore to the Geraldton Port navigation channel) consists of fine modern skeletal (carbonate) sand and ~60% of this sand is derived from modern bioclasts living in association with seagrass meadows, with the remainder coming from longshore transport from further south and the north-western edge of Southgates dunes. Most of this fine skeletal sand is moved via longshore transport to the north and exists mainly within the nearshore reefs ~2km from the shoreline (RHDHV 2023b).

The seafloor offshore of the fringing reefs in deeper water is composed primarily of medium to coarse sand that is largely relict and does not interact with the sediment transport mechanisms which occur in the shallower areas inside the fringing reefs <10 m depth. This relict sand is mainly derived from the erosion of submersed limestone structures.

In the northern embayment of Champion Bay (from the Port navigation channel to Drummonds Point), there is a mixture of fine-medium quartzose and modern skeletal sand. It is mostly found offshore from the Chapman River mouth with limited sediment redistribution to the north. Offshore sediment transport occurs in this area and allows the deposition of quartzose sand from the Chapman River mouth up to ~2km offshore at around 10 m water depth (near the middle of Champion Bay) (RHDHV 2023c).

In the area immediately north of the Batavia Coast Marina (BCM) extending to the Chapman River, the sediment has a relatively low carbonate content. Sediment input into the area is a mixture of artificial and natural sources, with the longshore sediment drift following the south-to-north transport system. The relatively high quartz content found along the northern beaches suggests some redistribution of the Chapman River-derived sand to the south (RHDHV 2023b). The main 'sinks' for sand in the Geraldton area are:

- Longshore Transport;
- Beaches and Dunes;
- Port Navigation Channel; and
- Areas within Champion Bay.

The natural longshore sediment transport has been interrupted along the coastline by the construction of structures associated with the Port of Geraldton, the BCM and Foreshore Redevelopments. It has been estimated that the coastal developments of the Port and Marina have reduced sand supply to beaches to the north of the BCM by 10-15,000 m^3/yr (RHDHV 2023c).

10.3 Potential Environmental Impacts

The placement of hard structures on the coast or offshore can alter the effect of coastal processes and hence impact the coastline and nearshore zone, and the environmental values they support (EPA, 2016f). Project activities and subsequent impacting pathways that have the potential to adversely affect coastal processes are presented in **Table 10-1**.

Table 10-1Project activities that have the potential to affect BCH

Project activity	Impact pathway	Impact type
Installation of Infrastructure	Affects to wave dynamics in the Port and adjacent areas including the FBH, Batavia Coast Marina and the Town Beach	Direct (Section 10.3.2.1)
	Affects to longshore sediment transport within Champion Bay	Direct (Section 10.3.2.2)
	Affects to water levels and currents within Champion Bay	Direct (Section 10.3.2.3)
	Affects to sediment transport and sedimentation characteristics within Champion Bay	Direct (Section 10.3.2.4)

10.3.1 Methods and modelling approach

To examine the potential impact of the NTH on longshore sediment transport, subtidal sediment transport, hydrodynamic conditions and sedimentation characteristics within Champion Bay, the following was completed:

- Long-term wave transformation modelling using SWAN,
- Longshore sediment transport modelling using LITPACK, LITDRIFT module, and
- Subtidal hydrodynamics and sediment transport modelling using SWAN and Delft3D.

The SWAN model was updated to incorporate the latest bathymetry and proposed infrastructure with optimised model grids. Multi-annual average longshore transport was determined using the LITPACK software; specifically, the LITDRIFT module computed the sediment transport capacity across the profile. This workflow has produced more reliable sediment transport rate estimates than previously applied models within the Geraldton region. The potential impacts of the proposed infrastructure on the transport of sediment in the sub-tidal zone under current, wind and wave action were assessed using existing Delft3D and SWAN modelling tools. Detailed description of modelling approach used to inform this assessment is provided in Appendix I.

10.3.2 Impact assessment

10.3.2.1 Installation of infrastructure affects wave dynamics in the Port and adjacent areas including the FBH, Batavia Coast Marina and the Town Beach

Champion Bay is a dynamic environment that has substantial spatial and temporal variability in the persistent wave climate (RHDHV 2024). To obtain a greater appreciation of the wave climate throughout Champion Bay, nearshore wave conditions were numerically derived using a model by transforming offshore (deep water, closest to the project site) ERA52 hindcast wave data (i.e., 84-year dataset) to the nearshore. The offshore hindcast wave data is transformed to the nearshore (at key cross-shore profile locations utilised in the LITDRIFT modelling) by means of a spectral wave model (RHDHV 2024). The long-term nearshore wave time series were predicted using the SWAN spectral wave model and a transformation matrix approach. The numerical model was calibrated against measured data at stations within Champion Bay and then further validated against measured wave data at Beacon station and four spot buoys (see Appendix I). This model was considered appropriate and the best practical source of information to inform the impact assessment. Analysis of the available data indicates that wave energy in Champion Bay increases northward from Town Beach to Glenfield Beach (**Figure 10-1**).

Results of this analysis indicated that the installing the NTH has the potential to reduce wave heights on the lee of the structure and in the vicinity of Town Beach and proximal to the Batavia Coast Marina (**Figure 10-2**). The wave climate at other locations throughout Champion Bay is not predicted to be impacted as a result of the installation of the NTH (RHDHV 2024). Based on model predictions presented in **Figure 10-2**, the majority of the predicted changes in wave climate will be limited to an area within the Port, Town Beach and it is unlikely to be noticeable in proximity to the Batavia Coast Marina. The wave climate is also not predicted to change on the windward side of the NTH. Model predictions indicate similar outcomes are also found for waves from other directions.

Wave roses for profiles at the P1 and P2 locations over the year across the multiple years of data are presented in **Figure 10-3** and **Figure 10-4**, respectively for both the existing and PMaxP development layouts. The results indicate after the installation of the NTH a shift in dominant wave directions at P1, from northwest (NW) to a direction between NW and north-northwest (NNW) along with a reduction in frequency of larger waves is predicted to occur. A similar shift is observed at P2, where the dominant wave direction changes from west-northwest (WNW) prior to the installation of the NTH to a direction between WNW and NW along with a reduction in the frequency of larger waves following installation.

Based on the model predictions, is it considered that although a relatively localised change in the wave climate may occur leeward of the NTH, the area to be influenced by these changes in Champion Bay is relatively small and the wave climate in the majority of the bay remains unaffected. As such, the installation of the NTH is unlikely to result in a significant impact on the geophysical processes that shape coastal morphology within the bay and therefore the environmental values of the coast are likely to not be impacted by the PMaxP.

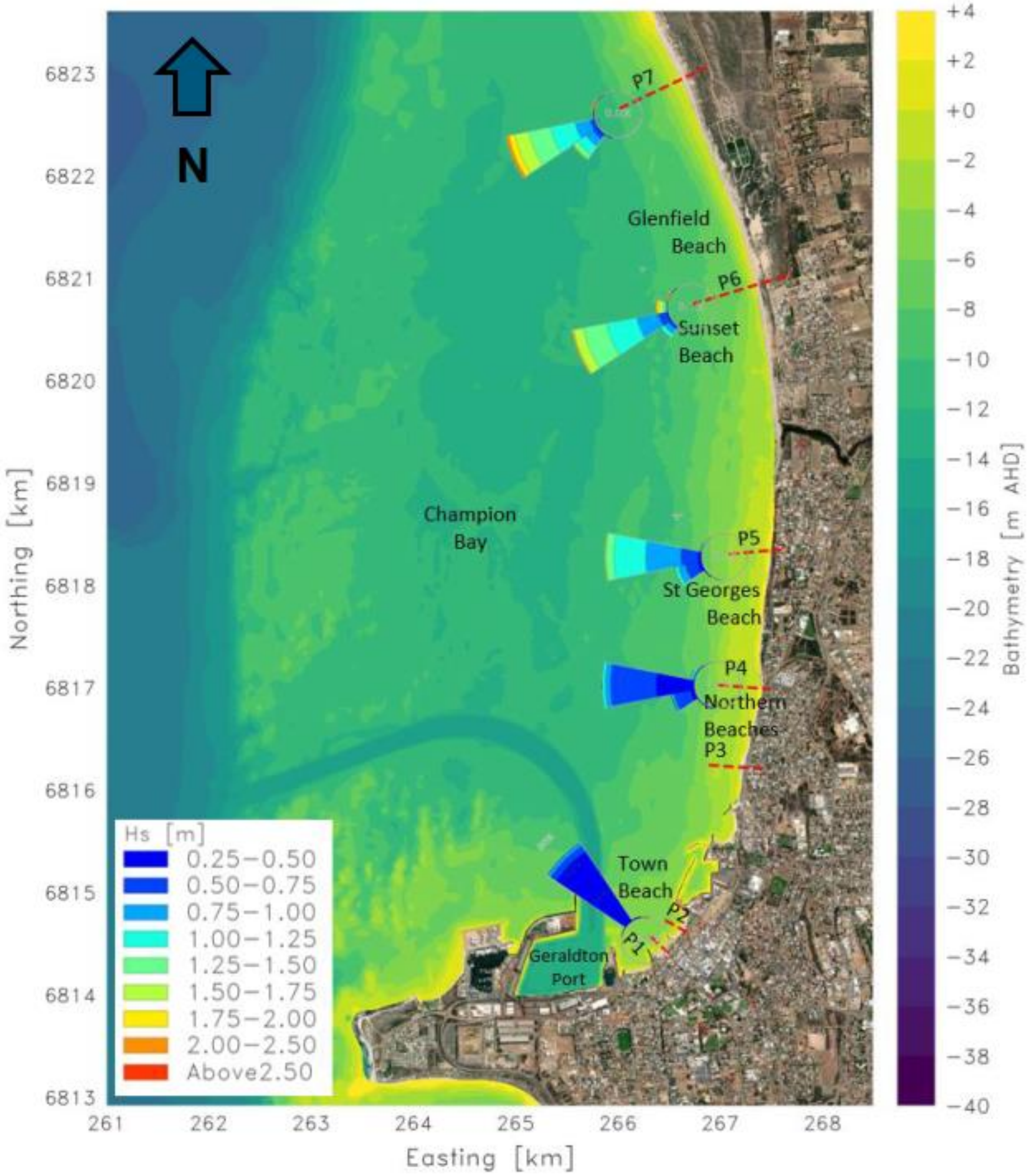


Figure 10-1 Wave roses at selected locations northward from the Town Beach to Glenfield Beach based on 84 year long time series of wave data simulated by the SWAN model

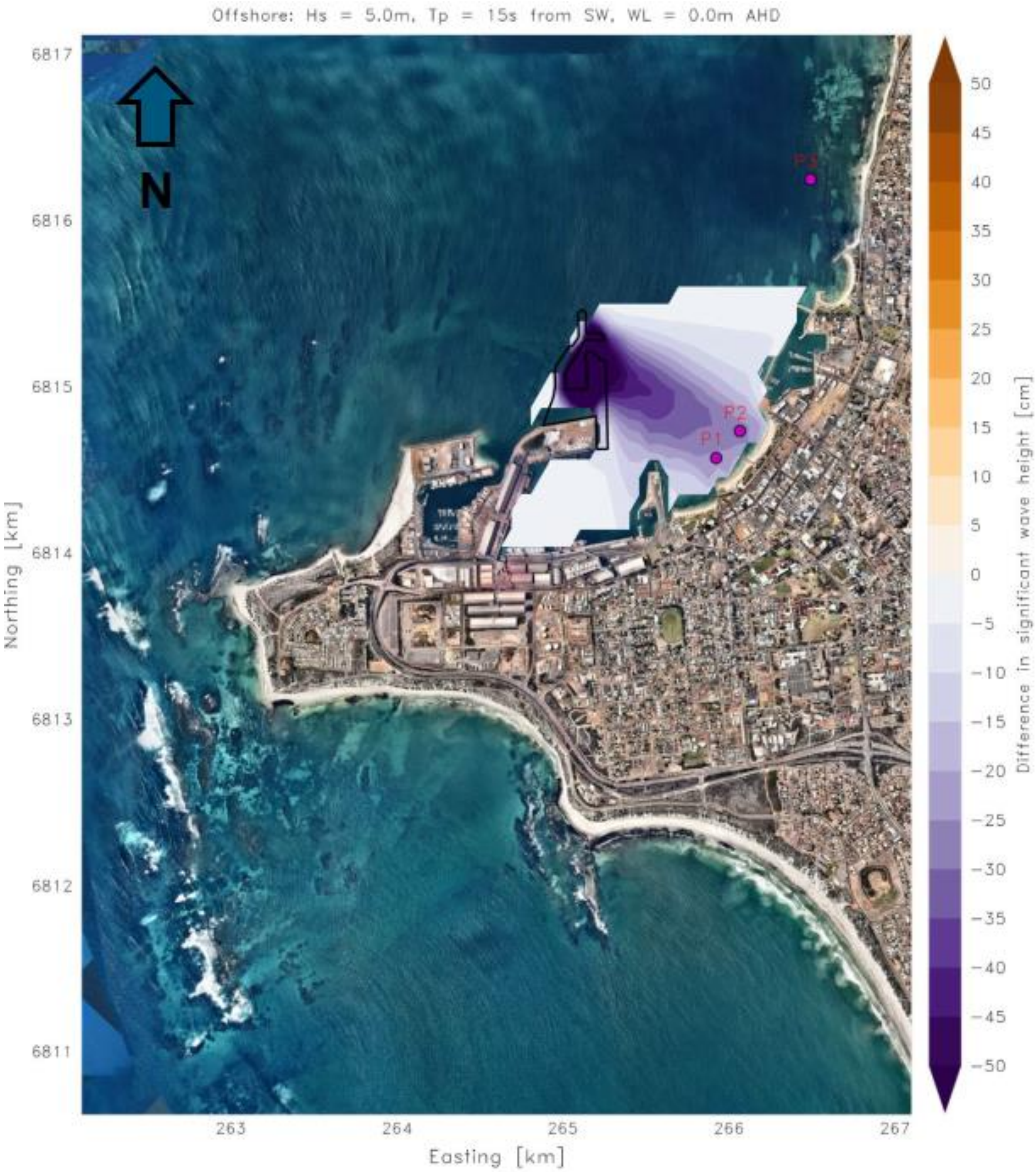


Figure 10-2 Spatial variation of significant wave height difference between the existing and Geraldton PMaxP development (shown in black outline) layout for a moderate extreme wave from SW

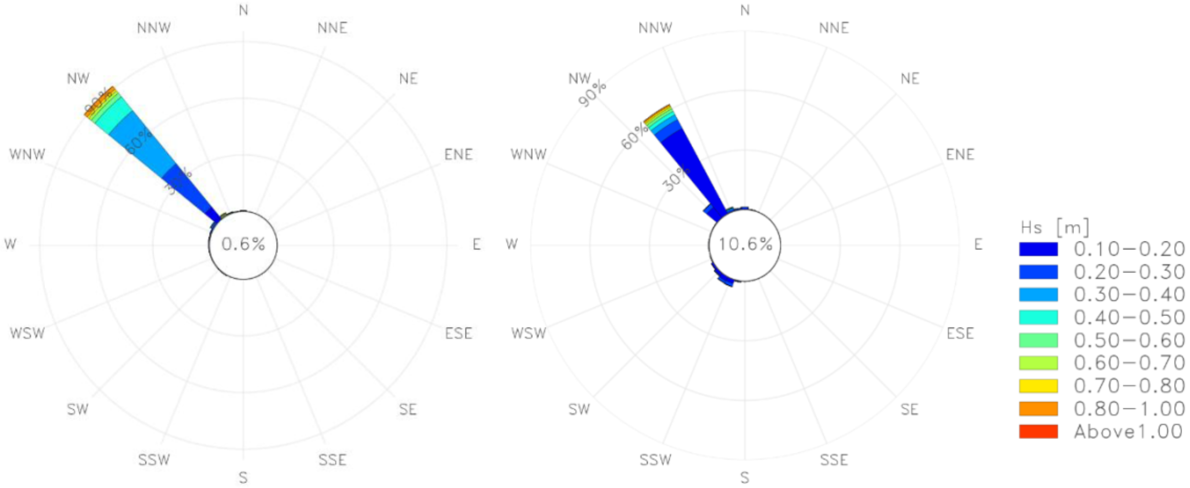


Figure 10-3 Wave rose at P1 for the existing (left) and PMaxP (right) based on simulated wave data available from 1/1/1940 to 1/1/2024

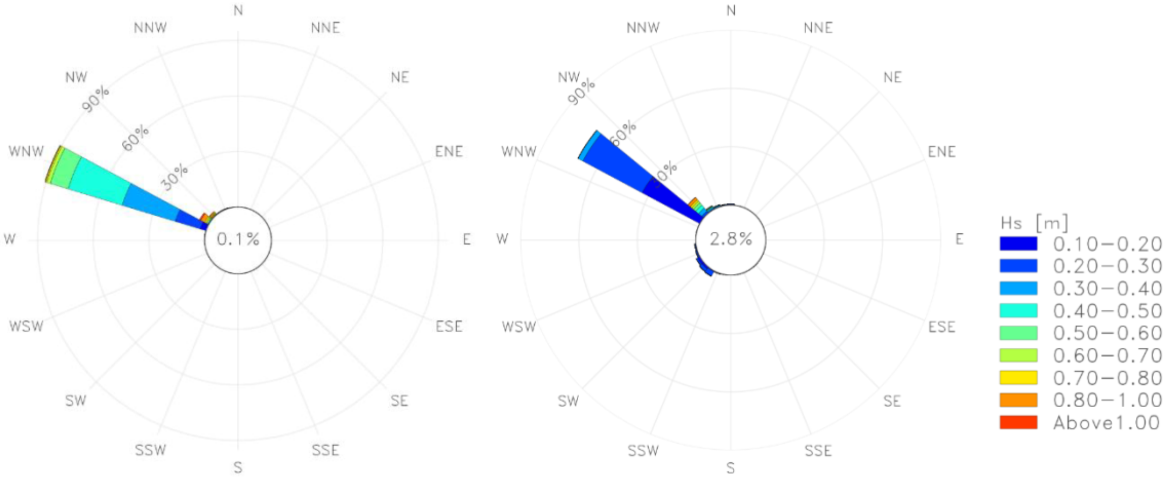


Figure 10-4 Wave rose at P2 for the existing (left) and PMaxP (right) based on simulated wave data available from 1/1/1940 to 1/1/2024

10.3.2.2 Installation of infrastructure affects to longshore sediment transport, within Champion Bay

A 50-year time series of wave data spanning from 1 January 1974 to 31 December 31, 2023, considered sufficiently long to produce statistically reliable results to assess potential impacts of the NTH on longshore sediment transport within Champion Bay (RHDHV 2024, Appendix I). Based on an assessment of current conditions the model indicated that within Champion Bay there is a general northward movement of sediment from Town Beach to Glenfield Beach and beyond (**Figure 10-5**). **Table 10-2** presents the predicted mean baseline annual longshore sediment at various sections calculated over 50 years (1974 - 2023). Results indicate that net northerly longshore sand movement ranges between 3,000 m^3/year to 32,800 m^3/year.

The results show that in general sediment transport rates (i.e., the gross transport rate) increase northward in Champion Bay. The net sand transport direction is consistently toward the north for all beaches considered, aligning with the findings of previous studies (see Appendix I). Further graphical output of cross-shore distribution of simulated average annual longshore transport of sand at the selected beaches is provided in Appendix I.

Under a NTH installation scenario, the longshore sediment transport model predicted that a slight change in the volume of material being transported the direction of sediment transport at and proximal to Town Beach would be southwards compared to northward in the pre-development assessment (**Figure 10-6**)(**Table 10-3**).

It is predicted that the PMaxP development layout will restrict the natural eastward and then northward transport of sediment from the south, necessitating the continuation of the bypassing programme to preserve the existing longshore transport dynamics along the Champion Bay foreshore. Under the baseline condition, it is assumed that a limited amount of sand can naturally bypass the navigation channel and move northward, independent of the bypassing programme. The Geraldton PMaxP development does not change this assumption. However, the sand bypassing programme remains essential for maintaining the continuity of longshore transport at the foreshore. If the sand bypassing programme continues unchanged, it is likely that the existing sediment transport dynamics and associated erosion/accretion patterns along most of the Champion Bay coastline (at P3 and further north) will remain unchanged (RHDHV 2024).

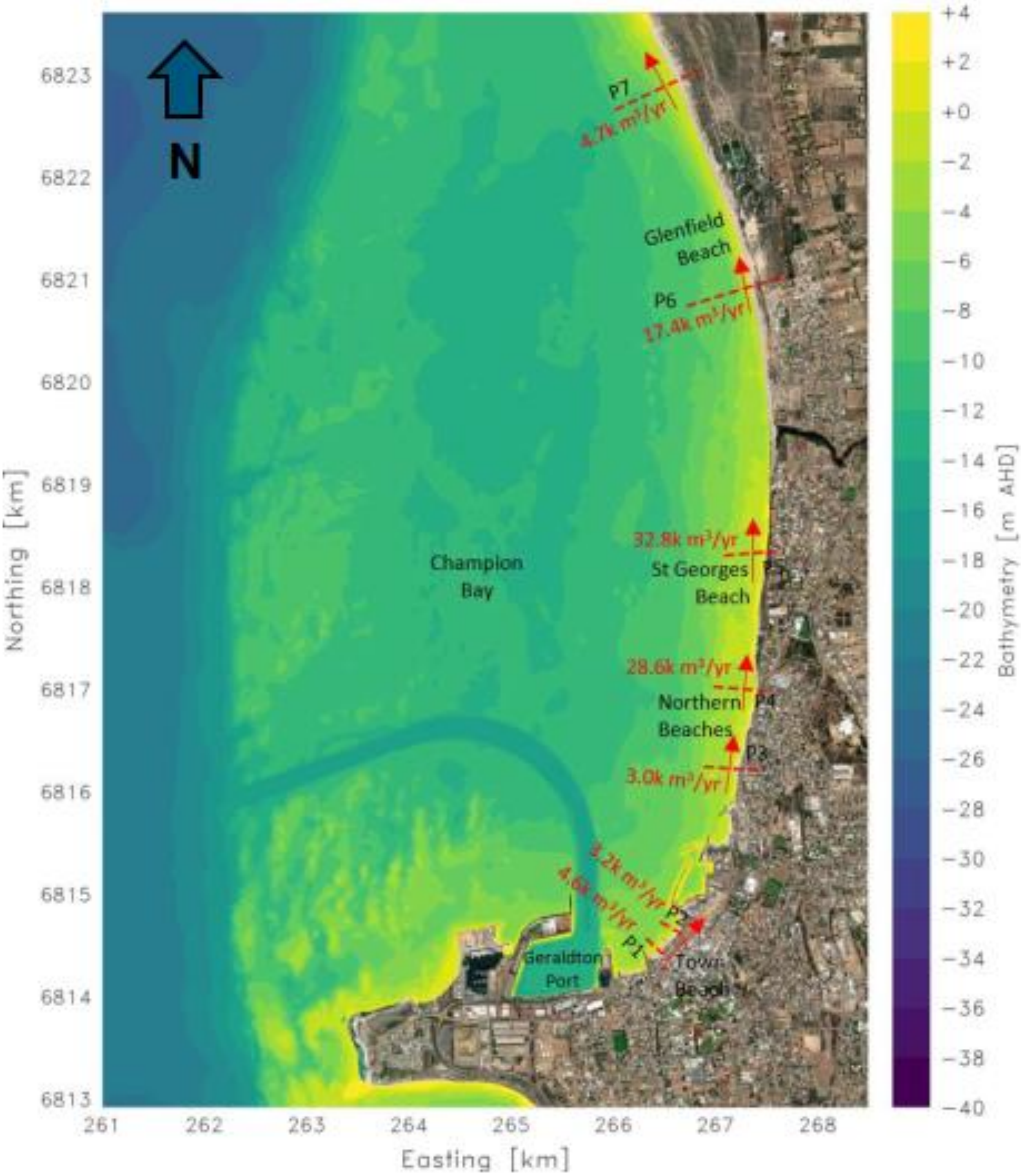


Figure 10-5 Overview of predicted existing annual net longshore transport of sand for the seven selected locations along the coastline northward from the Port

Table 10-2 Mean annual sediment longshore transport of sand (rounded) at various sections calculated over 50 years (1974 - 2023) – baseline scenario (negative values indicating southward transport, and vice versa)

Cross-section	Southward transport of sand (m3/year)	Northward transport of sand (m3/year)	Net transport (m3/year)	Gross transport (m3/year)
1	-1,300	5,900	4,600	7,200
2	-3,000	6,200	3,200	9,300
3	-6,400	9,400	3,000	15,800
4	-5,100	33,700	28,600	38,800
5	-5,000	37,900	32,800	42,900
6	-79,900	97,200	17,400	177,100
7	-41,100	45,900	4,700	87,000

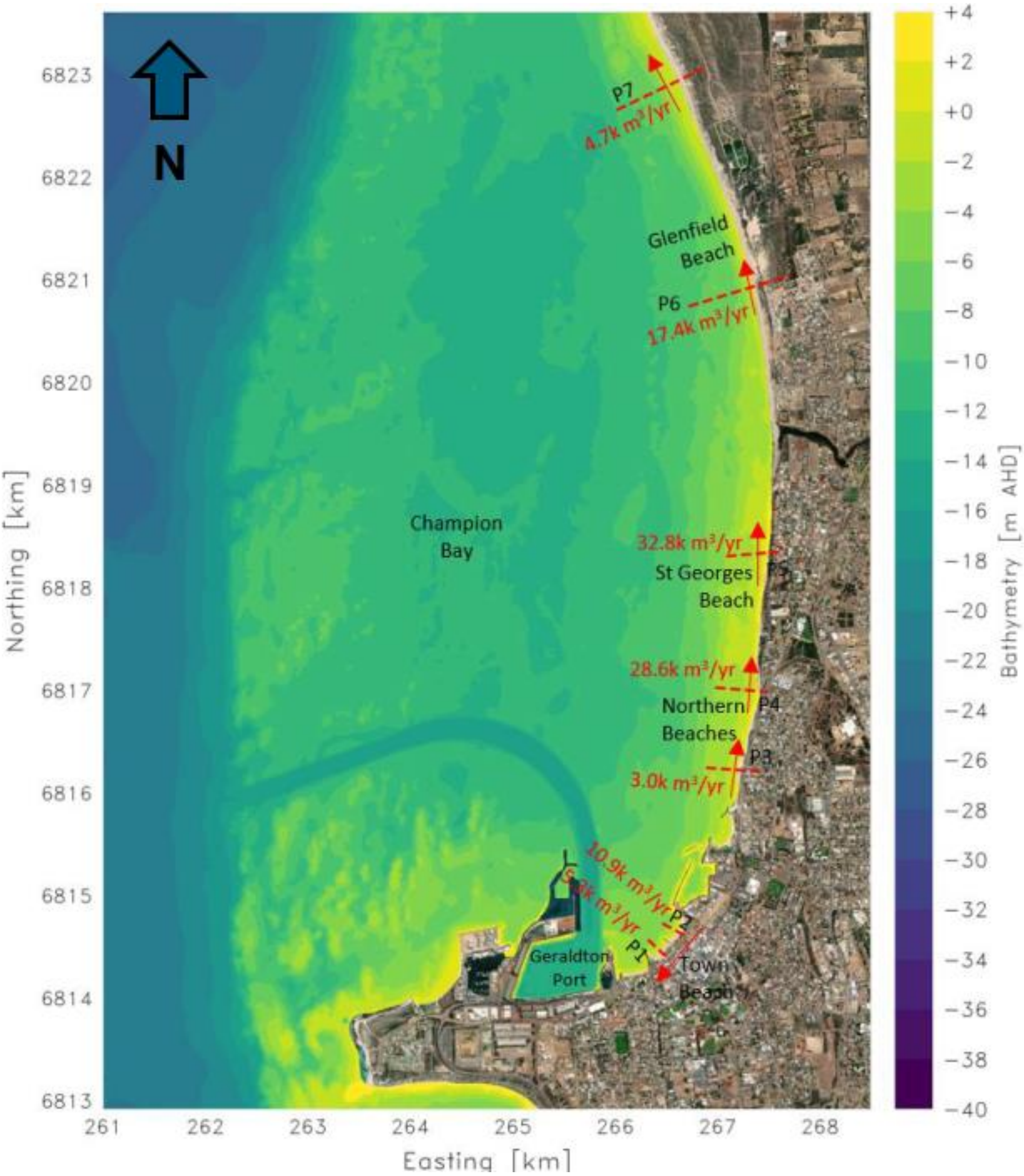


Figure 10-6 Overview of annual transport of sand for the seven selected profiles as part of a developed port scenario)

Table 10-3Mean annual sediment longshore transport of sand (rounded) at various sections calculated over 50 years (1974 - 2023) – Geraldton PMaxP development scenario (negative values indicating southward transport, and vice versa)

Cross-section	Southward transport of sand (m3/year)	Northward transport of sand (m3/year)	Net transport (m3/year)	Gross transport (m3/year)
1	-5,300	0	-5,300	5,400
2	-11,200	200	-10,900	11,400
3	-6,400	9,400	3,000	15,800
4	-5,100	33,700	28,600	38,800
5	-5,000	37,900	32,800	42,900
6	-79,900	97,200	17,400	177,100
7	-41,100	45,900	4,700	87,000

10.3.2.3 Installation of infrastructure affects to water levels and currents within Champion Bay

To predict the potential impacts of installation of the NTH on water levels and current characteristics a Delft3D hydrodynamic, wave and sediment transport model was developed (RHDHV 2024). The tidal currents in the Geraldton region are strongly correlated with the wind speed and direction, with very low current speeds due to astronomical tide (< 0.05 m/s). The dominant wind condition varies seasonally and so the hydrodynamic model was setup to simulate a seven-day spring neap tidal cycle for the following range of wind conditions:

- Southerly wind: a wind speed of 15 m/s from the south. This wind condition occurs most regularly during the summer, autumn and spring. The speed is representative of a strong southerly wind which is exceeded for less than 0.5% of the year;
- Easterly wind: a wind speed of 12.5 m/s from the east. This wind condition occurs most regularly during the autumn and winter. The speed is representative of a strong easterly wind which is exceeded for less than 0.5% of the year; and
- Northerly wind: a wind speed of 12.5 m/s from the north. This wind condition occurs most regularly during the winter. The speed is representative of a strong northerly wind which is exceeded for less than 0.5% of the year.

Water levels

Modelling results predict that for the three different wind conditions assessed:

- No change in water level was predicted at low water
- A localised increase in high water level is predicted in the new tug harbour and a localised reduction in high water level is predicted on the west side of the tug harbour reclamation during strong southerly and northerly winds, but the opposite is predicted during strong easterly winds (**Figure 10-7**, **Figure 10-8**, **Figure 10-9**)
- The magnitude of the changes in water level are predicted to be small, with a maximum absolute change of less than 0.02 m during all wind conditions.

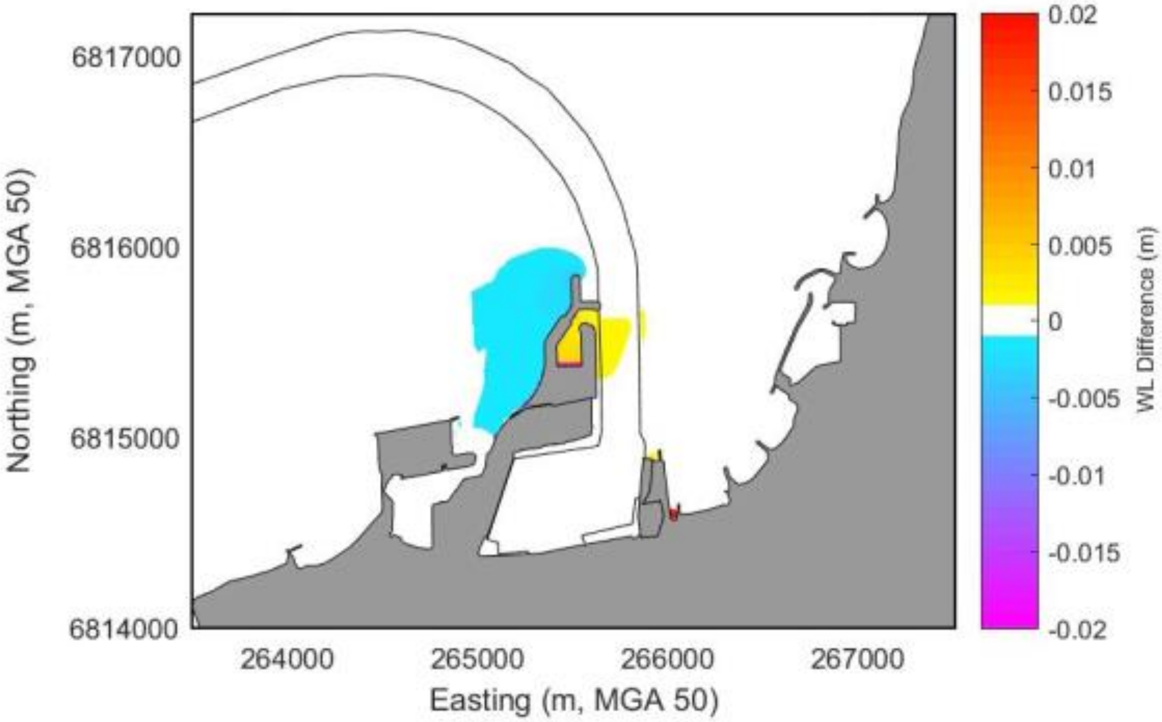


Figure 10-7 Modelled change in water level due to the PMaxP development at high water during a spring tide with strong southerly winds

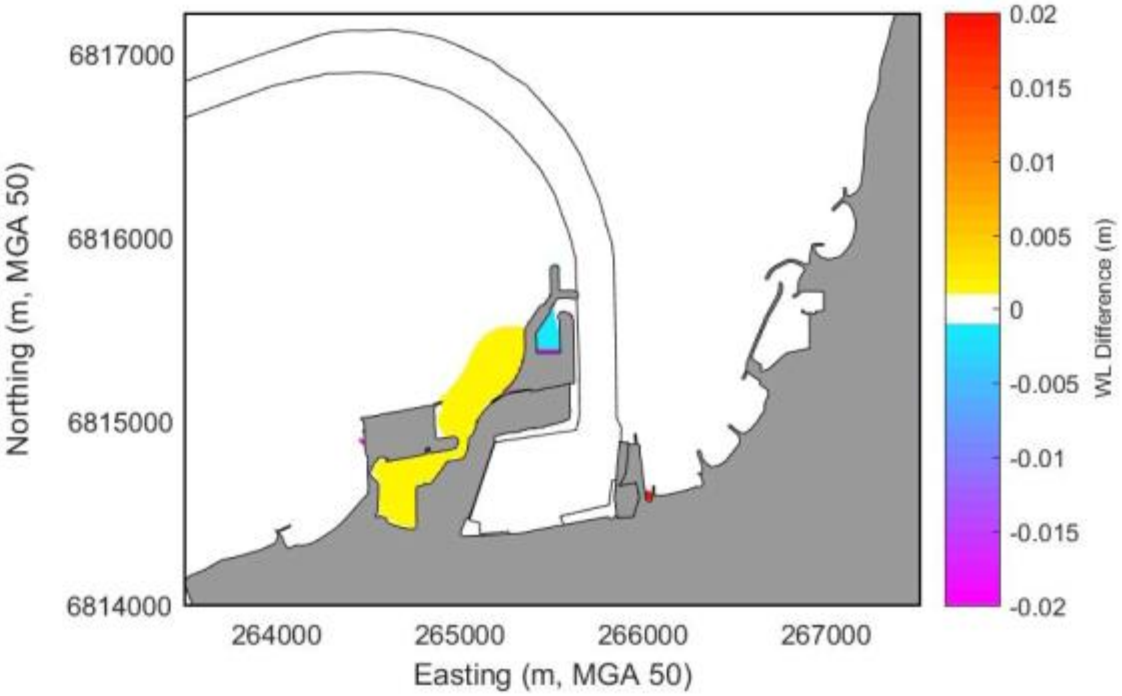


Figure 10-8 Modelled change in water level due to the PMaxP development at high water during a spring tide with strong easterly winds

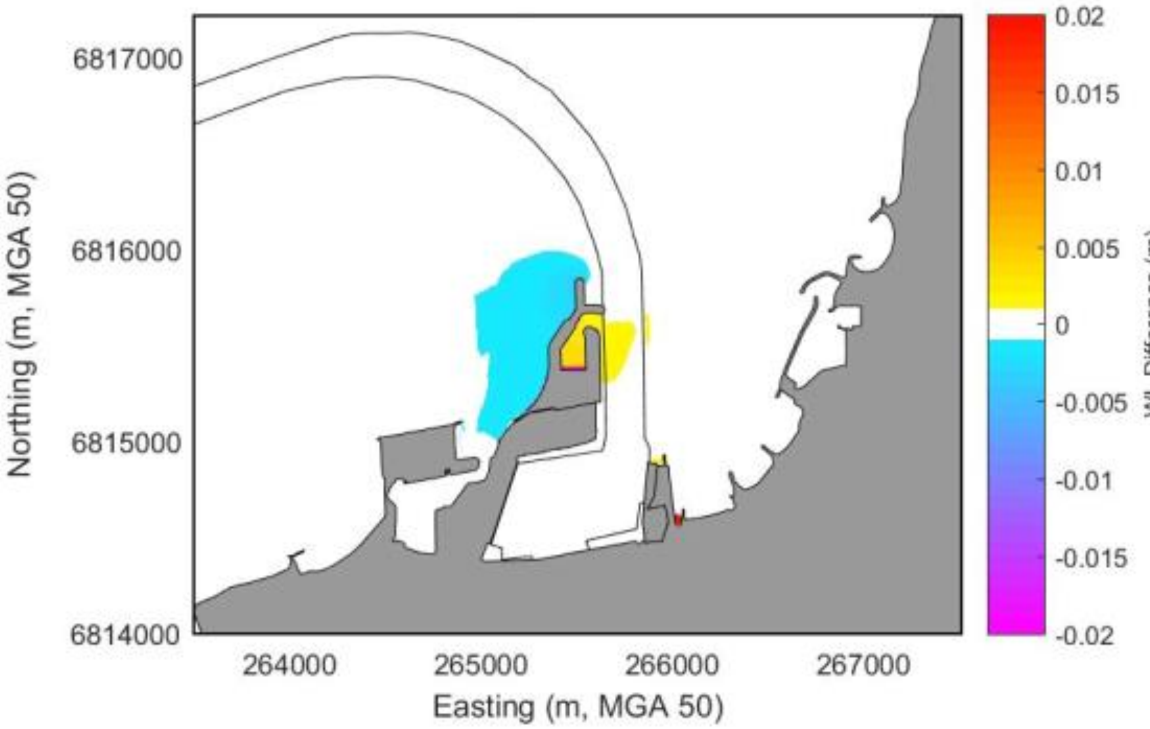


Figure 10-9 Modelled change in water level due to the Geraldton PMaxP development at high water during a spring tide with strong northerly winds

Water currents

The hydrodynamic model predicts that the installation of the NTH will result in localised changes in the water current and flow. Predicted changes in current speed caused by the reclamation associated with the additional length of the proposed breakwater compared to the existing conditions.

The modelling predicts generalised localised reduction in current speed to the west and east of the NTH and a localised increase in current speed to the north and south compared to existing conditions (**Figure 10-10** to **Figure 10-13**). The largest spatial change in current speed is predicted to occur during the strong easterly wind conditions when the existing flows were very low (less than 0.1 m/s throughout the majority of the region) (**Figure 10-11**). The reason for the relatively large spatial change for this wind condition was due to the NTH reclamation changes where the flow reversal occurs (currents in the south-west of the plot are to the east, while currents in the north-west of the plot are to the west), making the flow reversal occur further to the west and therefore reducing current speeds to the east and north of the tug harbour reclamation. Despite the spatial extent of the predicted changes in velocity of water currents the absolute difference between the existing conditions and PMaxP within Champion Bay are typically less than 0.02 m/s. The strong northerly modelled case does predict that the velocity of water currents to the northern end of the NTH would increase near the breakwater by up to 0.1 m/s (**Figure 10-12**).

During a typical wave event only limited and localised changes to the velocity of water currents are predicted to occur as a result of the installation of the NTH (**Figure 10-13**).The changes in predicted current speed are generally influence the local area of the port and the approach channel however, small reductions in the wave-induced current speeds adjacent to the Town Beaches and the Batavia Coast Marina are also predicted. These reductions at Town Beach and the Batavia Coast Marina are likely due to the NTH reducing wave height in this area and therefore reducing the wave induced currents which occur in these areas.

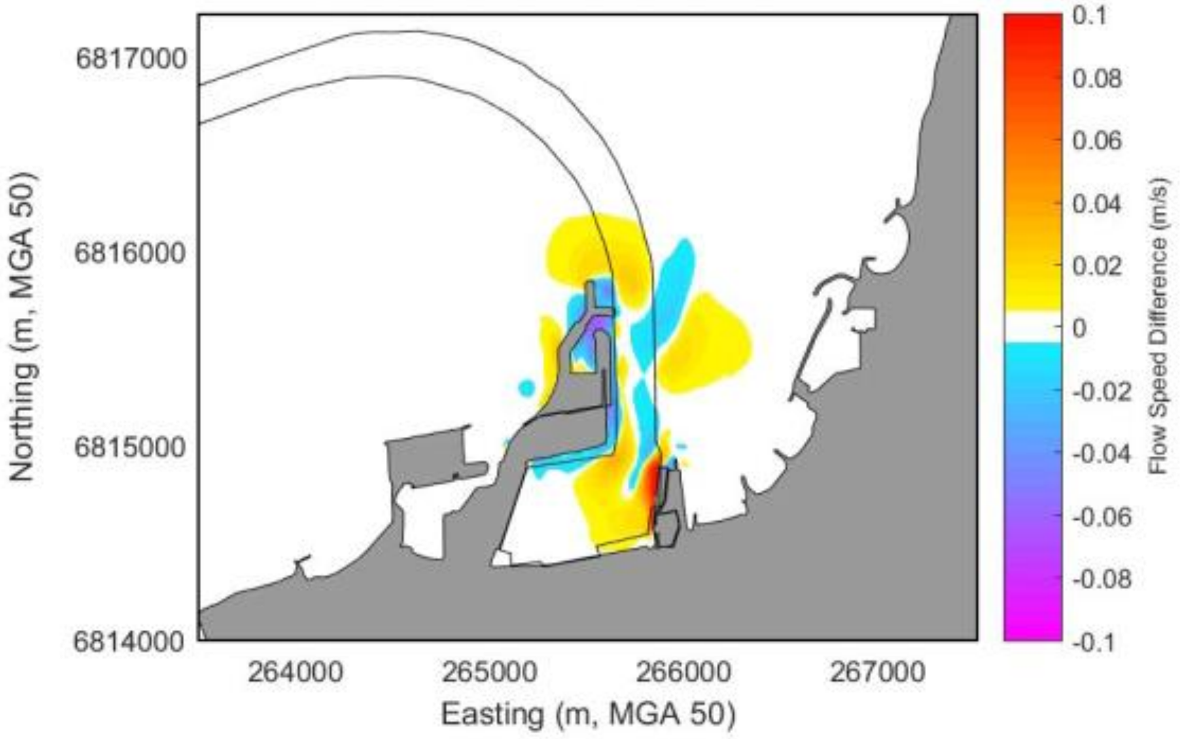


Figure 10-10 Modelled predicted change to the currents due to PMaxP development during a spring tide with strong southerly winds

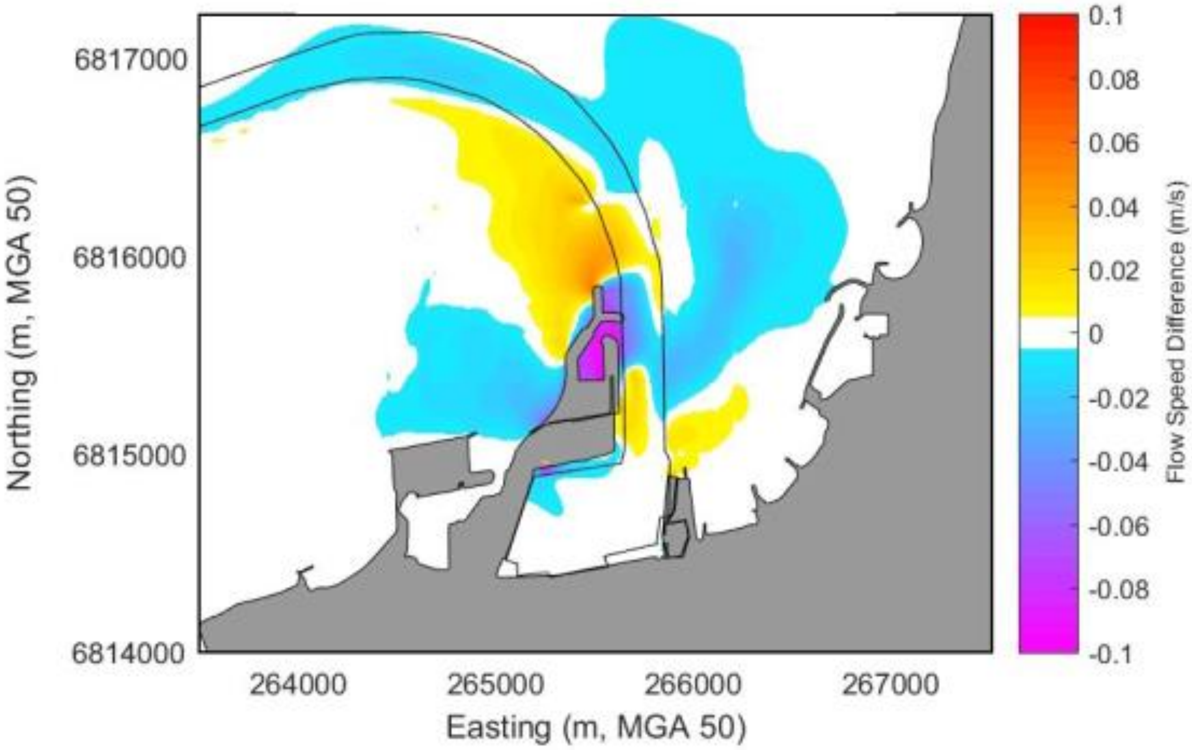


Figure 10-11 Modelled predicted change to the currents due to the PMaxP development during a spring tide with strong easterly winds

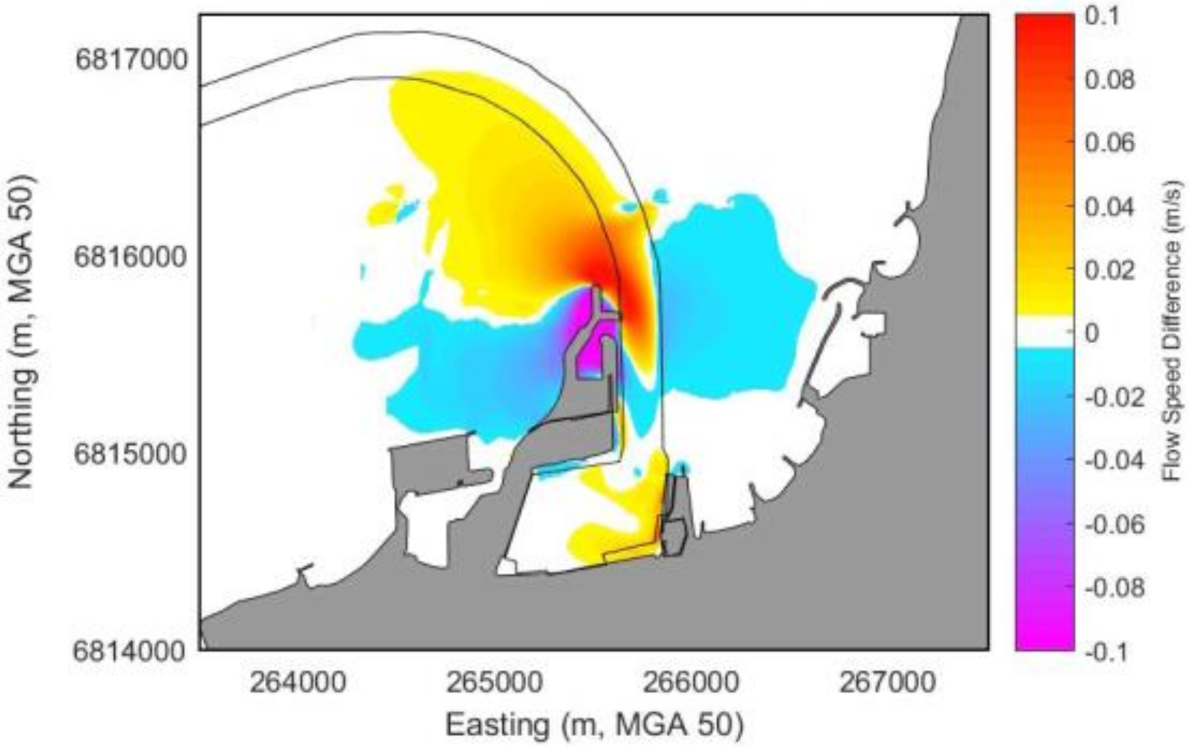


Figure 10-12 Modelled predicted change to the currents due to the PMaxP development during a spring tide with strong northerly winds

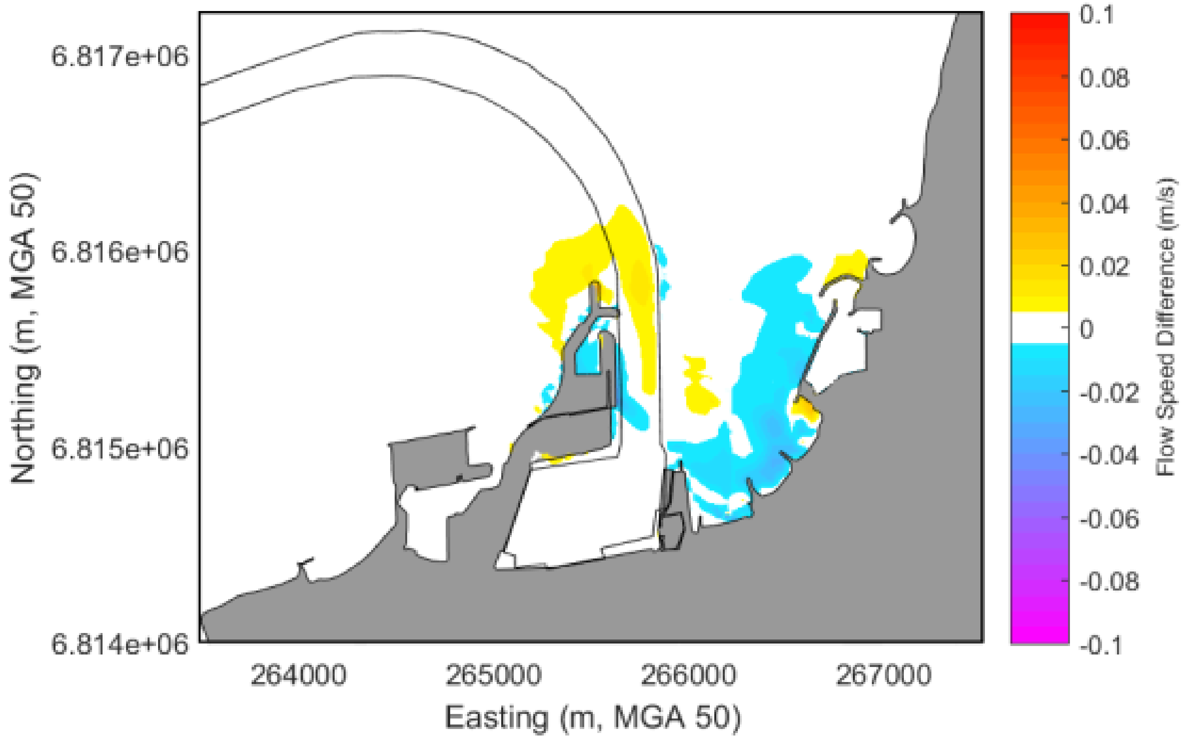


Figure 10-13 Modelled predicted change to combined current speeds due to the Geraldton PMaxP development during a typical wave event

10.3.2.4 Installation of infrastructure affects to sediment transport and sedimentation characteristics within Champion Bay

To predict the potential impacts of installation of the NTH on sedimentation characteristics a sediment transport model was coupled with the hydrodynamic and wave models (Section 10.3.2.3) to ensure that the dominant forces which drive the sediment transport were represented. The model was setup to simulate the sediment transport for the following metocean conditions:

- Typical waves: a typical wave condition from the south-west (at seaward end of access channel Hs = 1.25 m, Tp = 14 s) combined with time-varying wind conditions representative of typical wind conditions (south to south-westerly). Bed level changes were assessed during spring tides over four days as this is the typical duration for this type of typical wave event; and
- Large waves: a large wave event from the south-west (at seaward end of access channel Hs = 2.5 m, Tp = 14 s) combined with dominant wind conditions (south to south-westerly). Bed level changes were assessed over 1.5 days; this is considered to be representative of a typical duration for this type of large wave event.

The model included a spatially varying bed thickness of sand, with no sand included where areas of shallow reef were present (identified based on the bathymetry) or where seagrass covered more than 25% of the seabed (based on seagrass mapping described in SLR 2024).

Results of the modelled total combined suspended and bedload transport (herein referred to as total transport) along with the total transport vectors for both the existing and PMaxP cases during typical and a large wave event predicted (RHDHV 2024):

- During both events sediment transport is predicted to occur in an easterly to south-easterly direction towards the port, with the total transport rates being much higher for the large wave event (**Figure 10-14**) compared to the typical wave event (**Figure 10-15**)
- The total transport rates are predicted to be very similar for both cases around the port, with the main difference being a reduction in transport rate to the east of the proposed reclamation (which is more apparent for the large wave event)
- PMaxP is predicted to result in localised reductions in the total sediment transport rate for both wave conditions, with a larger reduction for the larger wave condition compared to the smaller wave condition
- The reduction in transport rates is predominantly within the new tug harbour and to the east of the approach channel, where the largest reductions in wave height were predicted.

The potential implications of the reduction in the sediment transport rates on sedimentation and erosion due to PMaxP were assessed for the two wave conditions. Results of the modelling predicted:

- Localised increases in sedimentation adjacent to the western wall of the tug harbour reclamation, with the increase in sedimentation predicted to predominantly be less than 0.05 m for the typical wave event (**Figure 10-16**[17]) and up to 0.2 m for the large wave event (**Figure 10-17**)

[17] It is important to note that a positive difference shown in the plots can be due to either increased sedimentation or a reduction in erosion between the existing case and the PMaxP development case while a negative difference can be due to either a reduction in sedimentation or an increase in erosion between the cases.

- Localised reduction in sedimentation at the entrance to the FBH to the west of the port. This is where sediment previously accumulated as it was bypassing the existing reclamation, but due to the NTH the sediment is now predicted to accumulate slightly further north
- Positive and negative changes on the eastern side of the approach channel in the area where PMaxP NTH has been shown to provide the largest reduction in wave height. These changes are due to the wave sheltering of PMaxP resulting in very limited erosion or sedimentation predicted to occur in this area compared to existing conditions. As a result, the positive changes are due to a predicted reduction in erosion and the negative changes are due to a predicted reduction in sedimentation due to PMaxP. The differences are focused in the following two main areas:
  - The area directly adjacent to the channel where seagrass beds are present. The existing case predicts localised areas of erosion adjacent to localised areas of sedimentation in this area, indicating minor overall net change in the volume of sand present, but the potential for sand of 200 µm to be mobile. PMaxP development case predicts very little erosion and sedimentation in this area due to the NTH sheltering the area from the south-westerly waves, indicating limited transport of sand of 200 µm in this area and the potential for this area to experience less morphological changes that under existing conditions
  - The areas adjacent to Town Beach and directly offshore of the Batavia Coast Marina breakwater. The existing case predicts erosion directly offshore of the beaches and breakwater and sedimentation on the beaches and adjacent to the breakwater, showing a predicted net onshore transport of 200 µm sand during these wave conditions. PMaxP development case predicts very little erosion and sedimentation in these areas, meaning that PMaxP results in less erosion (positive change) and less sedimentation (negative difference).
- There are no predicted impacts to hydrodynamics and the resultant potential sediment transport, within the foreshore and nearshore areas north of Midalia Beach which includes the Northern Beaches.
- The pattern of sedimentation at the entrance to the FBH appears to be a spatial redistribution rather an overall increase or decrease (i.e. accretion or erosion). The area of accretion which is already occurring appears to shift marginally further offshore of the entrance due to PMaxP, though not far enough to be considered a positive benefit to navigation of the entrance.
- The potential rotation of sediment movement (from a northerly to a localised southerly direction) near the Town Beach is not likely to result in a significant impact; however, further works are being undertaken in consultation with CGG. A Town Beach Adaptation Plan will be developed with input from key stakeholders (including but not limited to, CGG) to address the recommendations from the sediment transport modelling (RHDHV 2024).

Overall, the key findings of the model indicate that the implementation of the PMaxP will not significantly impact sediment transport or sedimentation characteristic within Champion Bay (RHDHV 2024).

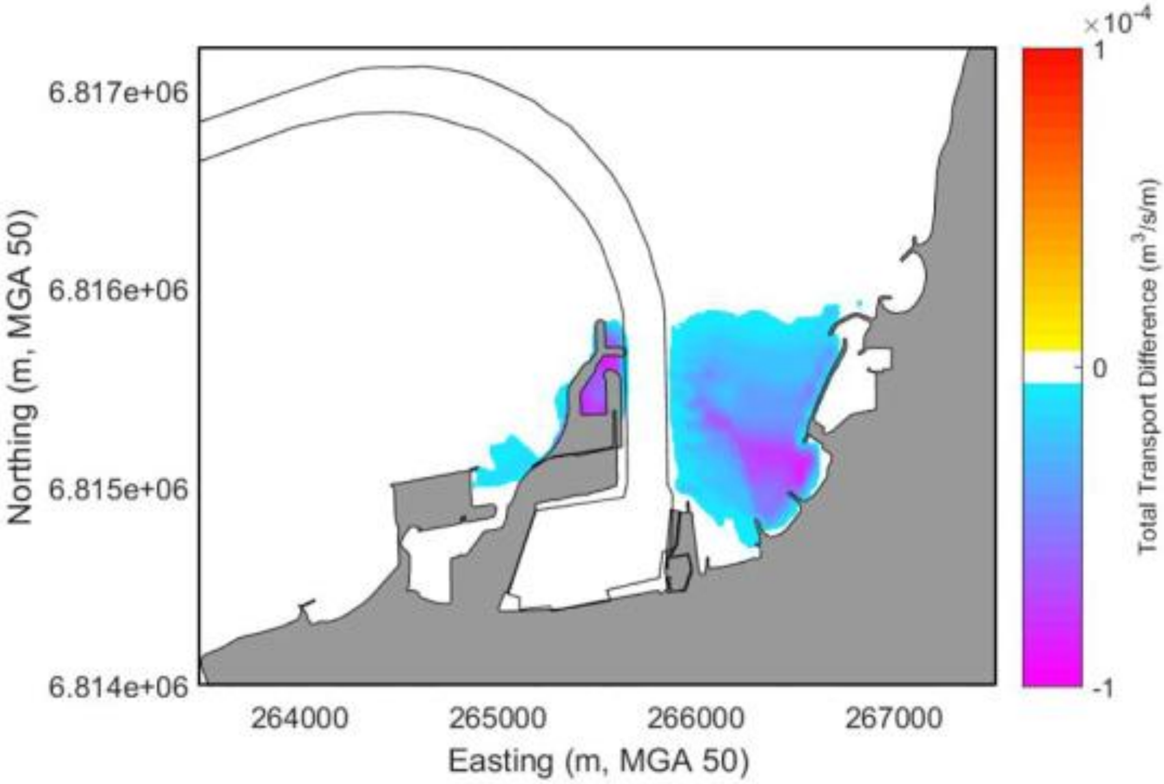


Figure 10-14 Modelled change in total transport due to PMaxP during a large south-westerly wave event

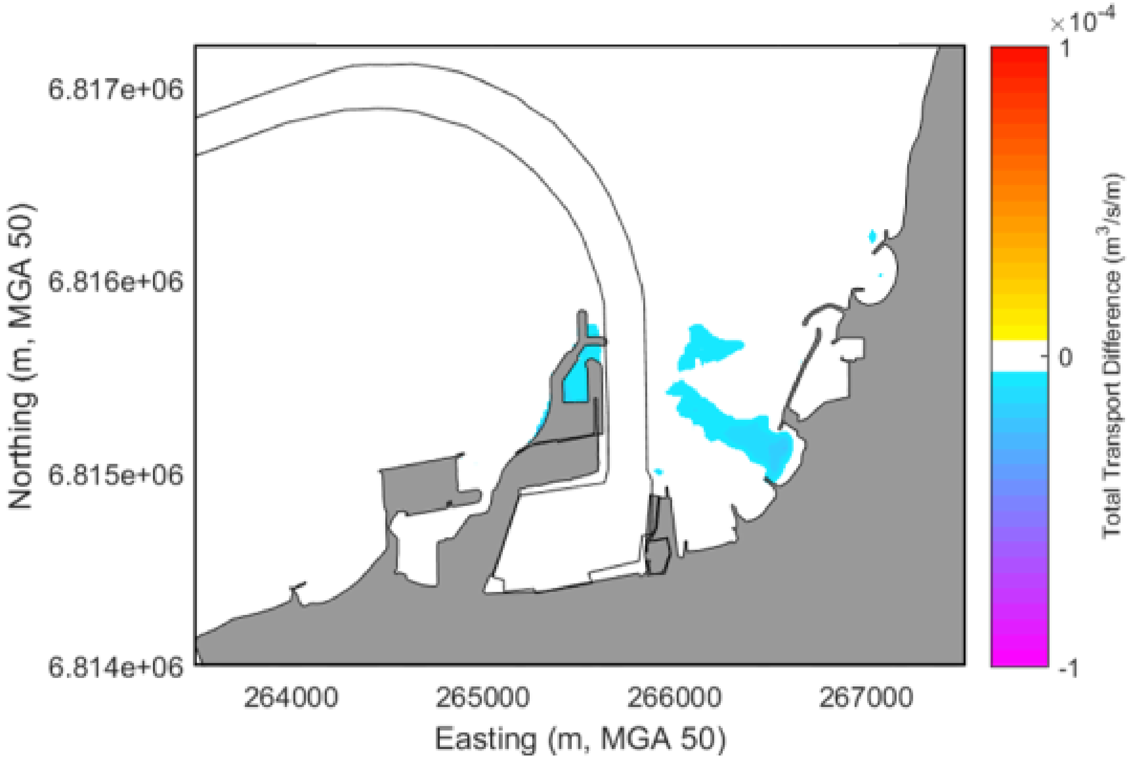


Figure 10-15 Modelled change in total transport due to PMaxP during a typical south-westerly wave event

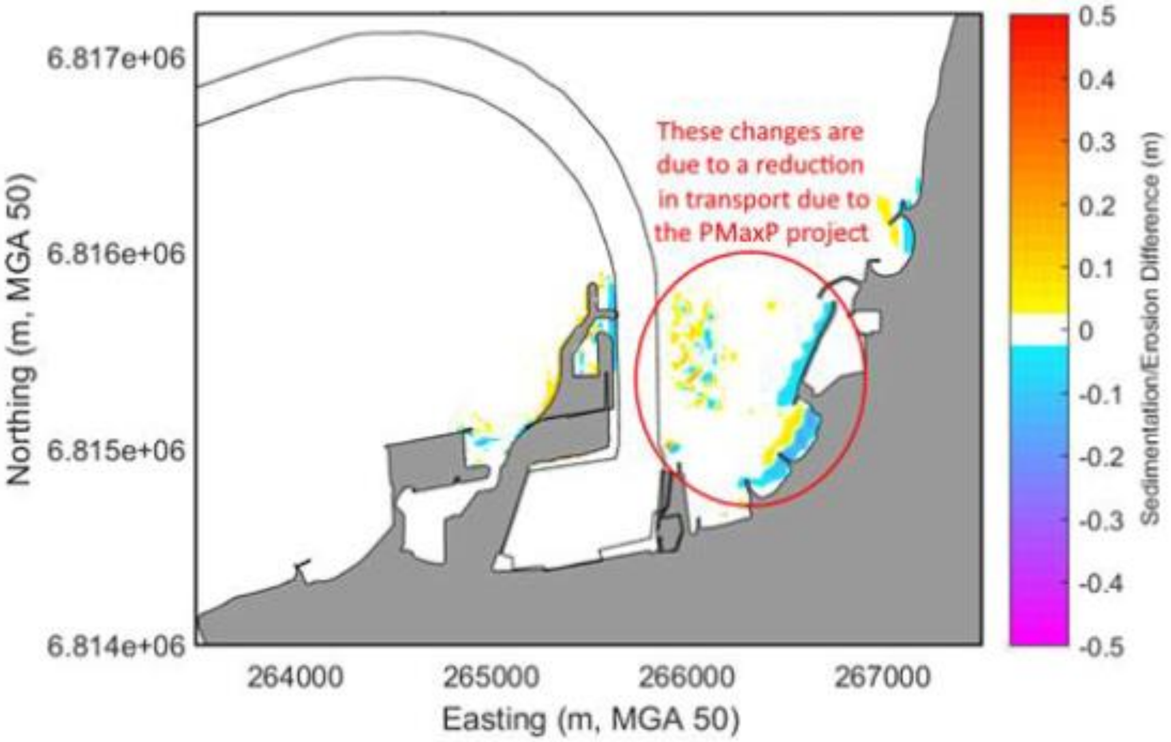


Figure 10-16 Modelled change in sedimentation/erosion due to the PMaxP (compared to existing conditions) over a typical wave event

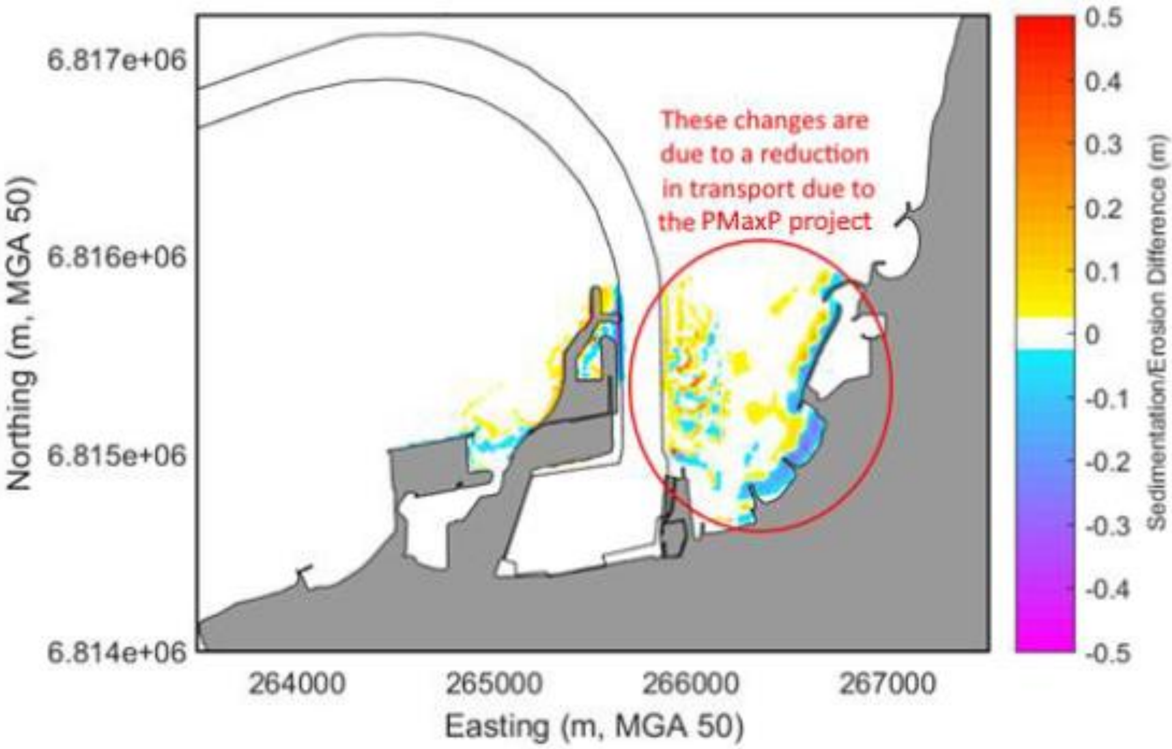


Figure 10-17 Modelled change in sedimentation/erosion due to the PMaxP (compared to existing conditions) over a large south-westerly wave event

10.4 Mitigation Hierarchy

It is not possible to avoid impacts to coastal processes due to the existing port infrastructure. Mitigation measures have therefore focussed on minimisation of those impacts.

10.4.1 Minimise

The PEP (approved proposal) was approved in 2002 and continues to meet the environmental objective of maintaining the geophysical processes that shape coastal morphology through the implementation of the (NBSP; Commitment 15, MS600). Due to the interruption of the natural longshore sediment transport pathways by the Port and city infrastructure, MWPA is committed under the NBSP to bypass 12,500 m^3 of sand from Pages Beach annually, relocating it to the northern beaches. The 'northern beaches' being defined as the coastline north of the BCM and south of the Chapman River.

The proposed tug harbour and related rock revetment (breakwater) is the key prominent feature of the PMaxP that could alter the longshore transport of sediment, however the detailed sediment transport modelling work (RHDHV 2024, Appendix I) indicates that this change would not be significant and that the existing Port shipping channel is the main sediment sink resulting in reduced longshore sediment movement.

The existing management of impacts resulting from Port infrastructure, including sand bypassing, is an ongoing commitment under MS 600 delivered via the implementation of the NBSP. This management will continue following the implementation of PMaxP under the newly developed Coastal Processes Management Plan (CPMP; MWPA 2025) that is intended to replace the NBSP. The CPMP provides a contemporary approach with improvement to management and monitoring programs incorporating insights from 22 years of sediment management under the NBSP.

The CPMP seeks to re-establish a Joint Agency Working Group (JAWG) for the ongoing management of the Geraldton coastline and details proactive monitoring and management of the Town Beaches. The CPMP has been developed in consultation with the City of Greater Geraldton (CGG), Department of Transport (DoT), and Department of Planning, Lands and Heritage (DPLH). The MWPA will continue to work with the CGG who manage erosion and accretion of coastal sediments as has been done since the PEP under the approved NBSP until such time as the CPMP is approved.

Offsets are not considered applicable to this factor.

10.5 Significance of Residual Impacts

The residual impacts to coastal processes are not expected to be significant solely attributable to the implementation of the PMaxP, noting that impacts related to existing Port infrastructure (related to the PEP) would be significant in the absence of any management. The ongoing implementation of the NBSP, subsequently proposed to be replaced by the CPMP, are considered sufficient tools to appropriately manage these impacts.

10.6 Environmental Outcomes

With the implementation of the CPMP, it is expected that the following objectives will be achieved and the environmental values of the coast protected:

- Maintain natural coastal processes while minimising sediment accumulation and migration within port navigable waters.
- Maintain public safety and minimise social impacts while enhancing community awareness of coastal processes.

11.0 Impact Assessment – Other Factors

In addition to the preliminary key environmental factors identified in Section 6, four other relevant environmental factors were also identified.

- Social Surroundings
- Terrestrial Environmental Quality (TEQ)
- Air Quality (AQ)
- Greenhouse Gas Emissions (GHG).

There has been a considered effort during the design stage of the PMaxP to undertake necessary impact assessments related to social surroundings impacts and an extensive community and stakeholder consultation process has been undertaken. The details are presented in Section 11.1.

Due to the very low significance of the environmental impact on the remaining three factors (TEQ, AQ, and GHG), and in consideration of the mitigation measures proposed to be implemented, these factors are not considered to be required for assessment. **Table 11-1** describes these other environmental factors and consideration of impacts.

Table 11-1Other Factors Environmental Impact Assessment

Factor and Objective	Receiving Environment	Potential Impacts	Mitigation hierarchy	Assessment and outcome
Land				
Terrestrial environmental quality *To maintain the quality of land and soils so that environmental values are protected.*	As an operating Port, most of the land area portion of the Development Envelope has already been developed. There are a number of registered contaminated sites on the DWER contaminated site database, however, these sites are not located within the proposed Development Envelope. The port was assessed via a Voluntary Audit Report (GHD, 2021) under the Contaminated Sites Act with DWER assigning a site classification of “Report not substantiated” (DWER, 2021). This notification acknowledged that the site remains an operational port with potentially contaminating activities occurring. The sediment quality of the dredge material proposed for use behind B1 / B7 / new tug harbour is discussed in Section 7.2.4. The Berth 7 reclamation area was approved in 2001 under Part V of the EP Act for disposal of Port-sourced materials.	• Potential impacts to the quality of land and soils through the reclamation of land using potentially contaminated materials (old and new tug harbour, and Berth 1, reclamation areas; refer Figure A-2) • Spills and/or leaks of fuels, oils, chemicals or other hazardous substances.	• All capital and maintenance dredge sediment has been characterised to inform appropriate disposal location and ensure no land contaminating activities occur, in the context of industrial Port land use (refer to Appendix B and Appendix C for material characterisation reports). • Implementation of the MCEMP. • Continued implementation of MWPA operational procedures, including internal soils acceptance processes for risk-based assessment of material proposed for placement in the material disposal /reclamation areas.	With the implementation of the proposed mitigation measures, the quality of land and soils will be maintained, and the Objective for Terrestrial Environmental Quality will be met.

Factor and Objective	Receiving Environment	Potential Impacts	Mitigation hierarchy	Assessment and outcome
Air				
Air quality *To maintain air quality and minimise emissions so that environmental values are protected.*	In accordance with L4275/1982/15; MWPA maintains air quality monitoring stations at the boundary of the Port and an offsite air quality monitoring station. The EPA assessment for the PEP included a consideration of dust during construction.	• Dust generation from reclamation and other land based, construction activities on sensitive receptors.	• MWPA holds Environmental Licence L4275/1982/15 for the operation of Geraldton Port. • Continued implementation of MWPA operational procedures and pollution control equipment.	It is unlikely, that the reclamation and construction activities associated with PMaxP will significantly change the dust emission levels. The environmental objective for air quality will be met.
Greenhouse gas emissions *To minimise the risk of environmental harm associated with climate change by reducing greenhouse gas emissions as far as practicable.*	A Greenhouse Gas Assessment was completed for the PMaxP (Appendix L) which considered the construction and operational phases and is summarised below. **Construction** Scope 1 • GHG emissions (FY24-25): 18,500 $tCO_{2\text{-}e}$ • GHG emissions (FY25-26): 14,900 $tCO_{2\text{-}e}$ • GHG emissions (FY26-27): 2,200 $tCO_{2\text{-}e}$ Scope 2 • Total GHG emissions = 0 $tCO_{2\text{-}e}$ **Operation** • Scope 1 annual average of 500 $tCO_{2\text{-}e}$ • Scope 2 annual average of 2,500 $tCO_{2\text{-}e}$ MWPA is currently developing an inventory for operational Scope 3 emissions in accordance with the Emissions Reduction Framework for Government Organisations (DWER 2023).	• Potential GHG emissions during construction and ongoing operations.	• Minimise greenhouse gas emissions through enhancement of facility and optimisation of operations.	During construction the Scope 1 or Scope 2 GHG emissions associated with Proposal are not expected to exceed 100,000 tonnes $CO_{2\text{-}e}$ in any year as defined by the Environmental Factor Guideline (EPA, 2023). Once operational, the PMaxP is anticipated to result in reduced GHG emissions through optimisation and a series of efficiency savings. The environmental objective for GHG will be met.

11.1 Social Surroundings

The Mid-West region of Western Australia is situated in the central – western part of the state, spanning approximately 285,000km^2 and featuring three distinct sub-regions, each with their own unique economic profiles: the Batavia Coast, Murchison, and North Midlands (Mid West Development Commission [MWDC], 2024).

The region features resilient mining, agriculture, and fishing industries, coupled with strong tourism, retail, manufacturing, construction, logistics and population servicing sectors. The annual economic output of the region is $17.311 billion (REMPLAN, 2024). The mining industry sector currently makes the greatest contribution to economic output, accounting for 48.5% of total output (REMPLAN, 2024). The diversity and adaptiveness of the region's industry profile is underpinned by an abundance of natural resources, minerals, and fertile agricultural zones (MWDC, 2024).

The Port is located within the City of Greater Geraldton, one of sixteen local government areas (LGAs) within the Mid-West region (MWDC, 2024).

Recreational and commercial activities including fishing, swimming, sailing/boating, windsurfing, ecotourism and aquaculture operations occur within Champion Bay. Implementation of PMaxP will not result in long term additional loss of recreational uses other than that assessed as part of PEP.

11.1.1 Heritage

11.1.1.1 Aboriginal Heritage

The traditional owners of the Mid West region are the Yamatji Aboriginal peoples.

A search of the Aboriginal Cultural Heritage Inquiry System (ACHIS) within a 5 km radius of the Port returned one record of a Registered Site of the Port: Place 20853 – Geraldton Southern Transport Corridor Field Site 04, which has no specific requirements, and no Lodged Places. There are no registered or lodged sites within the Port.

Based on this information, and discussions with local Aboriginal groups (Yamatji Land and Sea Council) during the PEP approvals process, an approval under Section 18 of the *Aboriginal Heritage Act 1972* was not deemed likely to be required as there was no reason to believe that aboriginal heritage may be disturbed via the proposed works, particularly given that much of the Proposal involves reclaiming land from the sea (URS 2001b).

However, in line with the requirements of the Yamatji Nation ILUA, MWPA prepared and submitted an Activity Notice for the PMaxP for YRSC review and consideration. The YSRC decision on the Activity Notice confirmed no need for further heritage surveys or management plans (refer **Appendix K**).

11.1.1.2 Maritime Heritage

A search of the WA Museum (WAM) 'Shipwrecks of Western Australia' database returned a shipwreck registered in shipping channel: Shipwreck 742, Unidentified Lighter 1 (1872/02), Chapman River. Correspondence with the WA Museum confirmed the coordinates of shipwreck number 742 on the WA Museum Shipwreck Database are likely to be inaccurate - records show this database entry is based off historical information. The WAM Shipwreck database is both located wrecks and any historical data of potential wreckages and strandings within the area. The coordinates of the wreck itself are historically only recorded in a latitudinal form in the historical data and thus a generalised location within the Champion Bay area was noted. This wreckage is recorded as being 'foundered at anchor' meaning it was likely to have been salvaged. (correspondence from Curator Maritime Heritage, WA Shipwrecks Museum; 18 June 2024).

11.1.1.3 Historic Heritage

A search of the InHerit database found no places of State or National heritage value were located within or adjacent the Development Envelope identified. The following places of local or other value are listed within or adjacent the Development Envelope:

- Place P4228: Geraldton Railway Jetty, Durlacher St (Local Heritage)
- Place P26645: Silos, 298 Marine Terrace (Local Heritage)
- Place P2986: Geraldton Shipping Harbour, Marine Terrace (Other Listings)
- Place P27052: Geraldton Port – Berth 1 and 2 and Cargo Shed, Ian Bogle Road (RHP – does not warrant assessment).

Correspondence with DPLH confirmed that the Geraldton Shipping Harbour (P2986) is unlikely to have the cultural heritage significance required for meeting the condition for entry in the State Register of Heritage Places under section 38 of *Heritage Act 2018* and therefore does not warrant full assessment (correspondence from DPLH, 8 July 2024).

11.1.2 Amenity

11.1.2.1 Recreational and Community Use

The recreational and community use assessment as part of the Social Surroundings Study (Appendix K) considers the community's demonstrated high utilisation of coastal areas, reflected in elevated active transport rates (6.2% walking and 2.4% cycling, compared to lower averages in Greater Geraldton) and strong coastal values within the community. Key community use areas in proximity to the Port include:

- Fishing Boat Harbour (FBH).
- Coastal pathways.
- Public viewing areas such as the Esplanade and Geraldton Foreshore.
- Recreational fishing zones.
- Town Beaches.

Community use of these public spaces is enabled through an extensive active transport network in the area and established coastal access routes. Geraldton's coastline has a high recreational value; current use patterns are heavily driven by significant tourism activity and a strong maritime recreation presence.

11.1.2.2 Visual

A Landscape and Visual Impact Assessment (LVIA; Appendix J) was completed to establish an understanding of key social issues, risks and considerations in relation to PMaxP. The LVIA defined the key landscape and visual values within the study area as the coastal environment, including the ocean, beaches, foreshore and ridgelines. This is moderated to an extent by the modifications to the landscape such as industrial and port infrastructure, breakwaters and cargo ships where these elements are visible. Parks and Reserves are also a key landscape and visual value, particularly along the coastal foreshore and on elevated vantage points which overlook Geraldton township and the ocean.

Elsewhere, views of the ocean and coastline and views toward the Project from within Geraldton township are typically limited due to the flat terrain and intervening buildings.

The existing landscape and visual environment within the study area was mapped into Landscape Character Zones (LCZs). **Table 11-2** shows the sensitivity of each LCZ to visual changes.

Table 11-2Sensitivity of LCZ to Visual Changes

LCZ	Sensitivity
Coastal LCZ	High
Industrial / Port LCZ	Low
Township LCZ	Medium
Parks and Reserves LCZ	High

The visual impact was assessed from 12 locations within the study area, of which four (4) viewpoints had photomontages prepared to illustrate the predicted view. A summary of the visual impact rating from the 12 viewpoints is provided in **Table 11-3**.

Table 11-3 Summary of Visual Impact

Viewpoint	Visual Impact
Viewpoint 1 – Pages Beach	Negligible to Minor
Viewpoint 2 – Lions Lookout	Negligible to Minor
Viewpoint 3 – Fishing Boat Harbour	Minor
Viewpoint 4 – The Esplanade	Moderate
Viewpoint 5 – Geraldton Yacht Club	Moderate
Viewpoint 6 – Batavia Coast Marina	Moderate
Viewpoint 7 – Dome Café Groyne	Moderate
Viewpoint 8 – HMAS Sydney II Memorial	Moderate
Viewpoint 9 – Wishing Well Lookout	Negligible to Minor
Viewpoint 10 – The Big Marble	Negligible to Minor
Viewpoint 11 – Bluff Point	Negligible to Minor
Viewpoint 12 – Chapman River	Negligible to Minor

11.1.2.3 Air Quality

The existing air monitoring network encompasses the port boundary monitoring stations and offset monitoring station. MWPA operations are subject to compliance with Environmental Licence L4275/1982/15. The Port-wide air quality modelling indicated that activities related to PMaxP would have a negligible impact on air quality due to the PMaxP being primarily a marine construction project with limited ability for dust emissions.

11.1.2.4 Acoustic

The Study's primary zone contains 5,181 residents. Sensitive receptors include:

- Residents located within the suburb of West End, 42.9% of whom are aged 65 years and over
- Residential areas within 1 km of the Port
- Tourism and hospitality businesses
- Existing port operational noise environment.

The amenity impact assessment undertaken for the Social Surroundings Study identified the potential impact to noise from construction and operational noise affecting Primary Zone receptors. The significance of this impact was determined to be moderate.

11.1.2.5 Economic

The economic impact assessment undertaken in the Social Surroundings Study (Appendix K) considered impacts to commercial fishing operations and tourism activities that could be directly affected by environmental changes resulting from port development activities.

Key economic activities potentially affected by physical and biological changes include:

- Commercial fishing operations, particularly live cray exporters operating in proximity to the Project development envelope.
- Maritime tourism operations that utilise the Port and affected marine environment.

The following baseline conditions outlines the economic context in which PMaxP will be developed:

- Agriculture, forestry, and fishing sector employs 733 people (4.1% of employment)
- Tourism supports 976 jobs (5.4% of total employment)
- Strong maritime business presence in the Primary Zone.

The economic impact assessment undertaken for the Social Surroundings Study identified the following potential impacts to key economic aspects:

- Commercial fishing – potential impact to commercial fishing from modified access requiring changes to fishing operations. Potential impacts to water quality around the live cray processing sea water intakes. This significance of these impacts were determined to be negligible.
- Tourism operations – potential impact to tourism operations from changed maritime infrastructure affecting tourism activity. This significance of this impact was determined to be negligible.

11.1.3 Assessment Overview

Potential direct and indirect social impacts from the implementation of PMaxP may include:

- Changes to visual amenity including potential loss of coastal amenity from some viewpoints and coastal erosion from construction of proposed port infrastructure.
- Temporary increases in dust, noise and vibration during construction affecting residents and local businesses.
- Disruption and/or displacement of aquaculture, recreational activities, eco-tourism, recreational and commercial fishing operations due to increased water turbidity associated with dredging activities.
- Temporary displacement of transport routes due to construction activity.
- Change to community values relating to the environment due to the adverse effects on the marine environment associated with the dredging and construction activities.
- Disturbance of Aboriginal sites or places or historic heritage value.

With due regard to the proximity of the Port to the Geraldton townsite, and high recreational and commercial value of the area, MWPA is commit to the following measures to manage and mitigate the potential impacts to social surroundings:

- Continued implementation of the Community and Stakeholder Engagement Plan (refer Appendix K).
- Clear, consistent and ongoing consultation with communities and established organisations to understand project concerns and possible enhancement projects or strategic scheduling and timing of project activities e.g. piling.
- Ongoing consultation with LGA and community regarding township-port interface and opportunities to retain or enhance visual amenity.
- Implement appropriate management and mitigation strategies as informed by Port-wide air quality and terrestrial acoustic modelling.
- Continue to implement the NBSP, and once approved the CPMP, to maintain the geophysical processes that shape coastal morphology.
- Management and minimisation of turbid plumes during dredging operations as far as practicable.
- Considering the form and finish of structures, including minimising the size of structures where possible, using colours which match the surroundings and less reflective materials.
- Considering the use of rock which matches the colour and texture of existing breakwaters.

Recreational and commercial activities were considered by the EPA during the assessment of MS600. The PMaxP activities will not result in long term additional loss of recreational uses than what was assessed as part of PEP. The temporary construction impacts will be managed through the implementation of the CSEP and technical management plans.

The LVIA (Appendix J) concluded that in the absence of docked vessels, the impact of the PMaxP would be negligible because the proposed wharfs and breakwaters would be visually absorbed by existing Port infrastructure.

The Social Surroundings Study (Appendix K) indicated that heritage and economic impacts were negligible and potential impacts to amenity and recreational use are likely to be minor. It concluded that the PMaxP can be implemented while protecting social values and delivering positive outcomes for the Geraldton community.

12.0 Matters of National Environmental Significance

As part of the ongoing environmental approvals process, an assessment of matters of national environmental significance (MNES) was completed for the PMaxP.

Relevant MNES were identified from a review of the Protected Matters Search Tool (PMST), Register of Critical Habitat, Biologically Important Areas (BIA) dataset and the map of threatened ecological communities (TECs) in Western Australia within a five-kilometre radius (the Study Locality) of the indicative project footprint. A likelihood of occurrence assessment was conducted for all relevant MNES identified in the review and those with medium to high likelihood of occurrence were assessed further using the Significant Impact Guidelines 1.1 – Matters of National Environmental Significance (Commonwealth of Australia, 2013).

No world heritage or national heritage areas, TECs, wetlands of international importance or Commonwealth marine areas occur or were predicted to occur and thus were not considered further as part of the significance assessment.

The review revealed one TEC, 34 threatened marine species and 18 migratory marine species with potential to occur within the Study Area. Of these, one threatened species and three migratory species were considered to have a medium to high likelihood of occurrence. These included:

- Australian Sea-lion (*Neophoca cinerea*) – endangered
- Caspian Tern (*Hydroprogne caspia*) – migratory
- Osprey (*Pandion haliaetus*) – migratory, and
- Humpback Whale (*Megaptera novaeangliae*) – migratory.

The MNES Significant Impact Assessments (SIAs) did not consider that the Project would have a significant impact on any of these species with the implementation of management actions during the construction of the PMaxP. These controls would include marine fauna observers, fauna exclusion zones, procedures (soft-start, shutdown etc.) detailed within a dedicated MFMP, as discussed in Section 9.0.

The Study Area is not considered to be utilised by an ecologically significant proportion of any migratory species. The permanently modified/lost habitat areas are not considered substantial for any of the threatened or migratory species, and MWPA is also committed to increasing the overall Australian Sea-lion haul-out habitat through the detailed design phase.

Given the potential impacts to MNES, a referral to DCCEEW under the EPBC Act was considered necessary to ensure the potential impacts to MNES were appropriately assessed and to ensure the environmental objectives would be met. The MFMP accompanied the EPBC Referral, which was submitted to DCCEEW in April 2025.

13.0 Holistic Impact Assessment

There are interconnections between the EPA Environmental Factors. The following section presents an assessment of the connections and interactions between the key environmental factors to inform a holistic view of impacts to the environment.

The inter-related impacts from breakwater construction, dredging, increased vessel activity, piling, and other construction activities were considered in this assessment. The potential interactions of the key environmental factors are depicted in **Figure 13-1** and further explained in **Table 13-1**.

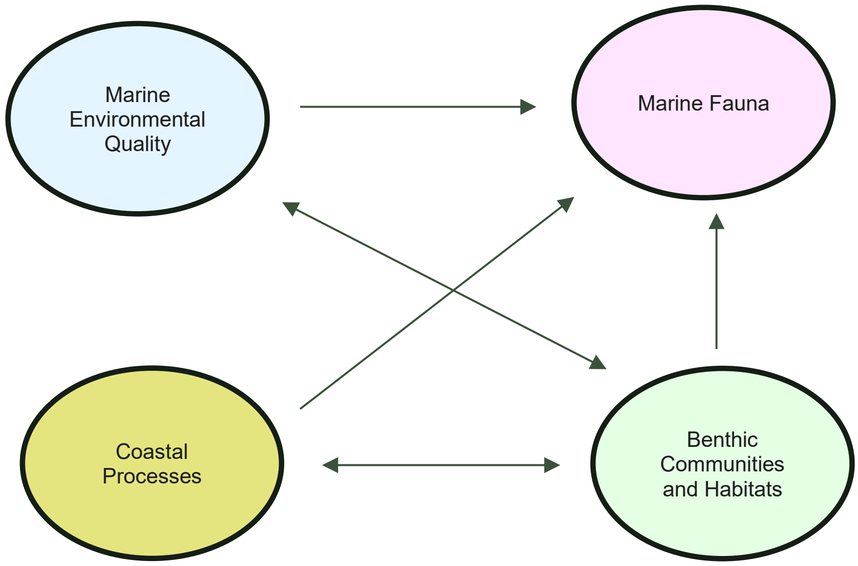


Figure 13-1 Holistic Key Factor Overview

Table 13-1 Key factor holistic assessment

Kay factor	Holistic assessment
Marine Environmental Quality	Impacts to marine environmental quality could also result in impacts to: • marine fauna by reducing visibility from increased suspended particles, and mobilisation of sediment contaminants • benthic communities and habitats (BCH) by reduced light availability and sedimentation.
Benthic Communities and Habitat	Impacts to BCH could also result in impacts to: • marine environmental quality as seagrasses and macroalgae can contribute to improving water and sediment quality in the marine environment • marine fauna as many species utilise BCH as foraging and breeding habitat • coastal processes as changes to the habitat can alter sediment availability and transport.
Coastal Processes	Impacts to coastal processes could also result in impacts to: • marine fauna by impacting potential habitats including BCH • benthic communities and habitat (BCH) due to altered longshore sediment movement and deposition.
Marine Fauna	It is considered unlikely that impacts to marine fauna would be holistically linked to impacts to other key factors, however it would have a strong link to the 'Social Surroundings' factor considered as part of PMaxP.

14.0 Cumulative Impact Assessment

Cumulative environmental impacts are defined as 'the successive, incremental, and interactive impacts on the environment of a Proposal with one or more impacts from past, present, and reasonably foreseeable future activities' (EPA, 2021).

14.1 Environmental Factors Considered

The environmental factors considered relevant to the Cumulative Impact Assessment are:

- Benthic Communities and Habitats
- Coastal Processes
- Marine Environmental Quality
- Marine Fauna.

14.2 Approved Proposal

The **Geraldton Port Enhancement Project** (PEP) was approved under MS600 for deepening and widening the shipping channel, deepening of the harbour basin, reclamation of land, offshore disposal of dredge spoil, reconfiguration and construction of breakwaters, construction of a railway line on the eastern breakwater, construction of beach stabilisation groynes in Town Beach and reclamation of Town Beach by sand nourishment.

Except for the annual sand bypassing program, these works were completed in 2003 and have been incorporated in the consideration of the receiving environment. For the cumulative assessment, the continued implementation of the sand bypassing has been considered.

14.2.1 Environmental Performance

The implementation of the PEP, specifically the capital dredging campaign resulted in a larger environmental impact than was predicted. The difference was largely due to the predictive modelling under-estimating the fines component of the dredged material, both in size fraction and magnitude (i.e. there were more fines and finer fines than predicted).

During the dredging campaign the plume extended beyond the limits of the model predictions and was found to impact benthic communities beyond the predicted areas. However, a subsequent review of the PEP impacts revealed that BCH had demonstrably recovered in reversibly impacted areas by the end of the 2006 summer (LeProvost, et al., 2007) . A study in 2021 highlights that seagrass in Champion Bay and the wider region remains in good condition and has recovered since PEP (BMT, 2021). Surveys in 2021 and 2022, following maintenance dredging of the Port in 2021, indicate that the environmental protection outcomes for BCH had been achieved (BMT, 2021; BMT, 2022).

Thus, it is reasonable to infer that the ecosystem function of BCH in Champion Bay and the wider region was not compromised by the PEP.

The lessons learnt from the PEP have informed the development of the PMaxP to reduce the potential for similar outcomes related to dredging. The PMaxP modelling utilised source terms defined by the Port sediment and crushed rock samples from the berth area to ensure the model predictions were as realistic as possible. Further, the proposed dredge methodology for PMaxP (rock breaking and backhoe dredging rather than cutter suction dredge) aims to minimise the extent of dredge material plumes.

14.3 Approved Proposal and Significant Amendment

A summary of the combined impacts of the PEP and those expected from the PMaxP are detailed in **Table 14-1**.

A detailed cumulative impact assessment of the combined impacts of the PEP and PMaxP and other relevant projects detailed in Section 14.4, considering the key environmental factors, is provided in **Table 14-2**.

Table 14-1 PEP and PMaxP Combined Impacts

Element	PEP	PMaxP	Combined
PMaxP Footprint and Development Envelope (DE), including marine structures	No DE was defined; the indicative DE is 207 ha, including: • Extension of the Town Beach groynes and nourishment of Town Beach • Northern breakwater extension and reclamation area • Modification of Seal Rocks • Eastern breakwater extension and railway line.	Disturbance footprint of up to 38 ha within a 75 ha DE, including: • Seawall extending north beyond existing Port boundary • Three new wharf decks (B1, B8/9) • Two jetties (tug harbour) • Extension of Berth 6 wharf deck	DE (including indicative DE for PEP) of 222 ha
Dredging and dredge material disposal	No dredge volume defined (indicative capital dredging of up to 5 Mm^3), comprised of: • Deepening of the harbour basin from 9.3 m to 12.1 m • Widening and extension of existing shipping channel • Offshore disposal of dredge spoil (3.5Mm^3) from channel • Up to 0.4 Mm^3 dredged material disposed to the northern reclamation area	Dredging of up to 258,000 m3 from the following areas: • Berth 1 • Berth 6 • Berth 8/9 • New tug harbour Onshore disposal of all dredge material within existing and new reclamation areas.	Combined dredging and disposal (offshore and onshore) of up to 5,258,000 m^3
BCH	70 ha (quantified from Port, Town Beach and shipping channel impact areas)	19 ha (predicted based on footprint and modelled impacts)[18]	89 ha BCH loss
Marine Fauna	Permanent alteration to Seal Rocks (ASL habitat)	Additional available haul out habitat created (new tug harbour seawall)	N/A
MEQ	Dredge plume	Dredge plume (smaller extent predicted)	N/A
Coastal Processes	Shipping channel altering sediment transport	No significant change	Alterations to sediment transport (mitigated by sand bypassing)

[18] Inclusive of ~2 ha of bare soft sediment within the existing Port footprint, lost to permanent land reclamation.

14.4 Other Projects Considered

The EPA (2021) defines reasonably foreseeable future activities as 'Third party (or proponent) activities which are already approved, are in a government approvals process, or are otherwise reasonably likely to proceed'.

For the PMaxP, the scope of the cumulative impact assessment focuses on the following projects and the significance of the combined impacts from the approved proposal (PEP) and the proposed amendment (PMaxP) at the regional scale:

- **Tourism Jetty adjacent to the Eastern Breakwater** in the Geraldton Port to provide pedestrian access to vessels from the existing facility. A project risk assessment and environmental impact assessment for the project was completed by MWPA and in consultation with EPA in 2019, it was determined that the project did not require referral for assessment under Part IV of the EP Act (O2, 2023). A native vegetation clearing permit (CPS 10011/1) was granted in July 2023 for disturbance of 0.62ha of seagrass within the jetty entrance channel. No clearing under this permit has yet been undertaken.
- Within the Geraldton Port boundary (immediately west of the commercial shipping harbour) the **Fishing Boat Harbour (FBH)** provides permanent and short-term pens for smaller vessels and a wharf for short stay to load and fuel vessels. Future development of the FBH is guided by the FBH Development Plan and includes the expansion of the area to accommodate more businesses, segregation of land uses through zoning, and the creation of a tourism precinct to better serve port users and the public (MWPA, 2022).

  Potential environmental impacts to the preliminary key environmental factors are not considered to be significant at a regional scale.
- **Murchison Hydrogen Renewables** is currently seeking approval under the EP Act to develop a combined onshore wind and solar energy facility (5.2 GW capacity) to produce green hydrogen for the emerging green energy markets. The proposal is located within the Shire of Northampton, approximately 150 km north of Geraldton.

  An impact assessment has not yet been completed for the Murchison Hydrogen Renewables; however, it is expected that there may be potential impacts on BCH, Coastal Processes, MEQ, marine fauna, flora and vegetation, terrestrial fauna, inland waters, air quality, and social surroundings. Due to the proximity of the Murchison Hydrogen Renewables to the PMaxP Development Envelope, it is expected the cumulative impact is limited to the disturbance of benthic habitat associated with the marine components of the proposal including a marine export facility, seawater intake and discharge pipeline, although the project is within a different BCH LAU.
- **Yogi Magnetite Project** has recently been approved by the EPA under Ministerial Statement 1225 (approved June 2024) for the construction and operation of a magnetite iron ore mine, located approximately 250 km east-northeast of Geraldton. The proposal allows for a slurry pipeline to Geraldton Port, water pipeline and gas pipeline, however there are no current plans for implementation.

  Although the Yogi Magnetite Project pipeline development envelope ends at Geraldton Port, the project does not propose to have an inherent risk on the marine environment and therefore, is not expected to have any common key factors with PMaxP that could potentially have a cumulative impact on the amenity of the Port if both projects were constructed at the same time.
- The proposed **Oakajee Deepwater Port** is located 24 km north of Geraldton with EP Act approvals already in place (MS469 and MS1139). However, it is noted that approval under MS 469 was originally published in February 1998. In April 2020, the

EPA considered the request by the proponent to extend the time limit of authorisation for the implementation of the deepwater port to 25 February 2023. The construction of the Oakajee Deepwater Port did not occur prior to this date, and a further extension is currently under consideration by the EPA. In the assessment report (EPA Report, 1672), the EPA recommended that the impacts to the key environmental factors are considered manageable, based on the requirements of existing conditions of MS 469.

Given that construction of the Oakajee Deepwater Port has not yet commenced, for the purpose of the cumulative assessment it has been assumed that the potential impacts that were assessed for the Oakajee Deepwater Port are not incorporated into the receiving environment and the development of the PMaxP may overlap with the key factors of BCH, MEQ, marine fauna and social surroundings, however impacts to BCH would be considered under a different LAU.

- The **Batavia Coast Marina** is an existing marina facility approximately 2 km north of the Geraldton Port. The Department of Transport has future plans to develop the marina in response to increased demand for additional marine facilities for example boat launching, boat pens and associated marine services (Department of Transport, 2023).

  There is limited public information regarding the potential environmental impacts of these upgrades for an assessment of cumulative impacts to be undertaken. The main impacts associated with the proposed development are related to the social surroundings. The proposal does not impact the marine environment and hence, is not expected to have a cumulative impact with PMaxP.

14.5 Marine Environmental Quality

Changes to marine environmental quality can result in significant alterations to the structures and functioning of marine environments. Champion Bay is often exposed to strong storm swell in the winter and strong southerly winds in spring and summer producing northerly longshore currents, and lighter winds in autumn. The bay is also susceptible to heat waves, cyclones and occasional river outflows. The Geraldton Port area is a highly dynamic environment that experiences significant natural environmental quality fluctuations, making the area vulnerable to marine environmental quality impacts as a result of project developments.

The PEP temporarily decreased water quality due to dredge plumes. The PMaxP will impact on the marine environmental quality through localised increases in turbidity from sediment disturbance, mobilisation of contaminants and potential release of bioavailable contaminants to the aquatic marine environment. However, the release of such contaminants is not expected to result in environmental harm as the dredge return water discharge will be highly localised, allowing sufficient dilution to maintain moderate levels of ecological protection within the harbour basin and high levels of ecological protection beyond the development envelope. While temporary impacts are expected during the implementation of the PMaxP, the revised dredge methodology is expected to minimise these impacts.

The PEP resulted in a variety of temporary disturbances to marine environmental quality including decreased water quality as a result of the extensive plumes from dredging activities (~5 Mm^3). The PMaxP is anticipated to result in temporary reductions to water quality but in smaller plumes due to the significantly smaller dredging activities proposed (258,000 m^3) and the lower impact dredging method. It is anticipated that the impacts as a result of the PEP development are no longer transient in the area. Therefore, the impacts anticipated from the PMaxP development are unlikely to result in amplified disturbance to marine environmental quality.

Assessment of cumulative impacts in **Table 14-2** determined that impacts to marine environmental quality is considered to be negligible given the short term and temporary nature of the impacts. When considering the combined impacts of the developments in the Geraldton region, it is anticipated that these projects will mainly result in localised turbidity and potential mobilisation of contaminants, which are expected to result from construction activities. Therefore, the proposed impacts will be temporary in nature and given the anticipated timing and duration of the projects it is unlikely that the impacts will result in a decline in marine environmental quality to the point where the marine environment is put at significant risk. The implementation of PMaxP alongside the existing and proposed developments in the Geraldton region, is anticipated to result in negligible impacts on marine environmental quality.

14.6 Benthic Communities and Habitats

LAUs are used to map and assess impacts to benthic habitats at an appropriate scale and have been used to assist in assessing cumulative impacts. Within the Geraldton region, one LAU covers the entirety of the Geraldton Port. The LAU stretches over 10 km north up to Glenfield and consists of a total area of approximately 48.3 km^2.

The PMaxP LAU has previously been defined based on a Department of Transport secondary sediment cell defined for Point Moore to Glenfield Beach (Stul et. Al., 2014). Within the Geraldton region, numerous proposals are located within the same LAU, however assessment in **Table 14-2** determined that none are likely to impact this LAU.

The PEP resulted in the loss of 70 ha of BCH within the Champion Bay LAU. PMaxP has the potential to result in indirect impacts to BCH through dredging activities, elevated turbidity, increased sedimentation, mobilisation of contaminants etc., however these are expected to be reversible impacts. Direct disturbance including the loss of approximately 19 ha of BCH will result from the PMaxP.

No habitats or species that are confined in their distribution to the Champion Bay – Port Grey area, with most habitats or species present in the area typically occurring widely throughout the Central West Coast Region. Whilst this is still the case, seagrasses, and to a lesser extent macroalgae, are still widely considered as important habitats as they provide a variety of ecological functions.

The DBCA Species and Communities Program has listed *Posidonia australis* meadows as a Priority 3(i) ecological community (PEC) for further survey, definition, and evaluation. The community consists of the assemblage of plants, animals and micro-organisms associated with seagrass meadows dominated by species from the *P. australis* complex and occurs as continuous to patchy seagrass meadows dominated by species from the *Posidonia australis* complex; *P. angustifolia*, *P. australis* and *P. sinuosa* (DBCA 2023b). The PMaxP and other projects in the Geraldton region have the potential to impact on this priority community through indirect changes to the marine environmental quality in the area. However, given the temporary and short-term nature of both project's impacts, the cumulative impact of these projects on the marine environmental quality is considered to be negligible.

Assessment of cumulative impacts in **Table 14-2** determined that impacts to BCH will not result in the loss of biological diversity and ecological integrity, both within and outside of the LAU. When considering the combined impacts of these projects, given the low percentage loss of BCH for majority of the projects and the variety of BCH that will be impacted, it is anticipated that the BCH within the Geraldton region will not be significantly altered to a point where whole communities and habitats are lost. Temporary indirect impacts will occur during construction for each project but given the anticipated timing and duration of the projects it is unlikely that the cumulative impact will result in declines to BCH health. The development of PMaxP alongside both existing and proposed developments within the Geraldton region, is not anticipated to significantly alter or damage BCH health or integrity in the area.

14.7 Marine Fauna

The surrounding Port and coastal waters of the West Coast Bioregion are home to a variety of marine fauna species including, shore/wading birds, pinnipeds, epifauna, infauna, bony fish, cartilaginous fish and marine mammals. The PMaxP area is situated within three Biologically Important Areas (BIAs) of conservation significant species, however, there are no critical habitats declared in Register of Critical Habitat under the EPBC Act within or surrounding the locality.

The implementation of the PEP resulted in the loss and/or modification of habitat but there were no reported direct impacts on marine fauna. The implementation of the PMaxP has the potential to permanently remove or modify habitat (BCH, haul-out), increase turbidity and sedimentation, or cause contaminant spills. Further, in the absence of appropriate management, the PMaxP could injure or kill fauna, cause permanent or temporary hearing loss, induce behavioural or stress responses.

Following the assessment of cumulative impacts undertaken in **Table 14-2**, it was determined that the proposed impacts are not expected to have a significant impact on marine fauna such that biological diversity or ecological integrity would be lost. When considering the combined impacts of the developments in the Geraldton region, it is anticipated that the interaction with marine fauna will increase in the form of loss or modification of habitat, potential contaminants and spills, injury and mortality from vessels, noise and vibrations etc. Through the implementation of adequate management measures during the construction and operation of each project, the impacts on marine fauna will be reduced significantly. The development of PMaxP alongside both existing and proposed developments within the Geraldton region, is not anticipated to injure or cause mortality to marine fauna and/or significantly damage or alter marine fauna habitat to a point where the health and livelihood of local species is compromised.

14.8 Coastal Processes

Geraldton Port has been significantly altered by anthropogenic developments for many years, with the placement of hard structures on the coastline or offshore having significant impact on coastal processes, coastlines, nearshore zones and the environmental values they support. Geraldton Port has a unique coastal process with its relatively shallow nearshore reef system that dissipates wave energy and promotes the growth of tombolo features on both large and small scales. These systems also set up complex nearshore currents and circulation patterns which dictate local sediment transport pathways (RHDHV 2023b).

The PEP development, notably the deepening of the shipping channel, predicted a significant impact to coastal processes, including sediment transport. The PEP MS600-conditioned NBSP aimed to reduce this impact. Through the construction of PMaxP a variety of coastal processes are likely to be impacted, particularly due to the potential to alter wave dynamics in the Port and the longshore sediment transport and hence areas of erosion and accretion along the Geraldton coastline. However, the predictive modelling completed for the PMaxP indicated that the impacts to coastal processes from PMaxP alone were insignificant and that the primary driver of change to sediment movement in the region was the shipping channel, implemented under the PEP (RHDHV 2023b). The CPMP will replace the NBSP as the primary management framework to manage impacts to coastal processes in perpetuity.

Following the assessment of cumulative impacts undertaken in **Table 14-2**, it was determined that impacts to Coastal Processes will not result in significant changes to coastal morphology. When considering the combined impacts of the developments in the Geraldton Port region, it is clear that the wave dynamics, currents, circulation patters, sediments etc, have been significantly altered due to anthropogenic developments.

However, although these developments have changed the natural coastal processes in the area, through the implementation of adequate management measures during the construction and operation of each project, it was determined that geophysical processes that shape coastal morphology can be maintained such that environmental values of the coast are protected. The development of PMaxP alongside the existing and proposed developments in the Geraldton region, is anticipated to result in impacts that are deemed insignificant in conjunction with existing structures.

Table 14-2Cumulative Impact Assessment

Project	Factor	Impacts	Assessment
Eastern Breakwater Tourism Jetty (O2 Marine, 2023)	Marine Environmental Quality	The proposed tourism jetty development will result in impacts to the marine environmental quality through increased localised turbidity, reduced water clarity and light and the potential for a hydrocarbon release via vessel spill. The tourism jetty project will result in the levelling of 2.25 ha of sediment and BCH. However, following review of the proposed monitoring and management strategies, it was determined that the activities are not expected to pose any significant residual risks to maintaining the quality of water, sediment and biota.	Impacts to MEQ are similar when comparing the PEP/PMaxP and the tourism jetty project, being the generation of localised turbidity and potential mobilisation of contaminants. Although temporary impacts are expected to occur during the implementation of the PMaxP, the revised dredge methodology, compared to that of the PEP, is expected to mitigate the impacts, both in the magnitude and extent of the dredge plume. Given the management measures put in place across both projects and the temporal separation of the marine environmental quality impacts, the cumulative impact of these projects is considered to be negligible and the residual impacts to MEQ will not be significant.
	Benthic Communities and Habitat	The activities associated with the construction of the tourism jetty would result in the direct irreversible loss of 0.62 ha of seagrasses, comprising: • 0.08 ha of low to sparse seagrass habitat • 0.24 ha of medium density seagrass habitat • 0.30 ha of high-density seagrass habitat A further 1.77 ha of bare ‘unvegetated’ substrate will also be directly impacted as a result of activities. As well as this, The tourism jetty project will result in the levelling of 2.25 ha of sediment and BCH. No change to BCH from baseline conditions outside the seabed levelling footprint is proposed. Therefore, the combined impact of the project activities is not considered to pose significant residual risks to the protection of BCH.	The BCH impacted by the PEP/PMaxP are similar to be cleared by the tourism jetty project. With many of the seagrass species to be cleared for the tourism jetty also cleared by the PEP and being proposed to be cleared for the PMaxP. The combined BCH impact from the PEP/PMaxP is 89 ha, or 1.83% of the LAU, whereas the clearing proposed for the tourism jetty project is only 0.01% of the LAU and is considered to be minimal disturbance. Therefore, combining these impacts with the impacts related to the PEP/PMaxP, will not result in significant changes to the residual impact on BCH. Thus, the cumulative impacts on BCH are not expected to be significant such that biological diversity and ecological integrity would be lost, in line with the outcomes from the PEP/PMaxP impact assessment.
	Marine Fauna	A variety of threatened or migratory species may occur within the vicinity of the Geraldton Port channel, including: • Australian Sea Lion (*Neophoca cinera*) • Humpback whale (*Megaptera novaeangliae*) • Indo-Pacific bottlenose dolphin (*Tursiops aduncus*) • Western rock lobster (*Panulirus cygnus*) Although there are identified marine fauna within the project area, the activities posed to these are typically low risk. Previous dredge reports in the area did not report any impacts, and with adequate management proposed there are no anticipated impacts to Marine Fauna from this project.	There were no direct impacts to marine fauna reported as part of the PEP implementation and the same is expected for the PMaxP, provided that underwater noise mitigation measures are implemented appropriately. The PEP/PMaxP impacts to marine fauna relate primarily to the loss or modification of habitat (BCH), which is the same for the Tourism Jetty. Therefore, given the low-risk nature of the projects and the significant management measures to be implemented, the cumulative impacts of these projects are not expected to have significant impact on marine fauna such that biological diversity and ecological integrity would be lost.
	Coastal Processes	The tourism jetty project will result in the levelling of 2.25 ha of sediment and BCH. However, it was determined that the levelling activities will not have impacts on the coastal process which occur within the LAU.	The PEP/PMaxP results in significant impacts to coastal processes, primarily related to the coastal infrastructure and shipping channel. These impacts are actively management under the MS600-approved NBSP, which is proposed to be replaced by the CPMP (MWPA 2025). The Eastern Breakwater Jetty is not expected to impact coastal processes and hence the assessment of significance is related to the PEP and PMaxP only and it is considered that these impacts can be managed by the ongoing implementation of the CPMP (MWPA 2025). Therefore, with the implementation of adequate management measures across both projects, the cumulative assessment has determined that the geophysical processes that shape coastal morphology can be maintained such that environmental values of the coast are protected.

Project	Factor	Impacts	Assessment
Geraldton Fishing Boat Harbour Development Plan (MWPA 2022)	Marine Environmental Quality	The Fishing Boat Harbour Development Plan (FBHDP) is currently at concept stage and includes both terrestrial and marine developments with the potential to impact MEQ. The FBHDP shares a number of potential adverse impacts with PMaxP including increased localised turbidity and reduced water clarity during rock wall construction and the potential for soil contaminants and hydrocarbon release during terrestrial land developments and future land reclamation.	Similarly to the PEP/PMaxP, the FBHDP may result in impacts to marine environmental quality via localised turbidity and the potential mobilisation and release of contaminants. The FBHDP, if implemented concurrently with PMaxP (and without adequate mitigation strategies in place) has the potential to duplicate and / or magnify localised impacts from PMaxP. However, the FBHDP is currently at concept stage, no formal timeline has been developed for implementation, and the project is not currently funded. All marine developments proposed under the FBHDP are expected to require formal assessment under Part IV of the EP Act and will therefore be subject to rigorous impact assessment (including cumulative impact assessment considering the PMaxP) upon referral. Taking into consideration the likely significant temporal separation of construction phase activities between PMaxP and the FBHDP, and the rigorous impact assessment and mitigation processes required prior to approval of the FBHDP project, it is considered that cumulative impacts of both projects can be managed such that the EPA objective for MEQ is met.
	Benthic Communities and Habitat	The FBHDP project has the potential to remove BCH from a footprint of ~26,690m² (26.7 ha). However, of this footprint ~22 ha are bare soft sediment which has accumulated due to natural sediment transport processes around the FBH northern reclaim and FBH entrance. This area is routinely dredged to maintain navigable depths at the FBH entrance. An additional area of ~ 5 ha is mapped as 'Pavement with Sand: Low Density Seagrass' (AECOM 2020). However, aerial imagery of the area indicates that seagrass densities appear very low or absent across much of the indicative project footprint.	The FBHDP is proposed to remove BCH from within a 26.7 ha footprint adjacent to the area of historic clearing associated with PEP and the proposed clearing for PMaxP within the Champion Bay LAU. The percentage loss for the impacted BCH across all BCH categories in the LAU from the proposed FBHDP and PMaxP is <0.9% of total BCH in the LAU. With consideration to the previous 70 ha of clearing of BCH by the PEP. It is expected that the BCH to be cleared by PMaxP and FBHDP is typically of lower ecological value that the clearing associated with PEP due to the current disturbance in the area. The loss is therefore not considered to pose significant risks to the environment in combination with the impacts related to the PEP/PMaxP. The cumulative impacts of these projects on BCH are therefore not expected to be a significant residual impact such that biological diversity and ecological integrity would be lost.
	Marine Fauna	Potential impacts to fauna within the FBHDP area are substantially similar to those posed by PMaxP. A variety of threatened, migratory species may occur within the vicinity of the Geraldton Port including: • Australian Sea Lion (*Neophoca cinera*) • Humpback whale (*Megaptera novaeangliae*) • Indo-Pacific bottlenose dolphin (*Tursiops aduncus*) • Western rock lobster (*Panulirus cygnus*) Potential impacts to fauna may include loss of BCH, modification of haul out habitat, mobilisation of sediment and contaminants, underwater & terrestrial noise exposure, vessel interactions, the introduction and spread of invasive marine species and intrusive light impacts during construction.	The PEP had no reported direct impacts to marine fauna during development, and it is anticipated that similar outcomes will be observed for the PMaxP through the implementation of underwater noise mitigation measures. Similar to the PEP impacts and proposed PMaxP impacts, the FBHDP is expected to impact on marine fauna primarily through the loss or modification of habitat, potential contaminants and spills, injury and mortality from vessels, noise and vibrations etc. Given the likely significant temporal separation of construction phase activities between PEP, PMaxP and the FBHDP, and the rigorous impact assessment and mitigation processes required prior to approval of the FBHDP project, it is considered that cumulative impacts of both projects can be managed such that significant impacts on marine fauna are avoided and biological diversity and ecological integrity are maintained.

Project	Factor	Impacts	Assessment
	Coastal Processes	The FBHDP will involve the construction of a substantial sea wall designed to afford long term coastal protection to the FBH precinct and considering the ongoing impacts of climate change. As seen with the existing FBH Northern Reclaim this structure will interrupt natural sediment transport processes and result in an increased sediment sink and the likely expansion of Pages Beach (and potential increased erosion at the northern beaches) if not actively managed.	The PEP/PMaxP development results in significant impacts to coastal processes, primarily related to the coastal infrastructure and shipping channels. These impacts are actively managed under the MS600 approved NBSP, which is proposed to be replaced by the CPMP (MWPA, 2025). MWPA has taken a leadership role in the ongoing management of the cumulative impacts of Geraldton's coastal infrastructure on the natural coastal processes of the region. This includes intensive sediment transport modelling effort, to better understand the potential drivers of sediment transport changes. MWPA has also undertaken >20 years of sand bypassing activities with an aim of maintaining a dynamic equilibrium within the local sediment transport cell. MWPA is committed to long term collaboration with local coastal managers to achieve best practice sediment management as part of the PEP/PMaxP. Any future construction of the FBHDP would require updated modelling and further refinement of the sand bypassing regime, to prevent further undesirable sedimentation and erosion because of the project. However, any such development would be undertaken within the framework of management measures already established under the PEP and PMaxP and is expected to provide an opportunity for continued improvement of sediment transport methods and outcomes for the region. Therefore, with the implementation of adequate management measures across both projects, the cumulative assessment has determined that the geophysical processes that shape coastal morphology can be maintained such that environmental values of the coast are protected.
Murchison Hydrogen Renewables Project (GHD, 2022)	Marine Environmental Quality	The project has the potential to result in impacts to the marine environmental quality due to the increased turbidity, suspended sediments, temporary release of contaminants and discharge of brine. Based on the proposed monitoring and management strategies, the project activities are not expected to pose any significant residual risks to the quality of water, sediment and biota.	The previous impacts from the PEP and the proposed impacts from the PMaxP will result in similar impacts to MEQ as the Murchison Hydrogen Renewable Project, through the generation of localised turbidity, potential mobilisation of contaminants and release of potentially bioavailable contaminants. Given the management measures put in place across both projects and the short-term, temporary nature of the marine environmental quality impacts, the cumulative impact of these projects is considered to be negligible and the residual impacts to MEQ will not be significant.
	Benthic Communities and Habitat	The Murchison Hydrogen Renewables Project will result in the direct disturbance and loss of benthic communities and habitat as a result of dredging and permanent marine infrastructure. Baseline BCH mapping has not been undertaken for this project at this stage. However, the project currently proposes to cover 566.7 ha of Marine Area, with the maximum extent of disturbance to benthic communities across all proposal elements currently proposed at 17.1 ha.	Although the baseline BCH mapping has not been undertaken for the Murchison Hydrogen Renewable Project, given the distance from the PEP/ PMaxP, it is anticipated that BCH to be cleared as a result of the Murchison Hydrogen Renewable Project will not be consistent with those previously cleared from the PEP and proposed to be cleared for the PMaxP. Therefore, the combination of these projects will not result in significant impacts to BCH. Given the Murchison Hydrogen Renewable Project is not located in the same LAU as the PEP/PMaxP, the impacts on BCH across these projects are not calculated within the same assessment unit. Thus, the cumulative impacts on BCH from the Murchison Hydrogen Renewable Project are not expected to be significant such that biological diversity and ecological integrity would be lost.
	Marine Fauna	The Murchison Hydrogen Renewables Project has the potential to impact on marine fauna through disturbance from vessel movements, lighting, noise and vibration, habitat destruction etc. Protected Matters Search Tool (PMST) results identified 38 marine bird species and 9 marine mammal species occurring within 40 km of the development envelope. However, due to the nature of the activities and with the implementation of adequate management measures it is anticipated that no habitat critical to the survival or no direct significant disturbance to marine fauna will occur as a result of the activities.	No direct impacts to marine fauna were observed during PEP development and therefore it is anticipated that no recorded impacts to marine fauna will occur as a result of the PMaxP assuming underwater noise mitigation measures are implemented appropriately. The Murchison Hydrogen Renewables Project has the potential to result in impacts to marine fauna primarily through the loss or modification of BCH, similarly to the clearing by PEP and proposed by PMaxP. Therefore, given the low-risk nature of the projects and the significant management measures to be implemented, the cumulative impacts of these projects are not expected to have significant impact on marine fauna such that biological diversity and ecological integrity would be lost.
	Coastal Processes	The Murchison Hydrogen Renewables Project has the potential to impact on the coastal processes within the area due to the alteration of wave dynamic, interruption of longshore sediment transport and potential sediment trapping. Currently, the processes in the area are largely unaltered with no man-made infrastructure or developments located within the coastal or marine portion of the development envelope. Therefore, the proposed development will be the first man-made infrastructure to disrupt this area, however, through the implementation of adequate management measures, the proposed development will ensure environmental values of the coast are maintained.	The PEP/PMaxP development results in significant impacts to the coastal processes due to the introduction of coastal infrastructure and the shipping channel. Given the Murchison Hydrogen Renewables Project is not expected to impact on the coastal processes within the same area as PEP/PMaxP the cumulative impact on coastal processes from the Murchison Hydrogen Renewables Project are not considered to be significant and as such the impacts from PEP/PMaxP can be managed through the ongoing implementation of the CPMP (MWPA 2025).Therefore, with the implementation of appropriate mitigation measures across both projects, the cumulative assessment has determined that the geophysical processes that shape coastal morphology can be maintained such that environmental values of the coast are protected.

Project	Factor	Impacts	Assessment
Oakajee Deepwater Port, Oakajee, Shire of Chapman Valley (EPA, 1997)	Marine Environmental Quality	The construction, on-going maintenance dredging, cargo movement, refuelling, stormwater run-off, shipping accidents, use of anti-fouling on ship hulls and poor water circulation as a result of the Oakajee project could all potentially impact on the marine water quality in the area. However, with the implementation of adequate monitoring and management strategies, the project activities are not expected to pose any significant residual risks to the quality of water, sediment and biota.	Impacts to MEQ are similar when comparing the PEP/PMaxP and the Oakajee Deepwater Port, being the generation of localised turbidity, and potential mobilisation of contaminants. Given the management measures put in place across both projects, spatial separation between Oakajee Deepwater Port and PEP/PMaxP and the short-term, temporary nature of the marine environmental quality impacts even if the Oakajee Deepwater Port was implemented concurrently with PMaxP (and without adequate mitigation strategies in place), the cumulative impact of these projects is considered to be negligible and the residual impacts to MEQ will not be significant.
	Benthic Communities and Habitats	The Oakajee project has the potential to impact on up to 170 ha of benthic marine habitat (Tingay & Welker, 1997). The Oakajee project area has six distinct habitat types, including sandy beaches, shallow sandy sea floor, extensive area of high reef, flat (shallow) limestone pavement, low reef ridges, deep limestone pavement. However, through the implementation of adequate management measures it was determined that the project will maintain the abundance, species diversity, productivity and geographic distribution of benthic habitats.	Although the BCH impacted by the PEP/PMaxP are similar categories to those proposed to be cleared for the Oakajee Deepwater Port project the distance between the projects will not result in BCH impacts within the same LAU. , Given the spatial separation between the impacts on BCH across these projects are not calculated within the same assessment unit. Thus, the cumulative impacts on BCH are not expected to be significant impact such that biological diversity and ecological integrity would be lost.
	Marine Fauna	The main impacts that will arise from the Oakajee project on the marine fauna in the area will result from the clearing of 170 ha of marine habitat. There is also potential for disturbance (i.e. noise, vibration, interactions etc,) with marine fauna during drilling and blasting activities. However, given the mobile nature of the species in the area and the implementation of management measures, it was determined that the project can be managed to meet its objective of maintaining the abundance, species diversity and geographic distribution of marine fauna.	Similarly to the PEP, it is anticipated that no direct impacts to marine fauna will be recorded as a result of development provided the underwater noise management measures are adequately implemented. The PEP/PMaxP has the potential to result in impacts to marine fauna primarily through loss or modification of BCH, which is the same for the Oakajee Deepwater Port project. Therefore, given the significant management measures to be implemented, the cumulative impacts of these projects are not expected to have significant impact on marine fauna such that biological diversity and ecological integrity would be lost.
	Coastal Processes	The project may result in changes to the coastal process in the area, as the development will act as a barrier to the longshore transport of sediment which may, without appropriate management, result in excessive accretion and/or erosion on either side of the breakwater potentially affecting beach stability. Through the monitoring of sediment movement and the implementation of management systems (i.e. sand bypassing, coastal engineering etc,) the proposal will maintain the stability of the beaches and the activities will not pose significant risks to the coastal processes in the area.	The PEP/PMaxP development results in significant impacts to the coastal processes due to the introduction of coastal infrastructure and the shipping channel. These impacts are actively managed under the MS600-approved NBSP, which is proposed to be replaced by the CPMP (MWPA 2025). Given that the Oakajee project is not anticipated to result in significant modifications to coastal processes and the spatial separation between the projects, the cumulative impact on coastal processes from the Oakajee Deepwater Port Development are not considered to be significant and as such the impacts from PEP/PMaxP can be managed through the ongoing implementation of the CPMP (MWPA 2025). Therefore, with the implementation of appropriate management measures, the cumulative assessment has determined that the geophysical processes that shape coastal morphology can be maintained such that environmental values of the coast are protected.

15.0 References

AECOM 2020, *Benthic Habitat Mapping – Champion Bay and Surrounds,* Mid West Ports Authority.

ANZG 2018, Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia. Available at www.waterquality.gov.au/anz-guidelines

BMT 2021, *Seagrass Health Survey Report - Seagrass Communities in Champion Bay and Surroundings,* Mid West Ports Authority.

BMT 2022, *Long Term Resilience of Seagrass Communities in Champion Bay,* Mid West Ports Authority.

Commonwealth of Australia 2009, National Assessment Guidelines for Dredging (NAGD).

Department of Biodiversity Conservation and Attractions (DBCA) 2022, Priority Ecological Communities for Western Australia Version 33. 1 June 2022.

Department of Biodiversity Conservation and Attractions (DBCA) 2023a, *Conservation Category Definitions for Western Australian Ecological Communities.*

Department of Biodiversity Conservation and Attractions (DBCA) 2023b, *Priority Ecological Communities for Western Australia Version 35.*

CSIRO 2008, Post-dredging recovery of seagrass in the Geraldton Region – Year 3 Report 2007, prepared for Geraldton Port Authority, February 2008.

Department of Climate Change, Energy, Environment and Water (DCCEEW) 2024, *Species Profile and Threats Database.* [Online] Available at: http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl [Accessed 2024].

Department of the Environment and Energy, 2017. *Australia National Guidelines for Whale and Dolphin Watching.*

Department of Planning Land and Heritage (DPLH) 2024, Aboriginal Cultural Heritage Inquiry System, accessed July 2024.

Department of Transport, 2023 Geraldton Batavia Coast Marina Future Development (transport.wa.gov.au).

Department of Water and Environmental Regulation (DWER) 2023 (draft), Emissions Reduction Framework for Government Organisations: A protocol for Western Australian Government agencies and Government Trading Enterprises to measure and reduce greenhouse gas emissions, final draft for Climate Action and Environment Portfolio Oversight Group, October 2023.

Environmental Protection Authority (EPA) 2023a, Statement of environmental principles, factors, objectives and aims of the EPA, published 4 April 2023.

EPA 2023b, *Environmental Factor Guideline: Social Surroundings.*

EPA 2023c, *Technical Guidance: Environmental impact assessment of Social Surroundings – Aboriginal cultural heritage.*

EPA 2021, *Technical Guidance: Environmental Impact Assessment of Marine Dredging Proposals.*

EPA 2020, *Report and recommendations of the Environmental Protection Authority: Oakajee Deepwater Port, Oakajee, Shire of Chapman Valley – inquiry under Section 46 of the Environmental Protection Act 1986 to amend Ministerial Statements 469, 774, 815 and 927.* Minister for State Development

EPA 2016a, *Environmental Factor Guideline: Marine Environmental Quality*

EPA 2016b, *Technical Guidance: Protecting the Quality of Western Australia's Marine Environment*

EPA 2016c, *Environmental Factor Guideline: Benthic Communities and Habitats*

EPA 2016d, *Technical Guidance: Protection of Benthic Communities and Habitats*

EPA 2016e, *Environmental Factor Guideline: Marine Fauna*

EPA 2016f, *Environmental Factor Guideline: Coastal Processes*

Geraldton Port Authority. 2002. *Geraldton Port Enhancement Project and Preparatory Works for the Town Beach Foreshore Redevelopment*.

GHD 2021, Voluntary Auditor's Report, prepared for MWPA, July 2021.

GHD. 2022. Environmental Referral Supporting Document Murchison Hydrogen Renewables Project.

Lavery, P., McMahon, K., Statton, J., Vanderklift, M., Strydom, S., and Kendrick, G. (2019). Defining thresholds and indicators of primary producer response to dredging-related pressures - Synthesis Report. WAMSI Dredging Science Node: Theme 5 Report – Project 5.6. March 2019.

LeProvost, I., Collins, P., Mulligan, M., & Hubbert, G. 2007. *Geraldton Port Dredging Project 2002-3: The Issues, the Events and the Final Outcome*.

Mid West Ports Authority 2019, Port Development Guidelines.

Mid West Ports Authority, 2022, Development Plan: Geraldton Fishing Boat Harbour.

Mid West Ports Authority 2025, Coastal Processes Management Plan, prepared to replace the Northern Beaches Stabilisation Plan, July 2025.

O2 Marine 2019, Geraldton Port Annual Compliance Sediment Survey 2019. Report prepared for the Mid West Ports Authority, August 2019.

O2 Marine 2020, Geraldton Port Tug Harbour Sediment Assessment. Report prepared for the Mid West Ports Authority, April 2020.

O2 Marine 2022a, *Benthic Communities and Habitat Cumulative Loss Assessment: MPWA Tourist Jetty,* Mid West Ports Authority.

O2 Marine 2022b, *Benthic Communities and Habitat Assessment: MWPA Tourist Jetty,* Mid West Ports Authority.

O2 Marine. 2022c. *Geraldton Fishing Boat Harbour Entrance Maintenance Dredge 2022.*

O2 Marine 2023, Environmental Impact Assessment: MWPA Eastern Breakwater Tourism Jetty.

O2 Marine 2024, MWPA Marine Environmental Monitoring and Management Plan (MEMMP), prepared for Mid West Ports Authority.

RHDHV 2023a, PMaxP capital dredge methodology review, internal memo prepared for Mid West Ports Authority.

RHDHV 2023b, Geraldton Coastal Process Analysis Stage 1 Report: Data Review, prepared for Mid West Ports Authority, 14 August 2023.

RHDHV 2023c, Geraldton Coastal Process Study: Stage 2 Hydrodynamic Modelling and Stage 3 Sediment Transport Understanding, prepared for Mid West Ports Authority, 14 August 2023.

RHDHV 2025, PMaxP Hydrodynamic and Plume Dispersion Modelling, prepared for Mid West Ports Authority

RHDHV 2024, PMaxP Sediment Transport Modelling, prepared for Mid West Ports Authority

RPS 2014, Geraldton Port 2014 Sediment Sampling Program. Report prepared for the Mid West Ports Authority.

SLR 2025a, PMaxP Marine Construction Environmental Management Plan, prepared for Mid West Ports Authority

SLR 2025b, PMaxP Marine Environmental Quality Management and Monitoring Plan, prepared for Mid West Ports Authority

SLR 2025c, PMaxP Benthic Communities and Habitats Management and Monitoring Plan, prepared for Mid West Ports Authority

SLR 2025d, PMaxP Marine Fauna Management Plan, prepared for Mid West Ports Authority

SLR 2024a, PMaxP Sediment Quality Summary Report, prepared for Mid West Ports Authority

SLR 2024b, PMaxP Benthic Communities and Habitats Survey, prepared for Mid West Ports Authority.

Stul, T., Gozzard, B., Eliot, I. & Eliot, M., 2014. *Coastal Sediment Cells for the Mid-West Region between the Moore River and Glenfield Beach, Western Australia,* WA Department of Transport.

Tingay, & Welker. 1997. *Oakajee Deepwater Port Public Environmental Review.*

URS 2001a, *Marine Habitats of Champion Bay, Port Grey and Geelvink Channel,* Geraldton Port Authority.

URS 2001b, Geraldton Port Enhancement Project and Town Beach Foreshore Redevelopment: Public Environmental Review, Assessment No. 1379, 7 November 2001.

WA Museum Shipwrecks Database, accessed May 2024, Unidentified Lighter 1 | Maritime Archaeology Databases (museum.wa.gov.au)

Appendix A Figures

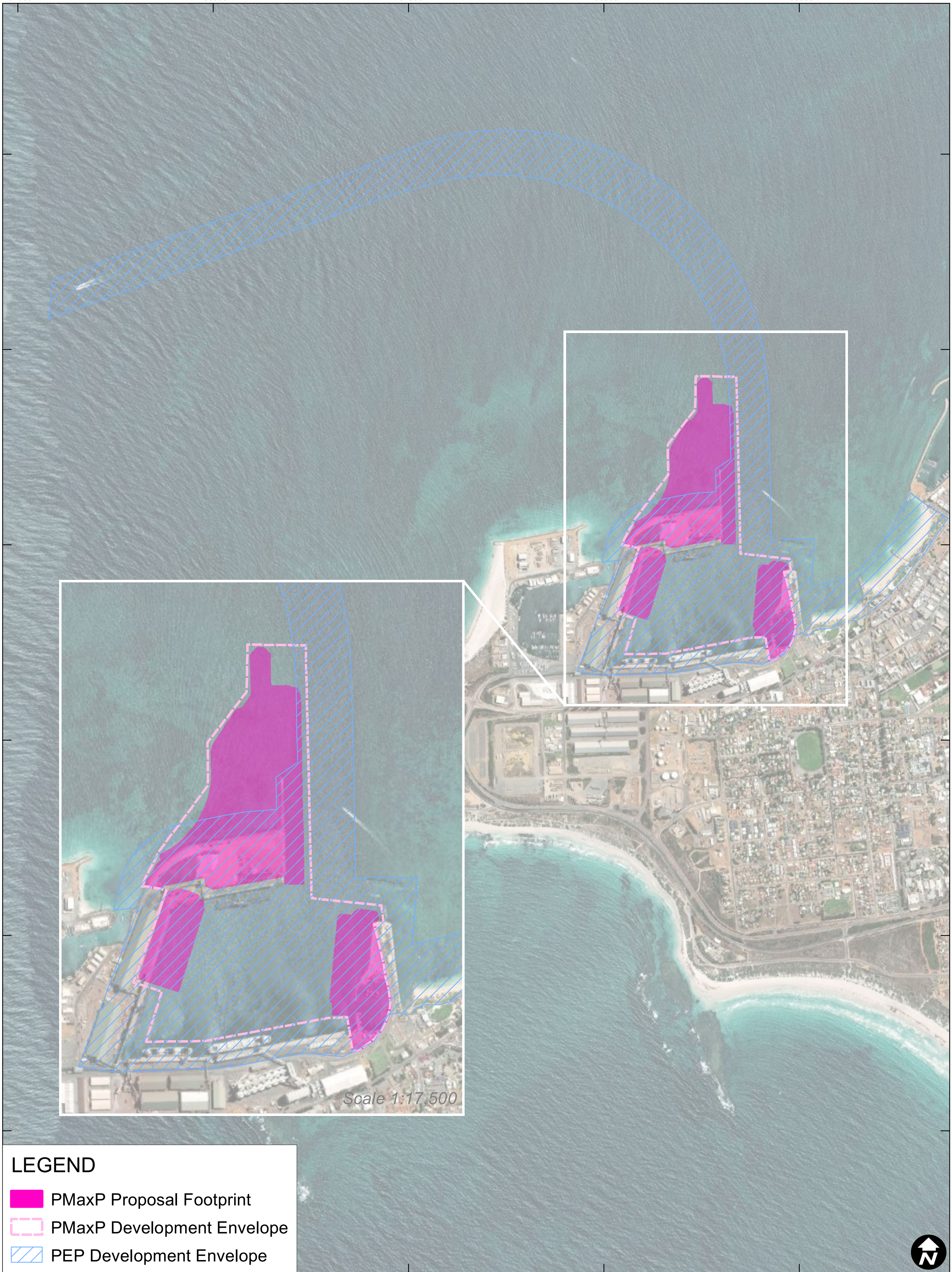
Environmental Impact Assessment

Geraldton Port Maximisation Project

Mid West Ports Authority

SLR Project No.: 675.072500.00007

24 July 2025



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Scale: 1:25,000 at A4
Coordinate System: GDA2020 MGA Zone 50

Date Drawn: 4/07/2025
Project Number: 675.072500

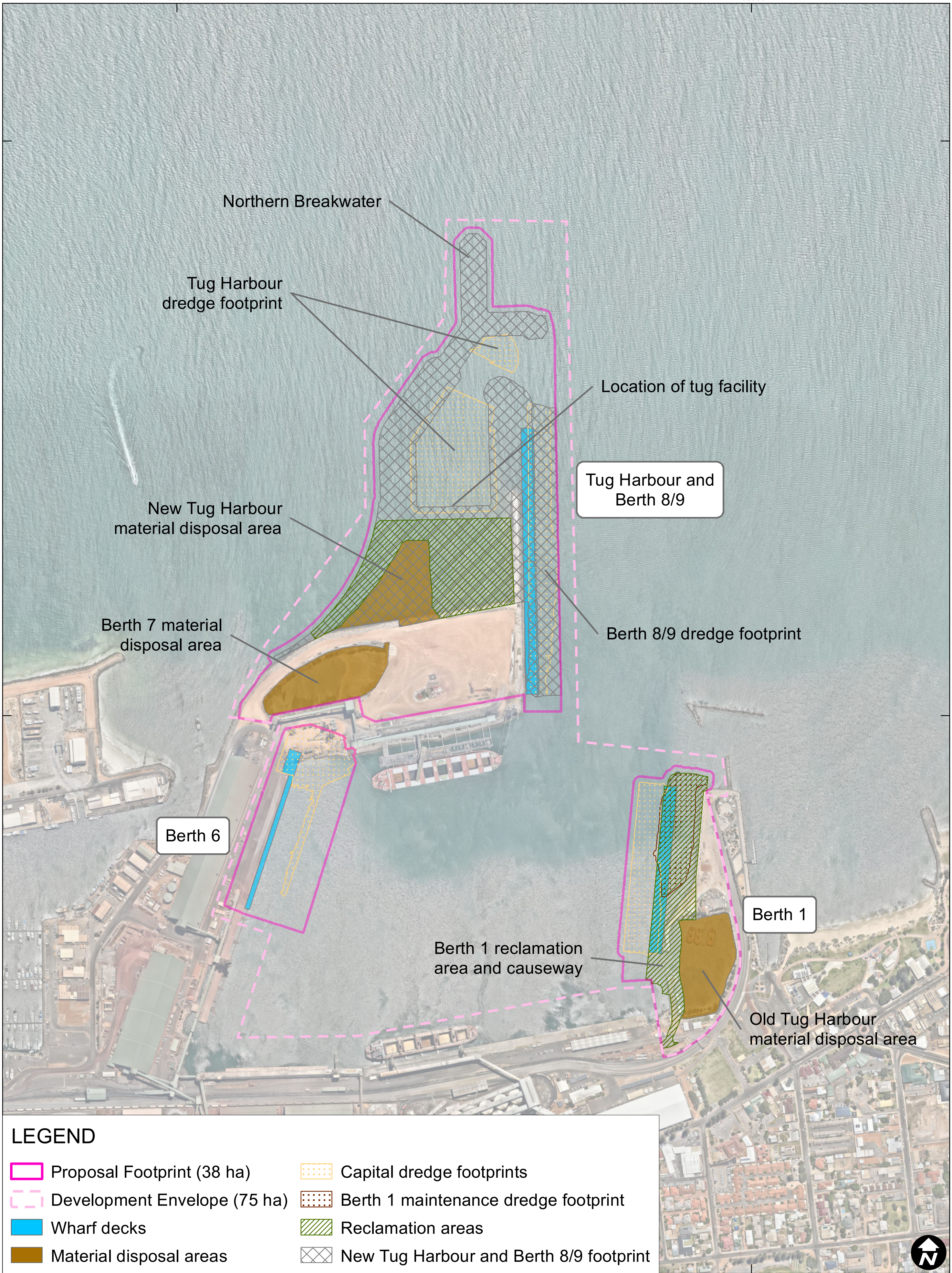
Data Source:
Nearmap WMS Server

SLR

THE PEP DEVELOPMENT ENVELOPE, PMAXP PROPOSAL FOOTPRINT AND DEVELOPMENT ENVELOPE

FIGURE A-1

\\AU.SLR.Local\Corporate\Projects-SLR\675-PER\675-PER\675.072500.00001 MWPA PMaxP - Marine\06 SLR Data\01 CADGIS\GIS\640_30470_F016_ProjectFootprint.mxd



Scale: 1:8,500 at A4
Coordinate System: GDA2020 MGA Zone 50

Date Drawn: 15/04/2025
Project Number: 675.072500

Data Source:
Nearmap WMS Server

SLR

PROPOSAL LAYOUT

FIGURE A-2

\\AU.SLR.Local\Corporate\Projects-SLR\675-PER\675-PER\675.072500.00001 MWPA PMaxP - Marine\06 SLR Data\01 CADGIS\GIS\640_30470_F025A_ProjectLayout.mxd

Appendix B Sediment Investigation

Environmental Impact Assessment

Geraldton Port Maximisation Project

Mid West Ports Authority

SLR Project No.: 675.072500.00007

24 July 2025

Appendix C Berth 6 Material Characterisation

Environmental Impact Assessment

Geraldton Port Maximisation Project

Mid West Ports Authority

SLR Project No.: 675.072500.00007

24 July 2025

Appendix D Hydrodynamic and Plume Modelling

Environmental Impact Assessment

Geraldton Port Maximisation Project

Mid West Ports Authority

SLR Project No.: 675.072500.00007

24 July 2025

Appendix E   BCH Survey Report

Environmental Impact Assessment

Geraldton Port Maximisation Project

Mid West Ports Authority

SLR Project No.: 675.072500.00007

24 July 2025

Appendix F BCH Cumulative Loss Assessment

Environmental Impact Assessment

Geraldton Port Maximisation Project

Mid West Ports Authority

SLR Project No.: 675.072500.00007

24 July 2025

Appendix G Underwater Acoustic Modelling

Environmental Impact Assessment

Geraldton Port Maximisation Project

Mid West Ports Authority

SLR Project No.: 675.072500.00007

24 July 2025

Appendix H Terrestrial Acoustic Assessment

Environmental Impact Assessment

Geraldton Port Maximisation Project

Mid West Ports Authority

SLR Project No.: 675.072500.00007

24 July 2025

Appendix I Sediment Transport Modelling

Environmental Impact Assessment

Geraldton Port Maximisation Project

Mid West Ports Authority

SLR Project No.: 675.072500.00007

24 July 2025

Appendix J Landscape Visual Impact Assessment

Environmental Impact Assessment

Geraldton Port Maximisation Project

Mid West Ports Authority

SLR Project No.: 675.072500.00007

24 July 2025

Appendix K Social Surroundings Study

Environmental Impact Assessment

Geraldton Port Maximisation Project

Mid West Ports Authority

SLR Project No.: 675.072500.00007

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Appendix L Greenhouse Gas Assessment

Environmental Impact Assessment

Geraldton Port Maximisation Project

Mid West Ports Authority

SLR Project No.: 675.072500.00007

24 July 2025

Making Sustainability Happen