MID WEST PORTS

Maintenance dredging

2022 FISHING BOAT HARBOUR ENTRANCE MAINTENANCE, DREDGE ENVIRONMENTAL MANAGEMENT PLAN

Prepared by O2 MARINE

Purpose

The Dredge Environmental Management Plan (DEMP) is designed to manage the Fishing Boat Harbour (FBH) entrance dredge program to protect and maintain the ecological values of Champion Bay. MWPA has identified the potential environmental impacts via a detailed environmental impact assessment and the DEMP sets out environmental management targets and actions.

The DEMP describes how the dredge program will be undertaken and outlines the environmental protection objectives, management measures, and targets for the successful execution of the dredge program.

Importance

The project's environmental performance will be monitored and validated through a detail management and monitoring program. The DEMP:

- Informs the dredging contractor's management plans and procedures;
- Defines the monitoring methods, frequency, sampling locations and triggers for action; and
- Defines MWPA stakeholder and performance reporting requirements.

MONITOR & MANAGE

- ✓ **Marine fauna observers on board vessel**
- ✓ Daily plume monitoring
- ✓ **Hydrographic surveys**
- ✓ Regular monitoring of water quality
- ✓ **Pre and post dredge benthic habitat surveys**
- ✓ Consultation with stakeholders
- ✓ **100% reuse of dredged sediments**

Outcomes

The Dredge Environmental Management Plan is designed to manage the dredge program to protect and maintain the ecological values of Champion Bay.

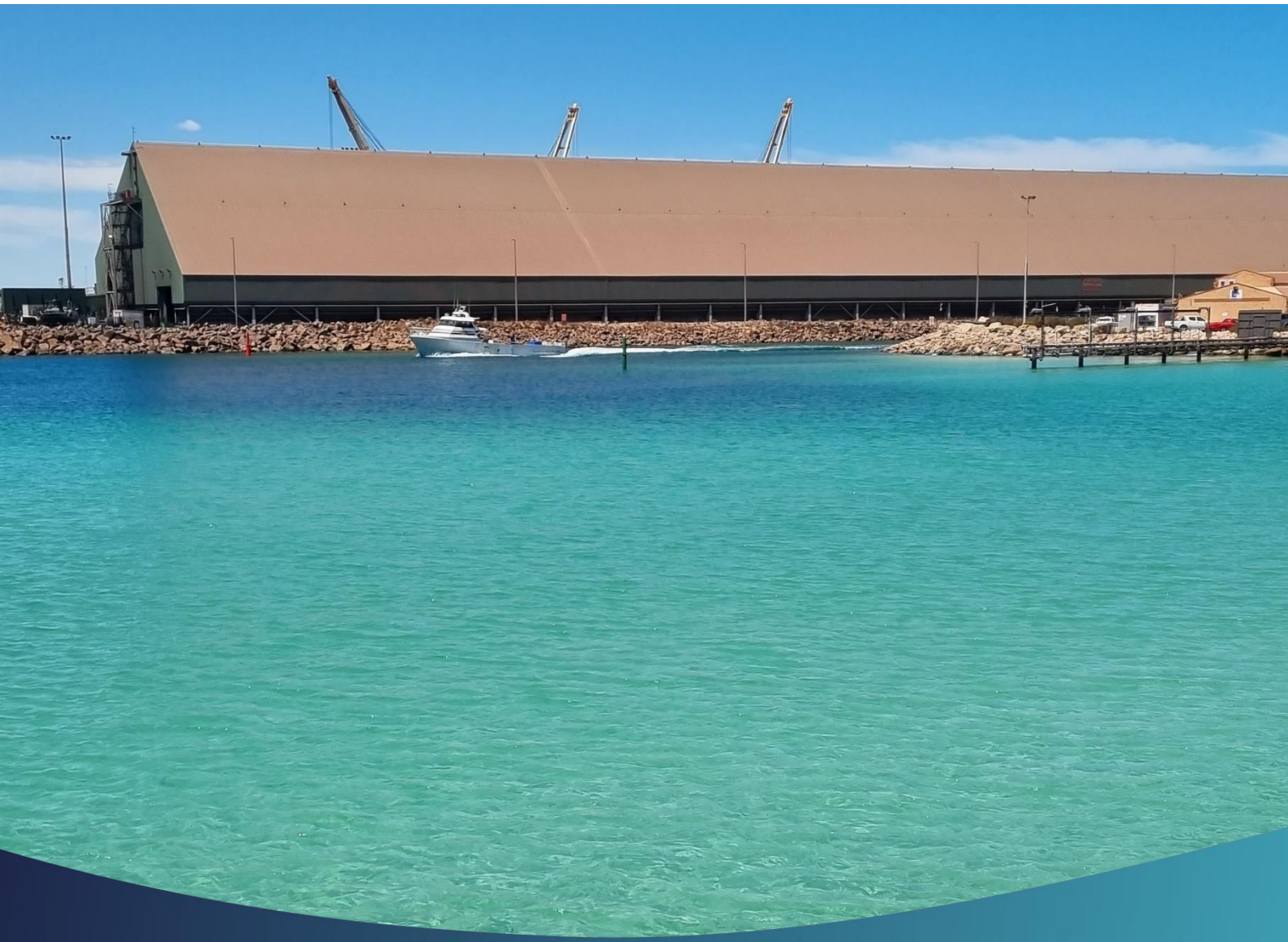
Public Input

Input from a public two week consultation period held in August 2022, have been incorporated into this plan.

Geraldton Fishing Boat Harbour Entrance Maintenance Dredge 2022

Environmental Impact Assessment

ENVIRONMENT
An O2Marine company



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Version Register

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Rev A	Draft	R Stevens C Holder	K Reynolds W Greenaway		
Rev B	Draft	R Stevens	K Reynolds W Greenaway	Comments from initial high level draft incorporated along with minor changes to dredge schedule	R Stevens 04/06/2022
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Executive Summary

The Geraldton Fishing Boat Harbour (FBH) is located approximately 430 km north of the Western Australian capital city of Perth on the Mid-west coastline. Locally the FBH is situated on the northern side of Point Moore, in the southern end of Champion Bay. The Midwest Ports Authority (MWPA) are responsible for the ongoing management and environmental performance of the FBH, adjacent Port and Port Waters. MWPA is proposing to undertake maintenance dredging within the entrance channel and adjacent to the Lease 25 Geraldton Fishing Cooperation facilities at the FBH, Western Australia.

Recent hydrographic surveys visual observation and reports from FBH users have identified sedimentation occurring along the FBH reclamation area and accumulating in the area colloquially known as 'Lives Beach' and the western side of the FBH entrance channel. Accumulated sediments have reduced available draft clearance and will require removal to continue safe navigation for vessels entering and exiting the FBH. To ensure ongoing navigational safety and operational efficiency of the Port, MWPA are planning to undertake a maintenance via a dredging campaign to remove up to 40,000 m^3 of sediment from the Lives Beach and FBH entrance dredge footprint and ongoing seabed levelling using a drag plough.

This Environmental Impact Assessment (EIA) presents an assessment of a Project to conduct maintenance dredging of the FBH entrance channel and Lives Beach, Geraldton WA (the Project) and review seabed levelling activities previously undertaken. The purpose of this EIA is to conduct an environmental impact assessment for the proposed project in accordance with Part IV of the *Environmental Protection Act 1986* (EP Act) and Technical Guidance – Environmental Impact Assessment of Marine Dredging Projects (EPA 2021b).

Overall actual and potential impacts of the Project on the environment are not considered to represent a significant environmental risk on the basis that:

- The EP Act principles and relevant Environmental Protection Authority (EPA) guidance documents have been considered in investigating and evaluating potential impacts of the Project on the EPA's environmental factors;
- A comprehensive set of monitoring and management measures have been developed to further mitigate potential impacts of the Project on the EPA's environmental factors;
- The proponent has committed to open and transparent reporting of environmental performance throughout the Project;
- Evaluation of impacts against all relevant environmental factors, including other environmental factors determined that the EPA's objectives are considered to be met. Specifically, for the key environmental factors the following outcomes were predicted:
  - Marine Environmental Quality:
    - Low Ecological Protection Area (LEPA) maintained adjacent to tailwater release returned to a Moderate Ecological Protection Area (MEPA) within one month.
    - A temporary, localised reduction in Marine Environmental Quality during dredging in the immediate vicinity of the dredge footprint.
    - Manage vessel bunkering, chemical storage and spill response to ensure no adverse impacts to the marine environment.
  - Benthic Communities and Habitat:

- No irreversible loss, or serious damage outside the dredge footprint.
- No detectible reduction from the baseline state of benthic communities outside the dredge footprint.

- Evaluation of impacts against Matter of National Environmental Significance determined that there are no predicted impacts.

Based on the outcomes of this EIA, it is recommended that MWPA implement a Dredge Environmental Management Plan (DEMP) to ensure all potential impacts are managed in accordance with this EIA to ensure predicted impacts achieved. Through the implementation of the recommended DEMP, this assessment identifies that the associated risks from the project are considered adequately minimised and avoided where possible. The implementation of the Project in accordance with the recommendations is therefore assessed as not resulting in 'Significant Environmental Impact' and does not trigger the requirement for referral under Part IV of the EP Act 1986.

It is therefore recommended that MWPA undertake a comprehensive risk assessment for the project, continue to consult with and engage relevant stakeholders and implement the management and monitoring programs stipulated within the DEMP accordingly.

Acronyms and Abbreviations

Acronyms/Abbreviation	Description
AHIS	Aboriginal Heritage Inquiry System
BCH	Benthic Communities and Habitat
CGG	City of Greater Geraldton
CoPC	Contaminants Of Potential Concern
CMP	Commonwealth Marine Park
CSD	Cutter Suction Dredge
DEMP	Dredging Environmental Management Plan
DLI	Daily Light Integral
DMPA	Dredge Material Placement Area
DSI	Detailed Site Investigation
EIA	Environmental Impact Assessment
EPA	Environmental Protection Authority
EQMF	Environmental Quality Management Framework
EQO	Environmental Quality Objectives
EV	Environmental Values
FBH	Fishing Boat Harbour
HEPA	High Ecological Protection Area
LAU	Local Assessment Unit
LEP	Levels of Ecological Protection
LEPA	Low Ecological Protection Area
MEPA	Moderate Ecological Protection Area
MNES	Matters of National Environmental Significance
MWPA	Mid West Ports Authority
NAGD	National Assessment Guidelines for Dredging
NEPM	National Environment Protection (Ambient Air Quality) Measure
PAH	Polycyclic Aromatic Hydrocarbons
PM2.5	Particulate Matter <2.5 µm
PM10	Particulate Matter <10 µm
SPL	Species Protection Level
SSC	Suspended Sediment Concentrations
TBT	Tributyltin
TEC	Threatened Ecological Community
TSP	Total Suspended Particulates
TSS	Total Suspended Solids

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Tables

1. Introduction

1.1. Document Purpose and Scope

This Environmental Impact Assessment (EIA) presents an assessment of a Project to conduct maintenance dredging of the Geraldton Port Fishing Boat Harbour (FBH) entrance channel and adjacent Lives Beach, Geraldton WA (the Project). The purpose of this EIA is to conduct an EIA for the project in accordance with Part IV of the *Environmental Protection Act 1986* (EP Act) and Technical Guidance – Environmental Impact Assessment of Marine Dredging Projects (EPA 2021b).

The scope of the document includes:

- A description of the proposed dredge Project and past seabed levelling activities (Section 2);
- Summary of stakeholder engagement undertaken in support of the Project (Section 3);
- An assessment of the potential environmental impacts of the Project in accordance with the EPA's Environmental Principles, Factors and associated Objectives (Section 4);
- An assessment of the potential environmental impacts of the Project on other environmental factors or matters against the environmental objective/s (Section 4.5.6);
- A holistic assessment of the impacts of the Project on the environment (Section 6).

1.2. Proponent

The Proponent for this Project is the Midwest Ports Authority (MWPA). The Proponent details are provided in Table 1.

Table 1 Proponent Details

Entity Name:	Mid West Ports Authority
Australian Business Number (ABN):	73 384 989 178
Address:	298 Marine Terrace, Geraldton Western Australia 6530
Key Contact (Role):	Damian Tully (CEO)
Key Contact Email:	communications@midwestports.com.au

1.3. Environmental Impact Assessment Process

1.3.1. *Environmental Protection Act 1986* (EP Act) (Part IV)

Part IV of the Environmental Protection Act 1986 (EP Act) defines the process through which actions should be assessed, and where significant environmental harm is possible, outlines the formal referral and assessment process. Whilst this EIA has been documented, the action is not predicted to have any significant environmental impacts and as such, will not be referred under the EP Act. However, this document ensures due process has been conducted in accordance with the EP Act and that a formal process of internal assessment has been conducted.

1.3.2. *Environmental 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, is typically focused on Matters of National Environmental Significance (MNES). There are no MNES identified that will be placed at risk of serious environmental harm from this Action, therefore no referral under the EPBC Act will be required.

1.4. Other Approvals and Regulation

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.* The Port of Geraldton in vested in MWPA under the Port Authorities Act 1999 and is recognised within the City of Greater Geraldton Local Planning Scheme No. 1.

The under Part 4, Section 30 of the Port Authorities 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;

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

(e) to be responsible for maintaining port property; and

(f) to protect the environment of the port and minimise the impact of port operations on that environment.'

The key legislation that applies to this EIA includes, but is not limited to:

- *Aboriginal Heritage Act* 1972 (AH Act);
- *Environmental Protection (Sea Dumping) Act 1981* (SD Act)
- *Biodiversity Conservation Act* 2016 (BC Act);
- *Environmental Protection Act* 1986 (EP Act);
- *Heritage of Western Australian Act* 1990 (HWA Act);
- *Underwater Cultural Heritage Act* 2018 (UCH Act);
- *Maritime Archaeology Act* 1973 (MA Act);
- *Port Authorities Act* 1999 (PA Act); and
- *Ports Legislation Amendment Act* 2014 (PLA Act).

1.5. Key Environmental Factors and Assessment Guidelines

Whilst this Project is not considered to represent any significant impacts under the EP and EPBC Acts, and therefore will not be referred for formal assessment, this document details and investigates the potential environmental impacts in accordance with the documents that apply to formally assessed actions. The following key EPA Technical Guidance have been considered in the development of this EIA:

- Statement of environmental principles, factors, objectives and aims of the EIA (EPA 2021a);
- Technical Guidance: Environmental impact assessment of marine dredging proposals (EPA 2021b):
- Technical Guidance: Protection of Benthic Communities and Habitats (EPA 2016a); and
- Technical Guidance: Protecting the quality of western Australia's marine environment (2016b).

In accordance with the technical guidance, potential project risks were identified for the following key environmental factors:

- Benthic Communities and Habitat;
- Marine Environmental Quality; and
- Air Quality.

Nine other environmental factors relevant to the Project were identified, however, due to the low risk of environmental impacts, and in consideration of the mitigation measures proposed to manage potential impacts, these factors are deemed not necessary of assessment by the EIA. The following environmental factors are deemed less significant, largely due to the existing environment/land use in which they occur. These factors include:

- Marine Fauna;
- Coastal Processes;
- Flora and Vegetation;
- Landforms;
- Terrestrial Environmental Quality;
- Inland Water Environmental Quality;
- Social Surroundings; and
- Hydrological Processes.

2. The Project

Geraldton and the Geraldton FBH are located approximately 430 km north of the Western Australian capital city of Perth on the Mid-west coastline. Locally the FBH is situated on the northern side of Point Moore, in the southern end of Champion Bay (Figure 1 and Figure 2).

The Mid West Ports Authority (MWPA) are responsible for the ongoing management and environmental performance of the FBH and surrounding Port Waters. MWPA is proposing to undertake maintenance dredging within the entrance channel and adjacent Lives Beach at the FBH, Geraldton, Western Australia.

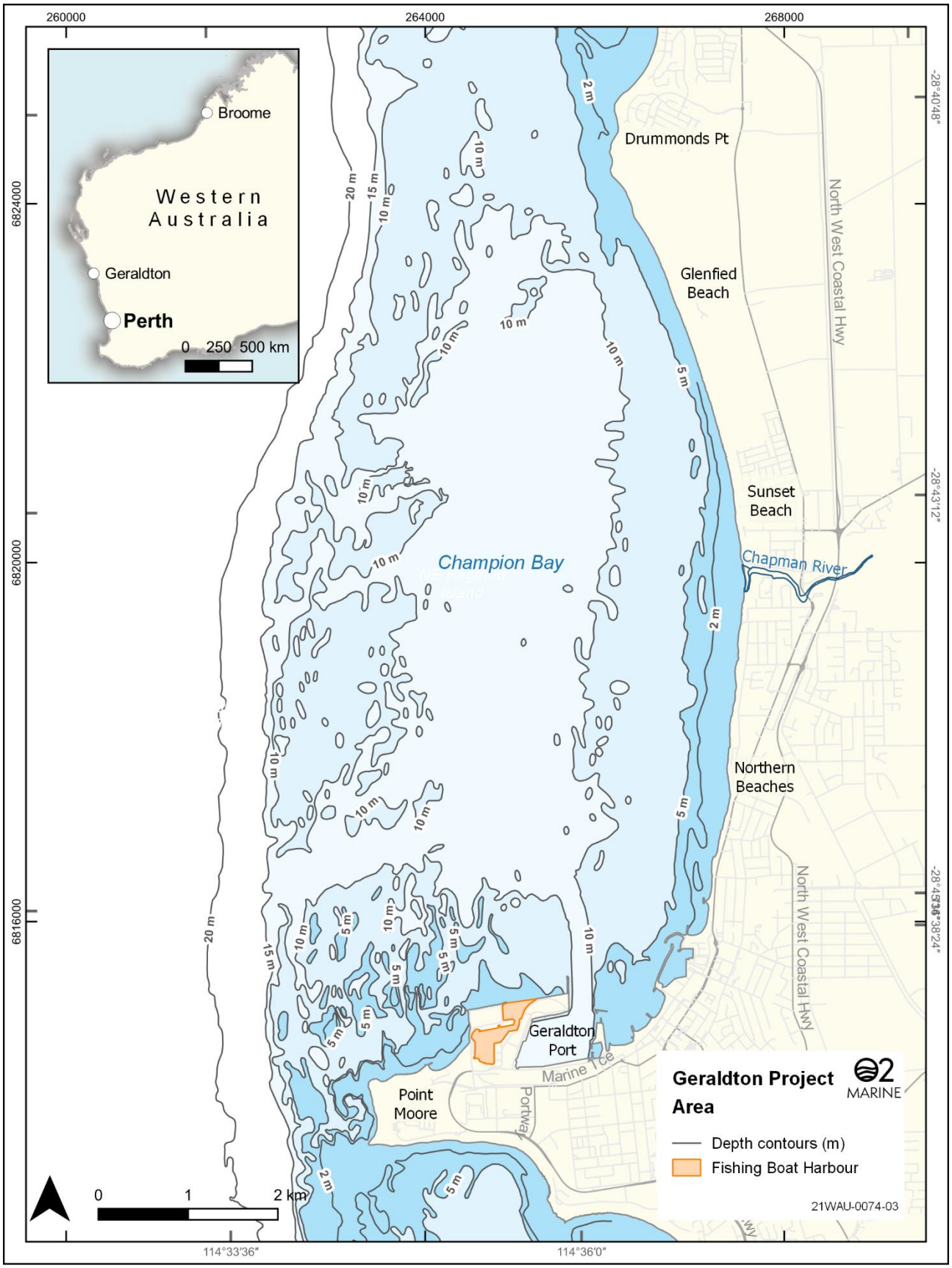

Figure 1 Geraldton Fishing Boat Harbour environmental setting and context

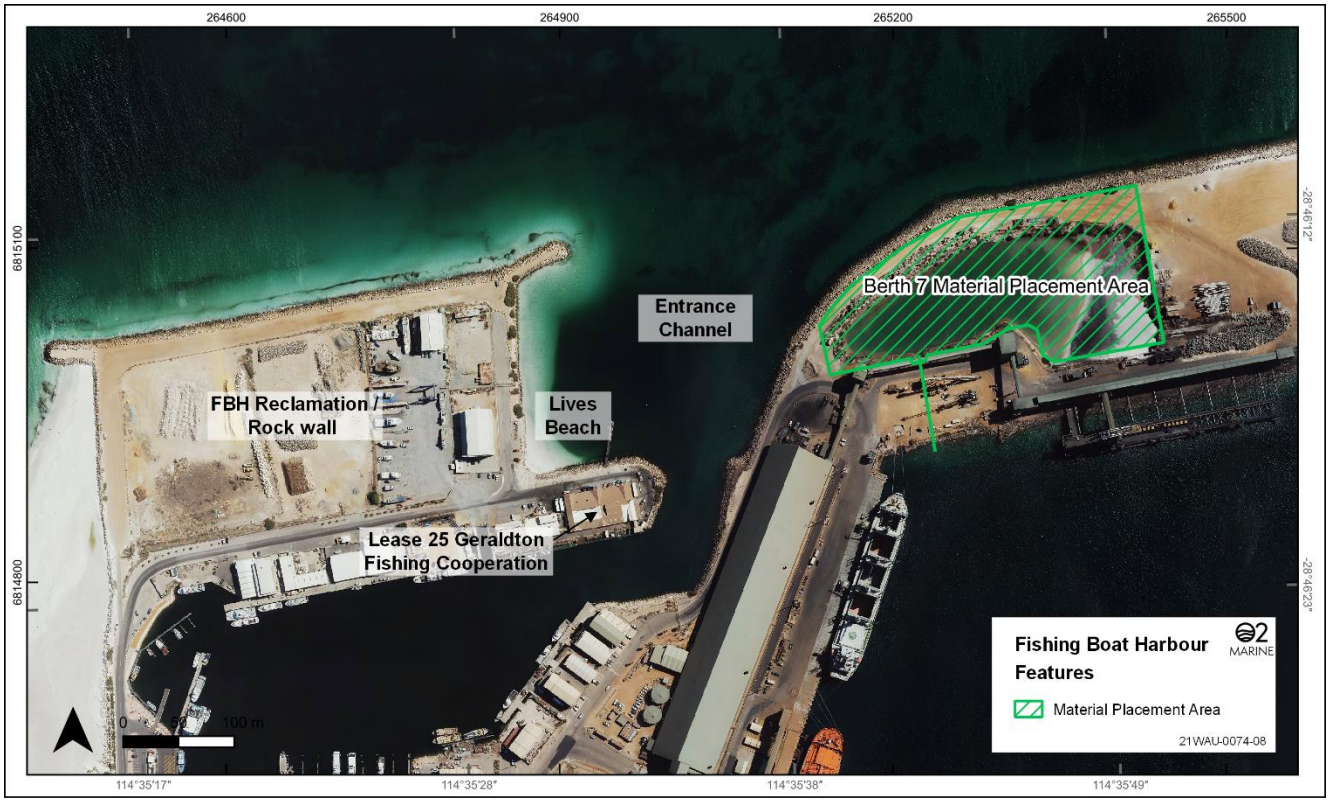

Figure 2 Fishing Boat Harbour key features

2.1. Project Description

2.1.1. Key Project Characteristics

The FBH is not a natural environment, its construction was restricted to extending rock walls and land reclamation to form the enclosed harbour with a single entrance channel located in the northeast corner. Previous capital dredging has taken place, though exact details are difficult to identify. Anecdotally it is understood that approximately 279,000 m3 of both sand and limestone rock were removed during previous reconfiguration projects that have taken place, though exact locations and dates are not certain.

2.1.1.1. Seabed Levelling

Sediment migration from Pages Beach around the FBH reclamation area has led to sediment accumulation along Lives Beach and within the FBH entrance channel. MWPA has attempted to manage this sediment accumulation via the Northern Beaches Stabilisation Program which involves annual sand recovery and relocation to nourish beaches north of the Port. In recent years these sand bypassing activities have been supplemented by seabed levelling to maintain a safe navigable draft for vessels entering and exiting the FBH.

Seabed levelling, “sweeping” or ‘drag ploughing’ is a maintenance activity commonly used within port waters around the world. These activities are defined by the use of a levelling bar or sweeping bar to level and push or drag material from shallow to adjacent deeper areas. Seabed levelling projects are generally small in scale and extent, and therefore generally do not trigger formal regulatory assessment under the EP Act.

2.1.1.2. Maintenance Dredging

Whilst seabed levelling provides MWPA with a temporary solution and a contingency to quickly redistribute sediments obstructing the FBH entrance, a formal dredge project has been identified as a longer-term solution. Dredging results in the removal of the accumulated sediments from the system preventing them from returning to the FBH Entrance. Maintenance dredging will ensure continued safe navigation for vessels entering and exiting the FBH.

Hydrographic representation of sediment accumulation is presented in Figure 3. Figure 4 presents the proposed dredging footprint and dredge material placement area (DMPA).

In alignment with MWPA's Sustainability Strategy the following goal was set:

> *To identify 100% beneficial use and environmentally sustainable placement options for the Geraldton Port maintenance dredge 2021 program; to place the dredge material with a purpose that would achieve a net environmental benefit and avoid sea dumping.*

To facilitate this goal MWPA conducted a workshop to determine the potential beneficial re-use options for the sediment (refer Section 2.1.3) which identified the following option:

- Onshore land reclamation of the material within the existing reclamation cell located north of Berth 7.

It is anticipated that dredging will commence during August 2022, with the works completed within two months.

A summary of the Project is provided in Table 2 and the key characteristics, including operational elements are summarised in Table 3 and presented in Figure 4.

Note that there are no physical elements requiring assessment associated with this Project.

Table 2 Summary of the Project

Project Title	Geraldton Fishing Boat Harbour 2022 Maintenance Dredging Project
Proponent Name	Midwest Ports Authority
Short Description	Conduct maintenance dredging of accumulated sediments within the FBH entrance and adjacent Lives Beach up to 40,000m^3. Sediments are considered of natural origins and free from contamination and will be relocated to a land base disposal area for allocation to future projects. Sediments will be relocated to the existing Berth 7 land reclamation cell.

Table 3 Location and Proposed extent of operational elements

Element	Location	Proposed Extent
Maintenance dredging of accumulated FBH entrance and Lives Beach sediments	Figure 3 Figure 4	Removal of up to 40,000 m^3 of sediments from a proposed dredge footprint area of 26,690 m^2 via cutter suction hopper dredge.
Landside reaction into existing Berth 7 DMPA	Figure 4	Placement of up to 40,000 m^3 of dredge material into existing land reclamation cell north of Berth 7
Seabed Levelling of the FBH entrance as a contingency measure	Figure 3	Relocation of sediment from high points to low points in the immediate levelling area, does not involve disposal of sediments outside of the immediate project area.

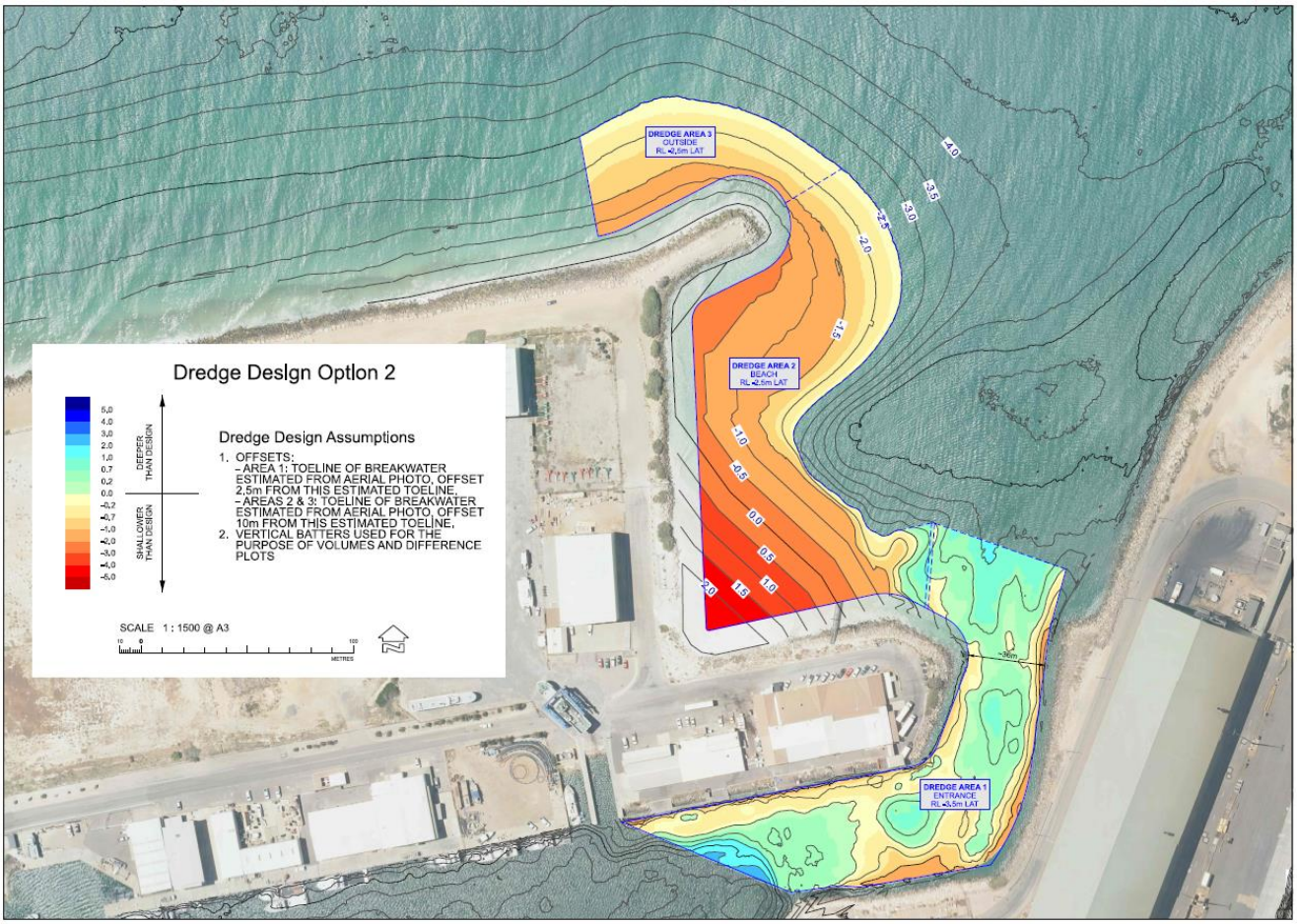

Figure 3 Hydrographic representation of the sediment accretion

Figure 4 Proposed dredging and relocation footprints

2.1.2. Justification

The Geraldton FBH has played a key role in facilitating the development and ongoing operations of the Midwest's professional fishing and vessel support industry. The FBH contains 152 permanent and short-term pens and a 98 m main wharf, including fuelling berth of 55 m, and an 80 m service jetty. Landside facilities typically include vessel support industries, including two hard stand facilities with Tami lift, boat building, engine and hydraulic services along with aquaculture, live cray and fish processing and wholesale facilities. Vessel access is through a common entrance and exit channel which is approximately 55 m wide and restricted to 3.5 m draft vessels up to 35 m in length.

In alignment with the Port Authority's regulated functions the proposed maintenance dredging project is required to reinstate the design depths and widths of the FBHs navigable waterways due to the accretion of sediments along the western side of the channel. Therefore, the objectives of the Project are to;

- maintain a navigable entrance channel and access to the harbour;
- facilitate safe and efficient maritime operations; and
- meet commercial commitments to FBH users.

If the sediments are not removed the impacts would result in unsafe navigable waterways, a decline in the efficiencies and profitability of the current fishing fleet and support industries, and increasing the risk of vessel grounding which could result in environmental impacts on the marine environmental quality of the FBH and wider Champion Bay.

2.1.3. Project Design Evolution

2.1.3.1. Sand Bypassing and Seabed Levelling

Annual sand bypassing conducted as part of the Northern Beaches Stabilisation Programme (GPA 2006) has removed sediments from Pages Beach for the past 18 years as part of the MWPA ongoing commitment under Ministerial Statement 600. In the past 3 years MWPA has removed 21,179 m3 of sand from Lives Beach as part of this program to reduce sediment accreting in the FBH Entrance. In 2020 and 2021 MWPA also conducted targeted seabed levelling to ensure larger vessels continue to have access their allocated pens within the FBH. No exact volumes were calculated during these two campaigns, however sufficient depth was gained for safe navigation after the completion of each campaign.

2.1.3.2. Requirement for Dredging

Accumulation of sediments along Lives Beach, situated along the eastern rock wall of the FBH reclaim area have been accreting over the past ~6 years and have reached a point over the past ~2 years where the sediments are continuing to mobilise south and accreting within the harbour entrance channel (Figure 3 and Figure 5) and along the adjacent reclaim rockwalls, known as 'Lives Beach'. As such these sediments require removal to ensure ongoing navigational and environmental safety and ensure that Port efficiencies are maintained.

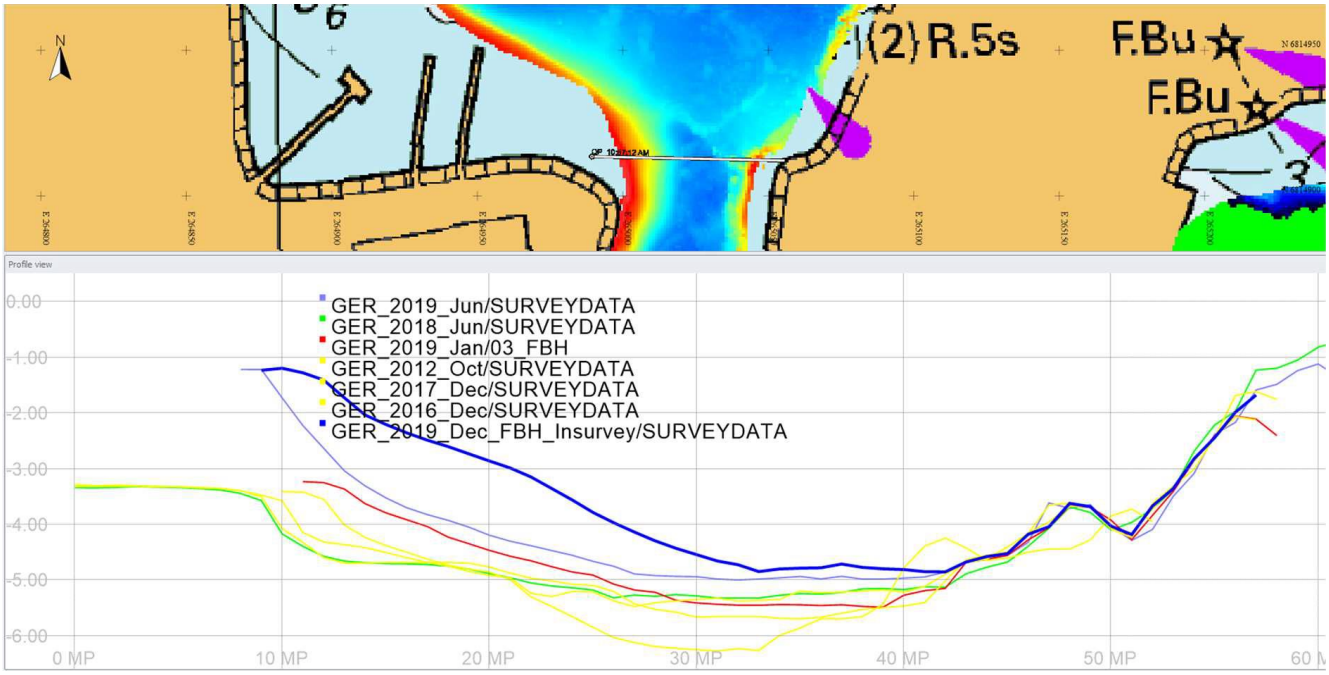

Figure 5 Fishing Boat Harbour entrance cross sections

Beneficial Use Assessment

To ensure that the Port goal of 100% beneficial use of dredge material is achieved a three-stage beneficial use assessment and workshop was conducted in accordance with PIANC (2009) on 28 February which included:

- Beneficial Use Options Identification;
- Fatal Flaws Screening Analysis; and

- Facilitated Multi Criteria Analysis.

The properties of the sediment to be dredged along with the current and predicted future maintenance dredging requirements are key considerations for identification and analysis of potential beneficial use options. PIANC (2009) provides a framework for assessing the beneficial use of dredged material, summarised in Figure 6.

Through internally workshopping this process with key MWPA personnel the following environmental and engineering categories were identified:

1. Environmental enhancement:
    a. Sand replenishment (nearshore) – placement of sand within the nearshore zone, inside the 'depth of closure' where sand can be actively transported to the shoreline by waves and currents;
    b. Sand replenishment (beach) – placement of sand directly to the beach or within the surf-zone to enhance the beach; and
    c. Dune restoration (erosion hotspots) – use of sand to restore dune systems experiencing significant erosion.
2. Engineering:
    a. Reclamation (existing) – placement within existing land reclamation to advance the Port's future development;
    b. Reclamation (new) – placement within new land reclamations as part of the Port's future development;
    c. Export – use of material for general construction, outside of reclamation. Includes the option of exporting the material; and
    d. Other – other engineering solutions, which may beneficially utilise sediment temporary storage of material for future uses/demands.

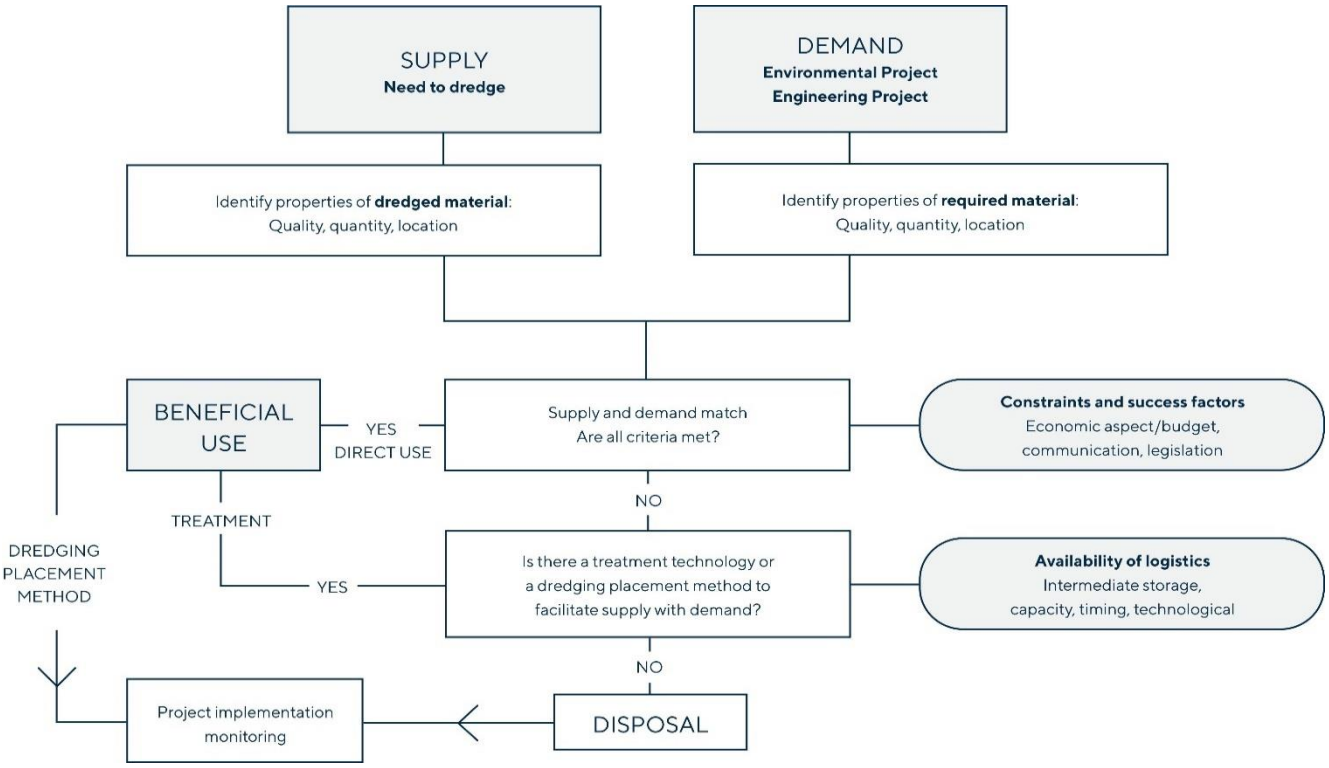

Figure 6 PIANC Framework for Dredge Material Beneficial Use

Following the identification of the preliminary beneficial use options, MWPA conducted a pre-screening against fatal flaws which included:

- Engineering fatal flaw:
  - Where disposal cannot be achieved with the available equipment or where practical engineering constraints would preclude the consideration of this option.
- Demand fatal flaw:
  - Where there is no identified demand for the option, the option may be feasible and practical, however is superficial to community or stakeholder needs.
- Environmental fatal flaw:
  - Where sediment characteristics were identified as unsuitable for environmental enhancement, creating a risk of contamination, instability, erosion or short-term infertility,

Remaining options were then applied to a multi-criteria assessment in accordance with Figure 7 to determine the final and most suitable option.

The final option selected is:

- Onshore land reclamation of the material within the existing reclamation cell located north of Berth 7

Figure 7 Multi-criteria assessment process

2.1.4. Project Operational Elements

2.1.4.1. Seabed Plough

Seabed levelling is a hydrodynamic dredging technique that mobilises material underwater and then uses the seabed slopes and natural water currents to move the material to another location. It has been used very successfully to level high spots within the FBH entrance by relocating accreted deposits into nearby deeper areas (i.e. approximately 100-200m to the north-east). A plough or sweep bar is mounted on a large steel A-frame then suspended below a seagoing tug or barge that can raise or lower the plough to the required depth (Figure 8). Ploughing and bed levelling is carried out with a high degree of accuracy using on-board GPS enabled system. The operations are supported by a hydrographic survey vessel to ensure required depths are achieved and new high points are not created during the operations.

Figure 8 Quest Marine during June 2020 FBH works (Photo MWPA).

2.1.4.2. Dredging Equipment

Dredging will be completed by a Cutter Suction Dredge (CSD) (Figure 9). These are typically non-propelled barges equipped with a hydraulic cutterhead, suction pipe and pumps.

During dredging, the cutterhead is lowered to the seabed, rotating and disturbing the material to be dredged. The cut material together with water is drawn into the suction mouth. This slurry mixture is then transported by the dredge pump through the discharge pipeline to the designated discharge site.

While operating, the CSD is considered stationary, with spud and anchor systems used for positioning the dredge within the dredging area. During the dredging works, a spud is lowered in the seabed to secure the vessel. Winches and anchors are used to swings the dredge from side to side allowing the cutterhead to removes material from the seabed.

The dredge is expected to be a small CSD with the following nominal specifications:

- Total Installed power: <200 kW
- Length: ~25 m
- Breadth: ~8 m
- Draught: ~2 m
- Discharge pipe diameter <400 mm

It is expected that an operational efficiency of ~65% will be achieved, which allows for operational constrains such as weather and shipping. An average production rate is expected to be ~100-200 m^3/hr.

Figure 9 Example CSD – CGC Dredging's Cooper II (Image Source CGC Dredging)

2.1.4.3. Dredging and Material Placement

Sediments totalling up to 40,000 m^3 will be removed from the channel entrance and Lives Beach and pumped directly into the Berth 7 DMPA via pipeline (Figure 4). Dredging will be conducted over 12-hour daily shifts – no 24-hour operations will occur during this project. The dredge project is estimated to extend out to a maximum of one month duration, with allowance for adverse weather delays.

In common with the 2002/2003, 2012 and 2022 dredge campaigns dredge material will be placed within the existing reclamation area (Northern Reclamation DMPA). The reclamation area was constructed during 2001 and 2002 as part of the MWPA's (formerly the Geraldton Port Authority) Port Enhancement Project. The reclamation area is double lined with a layer of geotextile cloth and plastic membrane on the northern, eastern and western sides (Figure 10). The geotextile was used to ensure the containment of silts, while the plastic membrane was used to reduce the permeability of the bund wall (URS 2001a). The southern wall (i.e. harbour side) of the reclamation area was considered impermeable to sediments and was intentionally left unlined so that any water would preferentially flow back toward the harbour (i.e. away from open waters and the intakes of the lobster processing plants).

Excess water ('tailwater') will return to the ocean via existing return water outlet pipes located in the south-western corner (i.e. northwest corner of the harbour) of the reclamation area (Figure 11).

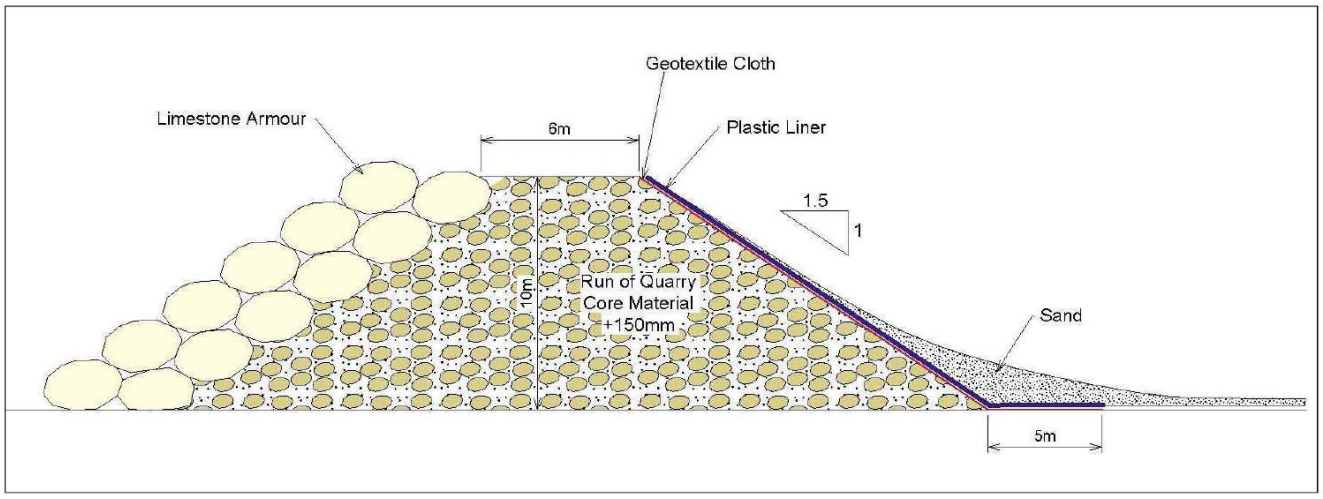

Figure 10 Bund Wall Cross Section

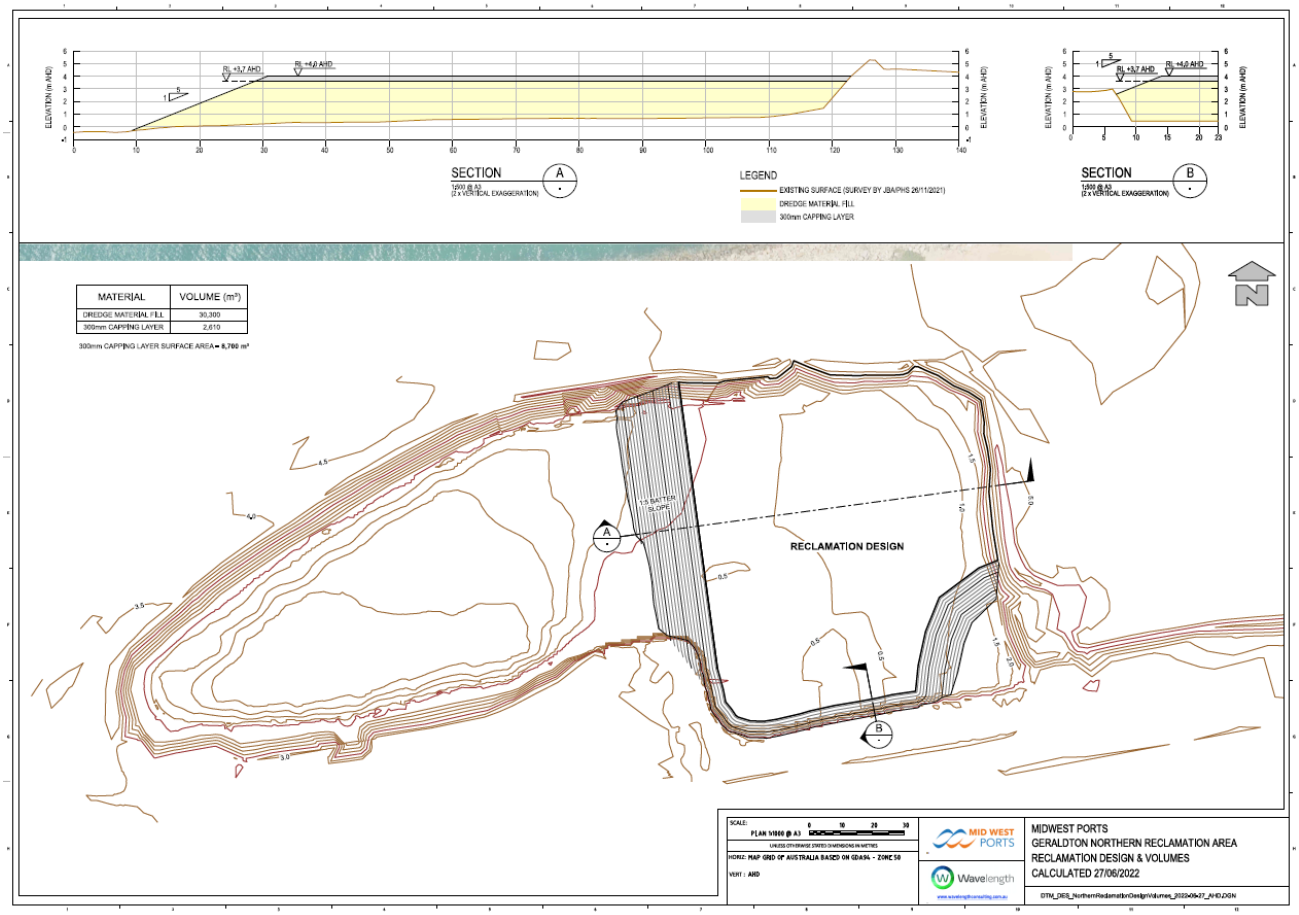

Figure 11 Berth 7 Dredge Material Placement Area and Tailwater Return Pipes

2.2. Local and Regional Context

The proposed dredging footprint and Berth 7 DMPA is situated near to the town of Geraldton, in Champion Bay between Point Moore in the south and Drummonds Point in the north, in the Midwest Region of Western Australia (Figure 12). The Project and all activities will occur entirely within the designated Port Waters of Geraldton Port.

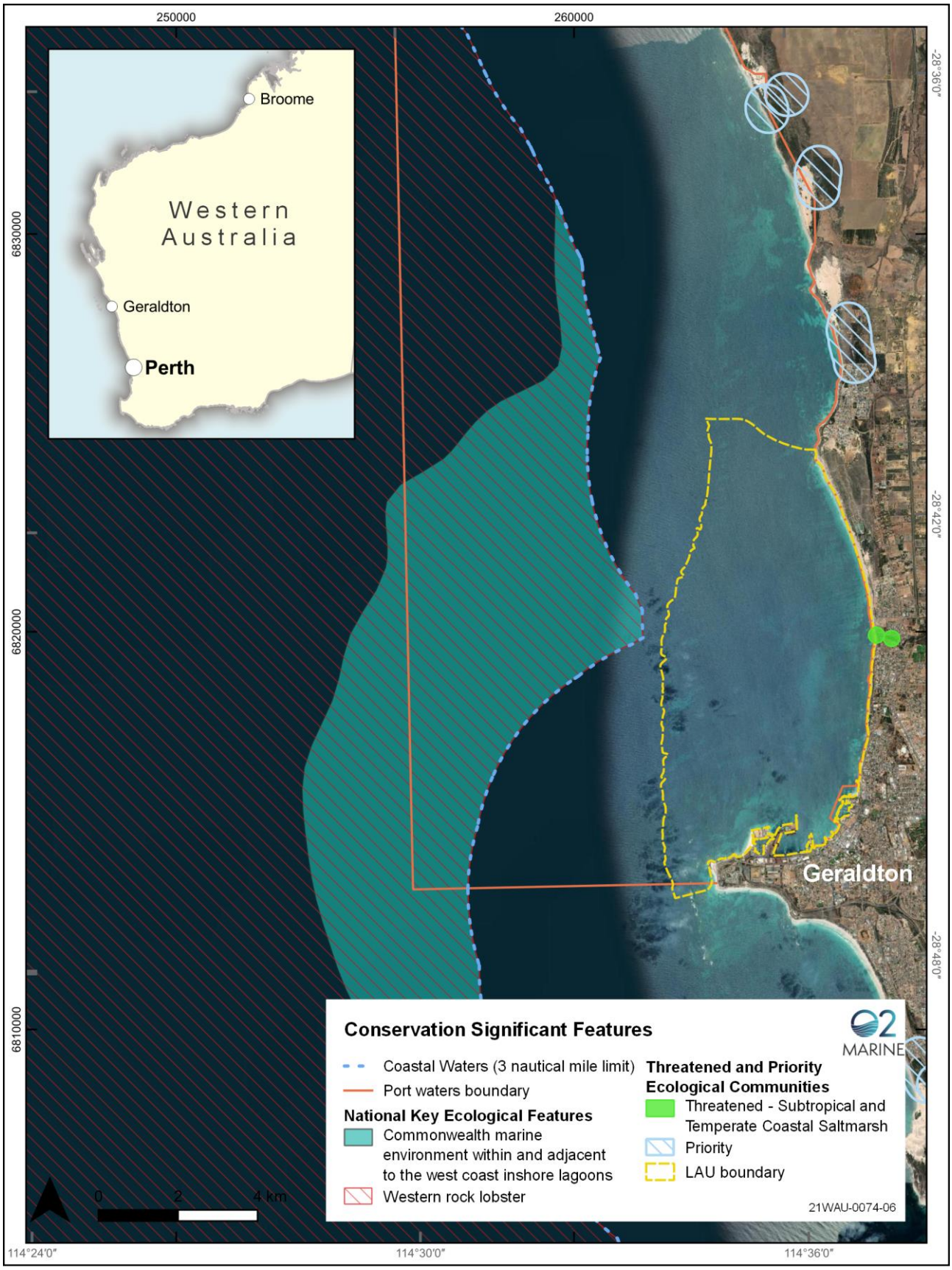

Figure 12 Proposed Maintenance Dredging Project – Local and Regional Context

2.2.1. Environmental Assets

Other than protected or conservation significant species which may occur in the Project Area, the following key features of conservation significance were identified within or adjacent to the Project area:

Commonwealth Features of Conservation Significance

- Abrolhos Commonwealth Marine Park (CMP) – Special Use Zone - The nearest CMP to the Project area is the Abrolhos CMR, which is located approximately 27 km south-west of the Project area. Given the distance from the Project area, impacts to this CMR are not predicted; and
- Threatened Ecological Community: Subtropical and Temperate Coastal Saltmarsh – Subtropical and temperate coastal saltmarsh Threatened Ecological Community (TEC) is known to occur adjacent to the Project area with an established community occurring within the Chapman River. The community occurs within the rivermouth area, typically an enclosed river system which intermittently flushes post heavy localised rainfall. Further discussion on the potential indirect effects upon this TEC are discussed in Section 4.3.
- Underwater Cultural Heritage – Eighty three (83) shipwrecks were identified through a search of the Australasian Underwater Cultural Heritage Database within the Midwest Region – Geraldton, with 32 occurring along the coastline between Dongara and Port Gregory. Eight of these occur within the wider Champion Bay area however there are no recorded wrecks within the Nearshore DMPA, nor is there any predicted impacts from this Project to identified existing wrecks.

State Features of Conservation Significance

- Abrolhos Islands National Park and Fish Habitat Protection Areas - The dredging area of influence lies entirely within MWPA Port Limits. Around 60km offshore from the Port of Geraldton is the Abrolhos Islands National Park and Fish Habitat Protection Areas, jointly managed between the Departments of Biodiversity, Conservation and Attract ions and Primary Industry and Regional Development.
- Aboriginal Heritage - Two registered Aboriginal Heritage Sites are recorded in the Aboriginal Heritage Inquiry System (AHIS) as being in the vicinity of the Project area. These include site ID 5561 Chapman River Mouth and 5874 Bluff Point Midden. As part of the 2021 Maintenance Dredging Project, to better understand and mitigate impacts to Aboriginal heritage, MWPA engaged with the Yamatji Southern Regional Corporation to ensure that key cultural and environmental sensitivities are not impacted by the Project. The outcomes of the initial engagement identified no concerns, however consideration of the impact upon the TEC was raised and discussed. Further assessment of potential impacts upon the TEC are discussed in Section 4.3. There is no requirement to seek approvals for the Project, however MPWA are committed to ongoing stakeholder consultation up to, during and post dredging as required. Further details are provided in Section 3.
- Other Heritage - A search of the Heritage Council database indicates no maritime or coastal heritage structures within the Project Area. The Point Moore Lighthouse cottage are listed, however these are not considered within the Project area as such no impacts from this Project are predicted.

There are 18 Shipwrecks identified on the WA Museum Shipwrecks database that are located off the coast of Geraldton with eight occurring within Champion Bay. Shipwrecks in State Waters are protected under the MA Act.

3. Stakeholder Engagement

3.1. Stakeholder Consultation

Engagement with key stakeholders involved a combination of face-to-face meetings, online 'virtual meetings', open forums, exchange of emails and advertising of management plans and impact assessments on the public webpage. The outcomes of stakeholder consultation that relate to assessment of the Project in accordance with Part IV of the EP Act are summarised in Table 4.

Table 4 Stakeholder Consultation Outcomes

Stakeholder	Status	Date	Method	Purpose	Outcome	Response
City of Greater Geraldton	Completed	21-Jan-2022	MS Teams Meeting	Proposed Project Scope	Concerns raised over re-use including - finer sand will wash away more quickly and cause windblown sand issues - nutrient content of sediment unknow for revegetation value - no need for additional sand for beach nourishment	MWPA elected to use material for land reclamation.
Community	Completed	15-Feb-2022	Website	General information	MWPA updated to provide early advice on planned dredging works and provide a portal for information storage.	
Fishing Boat Harbour Stakeholder Group. (Inc. representatives from Fishing Co Op, Commercial Lobster, Geraldton Professional Fathering Association)	Completed	22-Feb-2022	MS Teams Meeting/ Face-to-Face	Consult on proposed project scope and review risk to stakeholders	A number of apologies received. Attendance only by Fishing Co Op. Generally supportive of the project and proposed methodology. Key concern maintaining the quality of water at the live processing plan.	MWPA to ensure good communications maintained during the project. Follow up consultation to be undertake, to seek review of DEMP, to consult

						once dredging contractor is engaged and actual equipment/ method known.
MWPA Staff	Planned	TBC	News Letter	Initial notification to inform of the upcoming project.		
Community	Planned	07-Mar-2022	Social Media	Initial notification to inform the community of the upcoming project.		
City of Greater Geraldton	Planned	Prior to Beneficial Use-Assessment	Email with attached presentation	Consult to inform the selection of dredge material placement options and linkages to the Northern Beaches Stabilisation Programme.		
Department of Primary Industries and Regional Development – Fisheries – Geraldton Local Office	Planned	Prior to completion of Draft EIA/DEMP	Email with attached presentation & prior	To consult on the proposed project and discuss draft EIA		

			phone call			
Department of Biodiversity, Conservation and Attractions – Geraldton Local Office	Planned	Prior to advertising Draft DEMP	Email with attached presentation	To inform on the proposed project		
Department of Transport – Geraldton Local Office	Planned	Prior to advertising Draft DEMP	Email with attached presentation	To inform on the proposed project		
Department of Water and Environmental Regulation – Geraldton Local Office	Planned	Prior to advertising Draft DEMP	Email with attached presentation	To inform on the proposed project		
Northern Agricultural Catchments Council	Planned	TBC	Email with attached presentation	To inform on the proposed project		

Yamatji Southern Regional Corporation	Planned	TBC	Email with attached presentation	To inform on the proposed project - pass to Vickie		
Community	Planned	TBC	Website, email/social media	DEMP advertised for public comment on the MWPA website, with associated email/social media to inform community of opportunity to comment. 2-week public comment period.		
Community	Planned	TBC - commencement of dredging	Website, email/social media	To inform public of placed commencement of dredging		
Community	Planned	TBC - mid way	Website, email/social media	To inform public of project progress		
Community	Planned	TBC - completion of dredging	Website, email/social media	To inform public of completion of dredging		

3.2. Ongoing Stakeholder Consultation

MWPA has committed to further ongoing consultation with key stakeholders as the project progresses. One of the primary mechanisms for undertaking this consultation is through the MWPA's dedicated project webpage, targeted emails and social media posts will also provide project updates. MWPA meets regularly with several consultative committees such as:

MWPA Stakeholder Consultation Committee with representatives:

- City of Greater Geraldton;
- Geraldton Fishermen's Cooperative;
- Geraldton community members; and
- Local community groups and tourism organisations.

Port customers and work force:

- Berth Users and Customer meetings;
- Geraldton Fishing Boat Harbour Stakeholder Consultation Group; and
- MWPA Staff Consultative Committees.

Works are coordinated via the Harbour Master who disseminates marine notices to inform mariners of the program of works, exclusion zones and communication protocols.

4. Environmental Impact Assessment

4.1. Principles

A summary of how the EP Act principles (EPA 2021a) have been considered in relation to the Project is presented in Table 5.

Table 5 EP Act Principles

Principle	Consideration
1. The precautionary principle *Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.* *In application of this precautionary principle, decisions should be guided by:* a) *Careful evaluation to avoid, where practicable, serious or irreversible damage to the environment; and* b) *An assessment of the risk-weighted consequences of various options.*	A project specific risk assessment has been compiled by the Project Team to identify key risks, information gaps, monitoring and management requirements and to consider any appropriate alternatives to those aspects of the Project that posed the most significant environmental risks. The risk assessment was guided by current knowledge, previous lessons learned, and an understanding of environmental impacts gained from previous dredging and seabed levelling activities, typically using environmental data where available to reduce scientific uncertainty. Key changes made to the Project design to preserve the environment include: > Use of sand bypassing and seabed levelling to reduce sediment accretion; > Avoidance of offshore sea dumping of dredge material; > Workshopping all available dredge placement options to define placement with purpose options for beneficial use of dredge material; > Placement of all dredge material to purpose built land reclamation; > Identification of a key environmental window to avoid impacts to key receptors, such as seagrasses, whales and rock lobsters.
2. The principle of intergenerational equity *The present generation should ensure that the health, diversity and productivity of the environment is maintained and enhanced for the benefit of future generations.*	The Project will enable existing industry to continue whilst minimising potential environmental impacts for the required sediment removal. The Proponent considers that the Project is unlikely to result in any significant environmental impacts that would pose a threat to the health, diversity and productivity of the environment.
3. The principle of the conservation of biological diversity and ecological integrity *Conservation of biological diversity and ecological integrity should be a fundamental consideration.*	The potential impacts of the Project activities on the conservation of biological diversity and ecological integrity has been considered and discussed in relation to the following environmental factors: > Benthic Communities and Habitat (Section 4.3); > Marine Environmental Quality (Section 4.4);

	> Air Quality (Section 4.5) and > Other key factors (Section 4.5.6).
4. Principles relating to improved valuation, pricing and incentive mechanisms *i. Environmental factors should be included in the valuation of assets and services.* *ii. The polluter pays principles – those who generate pollution and waste should bear the cost of containment, avoidance and abatement.* iii. *The users of goods and services should pay prices based on the full life-cycle costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste.* iv. *Environmental goals, having been established, should be pursued in the most cost-effective way, by establishing incentive structure, including market mechanisms, which enable those best placed to maximise benefits and/or minimise costs to develop their own solution and responses to environmental problems.*	Environmental factors were considered in the Project design. The Project is not expected to generate any significant pollution or waste. Where possible, MWPA will: > Employ appropriately trained local personnel and source local goods and services; > Ensure leading best practice standards during construction to minimise emissions and discharges as far as reasonably possible; Where possible, source goods and services that have the least environmental impact.
5. The principle of waste minimisation *All reasonable and practicable measures should be taken to minimise the generation of waste and its discharge into the environment.*	The Project aims for 100% beneficial use for the Geraldton Port maintenance dredge material and to avoid treating the dredge material as a waste and dumping offshore with no net environmental or commercial benefits. Waste generated from the Project will be minimised through the implementation of the hierarchy of waste controls: reduce, re-use, recycle, recover and dispose.

4.2. Preliminary Key Environmental Factors

The preliminary key environmental factors for the Project were determined through application of previous understanding from similar, albeit larger, dredge programs, in particular the 2021 Maintenance Dredge Project. The preliminary key environmental factors are considered to be:

- Benthic Communities and Habitat;
- Marine Environmental Quality; and
- Air Quality.

These factors are addressed individually in Section 4.3, Section 4.4 and Section 4.5. Other relevant environmental factors are addressed in Section 4.4.6.

4.3. Benthic Communities and Habitat

4.3.1. EPA Objective

The EPA's objective for the factor 'Benthic Communities and Habitats' (BCH) is:

> *'To protect benthic communities and habitats so that biological diversity and ecological integrity are maintained.'*

4.3.2. Policy and Guidance

The following EPA policies and guidance have been considered in evaluating potential impacts on this factor:

- EPA (2016a). Environmental Factor Guideline: Benthic Communities and Habitats, EPA, Western Australia;
- EPA (2016b). Technical Guidance – Protection of Benthic Communities and Habitats, EPA, Western Australia; and
- EPA (2021b). Technical Guidance – Environmental Impact Assessment of Marine Dredging Proposals, EPA, Western Australia.

4.3.3. Receiving Environment

Studies of BCH that are relevant to the Project are identified in Table 6.

Table 6 Receiving Environment Studies – Benthic Communities and Habitat

Author (Date)	Study
Coupland (1997)	Rhizome and shoot structure, growth and response to sediment burial in *Amphibolis griffithii* (Black) den Hartog.
URS (2001a)	Marine Habitats of Champion Bay, Port Grey and Geelvink Channel
Mackey (2004)	Effects of Temporary PAR reduction on the seagrass *Amphibolis griffithii* (Black) den Hartog
Lavery *et. al* (2009)	Interactive effects of timing, intensity and duration of experimental shading on *Amphibolis griffithii.*
Lavery *et. al* (2019)	Defining thresholds and indicators of primary producer response to dredging-related pressures - Synthesis Report
AECOM (2020)	Benthic Habitat Mapping Report – Champion Bay and Surrounds
BMT (2021a)	Seagrass Communities in Champion Bay and Surroundings

4.3.3.1. Characteristics, Distribution and Condition of Benthic Habitat and Communities

Broad Scale Habitat Mapping – Champion Bay

Habitat mapping undertaken by AECOM (2020) identified that the benthic habitats of Champion Bay and the surrounding area can be broken down into a range of habitats, with the key feature of the Bay the limestone substrate which underlies most of the bay and surrounds. Limestone reef presence, relief or reef profile, and the depth of sand overlaying reef, are key factors which influence the epibenthic communities in the bay and surrounding areas. Exposure from prevailing south westerly swell and seas is also a key factor as they play a pivotal role in the movement and dispersal of sand within the bay. Deposition, erosion or frequent resuspension of sand due to wave and tidal water movement greatly influences what type of epibenthic communities colonise certain areas in the bay. Key distinctions can be seen in habitats with similar depths, topography and substrate slope but with varying levels of protection from swell and waves. AECOM described the following natural habitat types, and associated communities:

1. Deep water sand, No epibenthic macrobiota;
2. Deep water pavement with sand, Macroalgae dominant;
3. Deep water reef slope, Macroalgae;
4. High profile deep reef 1-4 m, Macroalgae dominant;

5. Sloping pavement with sand, Low density macroalgae and seagrass;
6. Pavement with sand, No macrobiota;
7. Pavement with sand, Low density seagrass;
8. Pavement with sand, High density seagrass;
9. Pavement with shallow sand, Seagrass dominant;
10. Pavement with sand, Macroalgae
11. Low profile reef with sand, Macroalgae and seagrass codominant;
12. Low profile reef with deep sand, Low density seagrass and macroalgae;
13. Low profile reef with sand, seagrass and macroalgae; and
14. High profile shallow reef 1-4 m, Macroalgae dominant.

A summary of the habitat mapping is described below. Please refer to AECOM (20210) for further details.

Deep Water Communities and Habitat (1-4)

The deep-water habitats typically occur west of a series of north south orientated limestone reef systems which run from Point Moore to the north of Champion Bay and continue on past Drummonds Point. These habitats occur where the low-profile reef with sand become the high-profile reef line which forms the western edge of Champion Bay and the deep-water offshore habitats of Geelvink Channel. The habitat is highly variable as it transitions from high profile macroalgae dominated reef in relatively shallow waters (8–12 m) to the deeper (>20 m) sand and sand covered pavement offshore habitats. The area is characterised by very high profile (> 4 m) reef walls and overhangs which give way to sloping pavement into deeper water. Epibenthic biota were also highly variable.

Benthic communities associated with low and high relief reef are macroalgal with common species such as red and brown algae (*Sargassum* and *Ecklonia*) with a conspicuous understory of *Amphibolis* and *Thalassodendron* seagrass. Interspersed amongst these floral assemblages are substantial patches of completely bare, heavily rippled deep sand. The deep-water reef slope benthic communities are highly variable with small red and brown algae, brown lobed algae, crustose coralline algae, and sporadic sponges and solitary hard corals including *Turbinaria*, *Faviids* and small *Acropora* species. Deep water pavement and sand habitats typically comprised no benthic communities or were dominated by *Sargassum* and *Ecklonia* some patches of low cover *Amphibolis* and *Thalassodendron*.

Limestone Pavement and Sand Communities and Habitats (5-10)

Limestone pavement, with overlying sand of varying depth which receives regular resuspension from swell waves and currents, comprise most of the habitat type in the eastern side of Champion Bay. It's characterised by gradually sloping sand veneered pavement and supports a mosaic of mixed assemblages of macroalgae and seagrass interspersed with equal areas of bare sand. The south-eastern corner of Champion Bay and directly north of the fishing boat harbour entrance is characterised by areas of stable sand generally overlaying pavement. The area receives some protection from swell waves and consequently supports large high-density seagrass meadows, typically dominated by *Halophila, Syringodium* and *Posidonia* with up to 90% coverage mapped.

The seabed in the central part of Champion Bay is the deepest continuous area in the bay forming a natural basin between the eastern nearshore area and the high-profile western reefs. The topography is relatively flat with no sloping in either direction. The area is predominantly sand covered substrate with seagrass meadows of mostly

moderate to dense (up to 70% cover) *Amphibolis* with *Halophila* and *Syringodium*. Low densities of small red and brown algae, *Ecklonia* and *Sargassum* also occur.

Several areas in shallow water fringing the fishing boat harbour, and north of the Northern Reclamation DMPA, consisted of deeper sand on pavement which supported little to no benthic communities. The area is often characterised by loose seagrass and macroalgal wrack. Two areas further seaward also featured sand across large areas with very little benthic communities.

Low density seagrass meadows on sand veneered pavement account for a large area directly north of the fishing boat harbour up to the start of the entrance channel. The 10 m isobath appeared to be the depth limit for seagrass dominance in this habitat. West of the fishing boat harbour a band of low-density meadows stretching from the 4 m isobath seaward to the start of the low-profile reef areas gradually curving south towards Point Moore. Substrate in the area was characterised by moderately deeper sand veneers on pavement with seagrass density ranging from 5% to 50% and dominated by *Halophila*. Smaller patches of low cover *Posidonia* and *Syringodium* were also observed.

Shallow Reef Communities and Habitats

Running along the south-eastern shoreline of the Bay from Sunset Beach southwards to just north of the marina, and extending out ~400 m from shore, is an area of dissected limestone shoreline platform with high relief at the offshore end. The habitat contains numerous holes and depressions and supports predominantly large *Ecklonia* and *Sargassum*, with occasional patches of high density *Amphibolis* and *Thalassodendron* seagrass.

North of the entrance channel, low profile reef with sand encompasses the transition between the central basin and the high-profile western reefs. Topographically, the area is predominantly moderate profile (0-1 m) with a gradual rise of approximately 2-4 m from the border of the central basin to the base of the high-profile western reefs. Macroalgae dominate the higher relief areas, while seagrass dominate the lower relief areas which also feature sand. Both biota groups were recorded at up to 50% cover with *Amphibolis* dominating the seagrass taxa and *Sargassum* with *Ecklonia* dominating the macroalgae.

The south-eastern corner of the Bay is characterised by a shallow nearshore area of low-profile reef consisting of rocks, cobbles and low-profile limestone outcrops, surrounded by areas of mostly bare sand. As the seabed becomes shallower towards the shoreline, progressively less limestone is exposed, and deep sand becomes more prominent. Reef areas support low density small algae, with areas of sand supporting low density *Posidonia* and *Halophila* seagrasses. The area also comprised areas of dense seagrass wrack on bare sand.

South of the entrance channel areas of undulating substrate comprising a mix of low-profile limestone rises interpreted with sandy patches and higher relief reef occur. Low-profile limestone predominantly comprises macroalgae, whilst sand inundated pockets support seagrass such as *Halophila* and *Posidonia*. Sections of higher relief support dense communities of small red and brown algae, *Ecklonia* and *Sargassum.* Notably, *Posidonia* is distinct to the southern areas as the northern low profile reef areas are dominated by *Amphibolis*.

Seagrass Condition

To determine the current baseline, or pre-dredging, seagrass health and condition, BMT (2021a) undertook a health investigation at key locations previously incorporated into Geraldton Port dredging programs (2002/2003 and 2012). BMT (2021a) collected data on six key seagrass health indicators across 14 sites within Champion Bay, along with sites at Greenough, Dongara and Jurien Bay to provide regional context. As many of these sites have

historical data a comparison with previous data to provide statistical assessment on the current health was completed.

Overall BMT (2021a) summarised that seagrass indicators, such as shoot density, shoot height, leaves per shoot/cluster and aboveground biomass measured at *A. antarctica* and *P. sinuosa* sites showed a relative increase compared to the historical dataset. BMT (2021a) also identified fluctuations within community composition and health over the years. It was identified that this had also occurred within the wider monitoring program and also worldwide. BMT (2021a) surmised that the dynamic nature of Champion Bay (strong waves and currents) are continuously responsible for redistributing sand within the Bay, which is responsible for both creating new, and destroying old BCH communities. It is also possible that global water temperature rise, and the marine heatwave from 2011 may have been responsible for community shifts observed during 2021. It is therefore reasonable to assume that a high level of natural variability occurs within Champion Bay BCH habitats, particularly for seagrasses.

4.3.3.2. Local Assessment Unit (LAU)

Section 4.2 of EPA (2016b) outlines the requirement to clearly define spatially based LAUs within which BCH can be quantified, assessed and presented. LAUs are required to be location specific, assessed on a case-by-case basis and consider local aspects of bathymetry, substrate type, exposure, currents, biological attributes such as habitat types. EPA (2016b) suggests that LAUs should typically be established in units approximately 50 km2. Applying this guidance for the Project scale the DoT defined secondary sediment cell for Point Moore to Glenfield (Stul *et. al.* 2014) is considered to represent a suitable boundary for the LAU related to this Project. Sediment cells define natural units with each cell encompassing adjoining marine and terrestrial environments, thereby providing a base for integrated coastal management in which the component of each cell is considered holistically as an interactive system.

Relevant aspects for application of the Point Moore to Glenfield Beach secondary sediment cell as an LAU considered are as follows:

- The spatial are of the sediment cell is 47.6 km^2;
- The spatial boundary extends for a similar distribution as the modelling domain and the habitat assessment work completed for this Project;
- 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;
- The sediment cell classification considered reef systems, substrate types, water circulation, wave exposure and currents occurring when defining the boundary;
- The boundary extends from Point Moore in the south to Drummonds Point in the north, defined at the western extent by the 15 m bathymetric contour and incorporates all of the shoreline, including Chapman Rivermouth.

The LAU is presented in Figure 13.

Figure 13 Spatial Local Assessment Unit boundary for the Geraldton Maintenance Dredging Project

4.3.3.3. Benthic Habitat Mapping

Based on data from AECOM (2020) and BMT (2021b), O2 Marine created a consolidated habit map for the LAU. The consolidated habitat map is presented in Figure 14. The areas of BCH which occur within the LAU are described in Table 8.

For the purposes of the habitat classification, the AECOM BCH descriptions have been assigned to categories in accordance with Table 7.

Table 7 Description categories used for this CLA as they relate to BCH descriptors from AECOM (2020)

CLA Category	Density	AECOM BCH Description
Bare Sand	NA	Deep water sand, No epibenthic macrobiota.
		Pavement with sand, No macrobiota.
Macroalgae	NA	Deep water pavement with sand, Macroalgae dominant.
		Deep water reef slope, Macroalgae.
		High profile deep reef 1-4 m, Macroalgae dominant.
		Pavement with sand, Macroalgae.
		High profile shallow reef 1-4 m, Macroalgae dominant.
Seagrass	High	Pavement with sand, High density seagrass.
	Medium	Pavement with shallow sand, Seagrass dominant.
	Low	Pavement with sand, Low density seagrass.
Mixed Assemblage – Seagrass and Macroalgae	NA	Sloping pavement with sand, Low density macroalgae and seagrass;
		Low profile reef with sand, Macroalgae and seagrass codominant
		Low profile reef with deep sand, Low density seagrass and macroalgae.
		Low profile reef with sand, seagrass and macroalgae.
Coral	NA	Seal Rocks Breakwater, Coral Habitat

Table 8 BCH area within the proposed LAU. Note percentages rounded to nearest whole figure.

CLA Category	Density	Area (% LAU)	Area (m^2)
Bare Sand	NA	3	1,281,294
Seagrass	Low density	3	1,586,982
	Medium Density	17	8,293,113
	High Density	6	3,061,551
Macroalgae	NA	33	15,555,526
Mixed Assemblage – Seagrass and Macroalgae	NA	33	15,878,474
Coral	NA	<1	3,628
Infrastructure (Dredge footprint, groynes, marina etc.)	NA	4	1,982,888

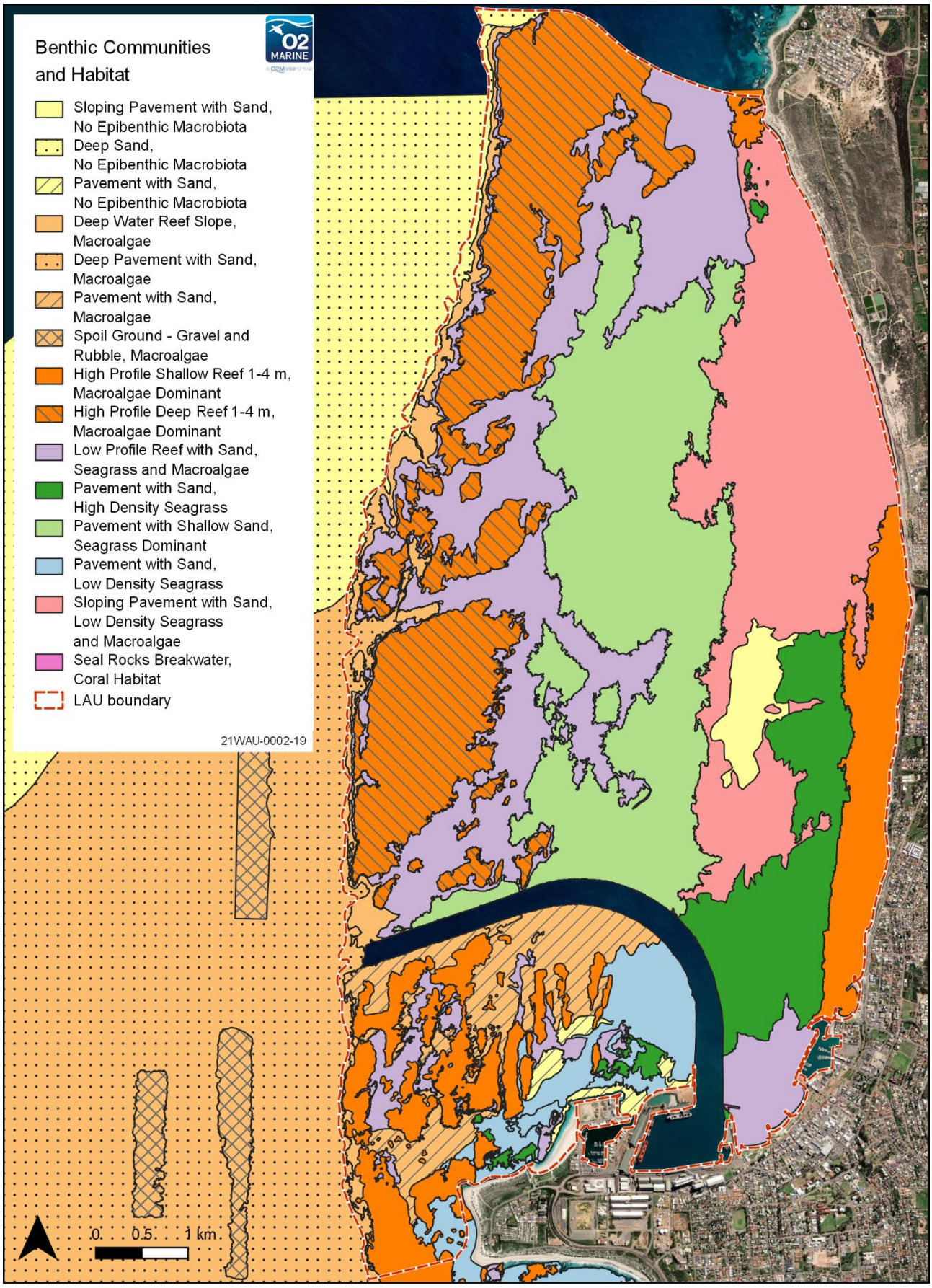

Figure 14 Champion Bay Habitat Map – source data AECOM (2020) and BMT (2021b)

4.3.3.4. Regional Significance and Conservation Status

The marine habitats mapped during 2020 are largely comparable to previous BCH mapping undertaken during technical studies during 2001 in preparation for the capital dredging project referred to the EPA. URS (2001a) identified no habitats or species that are confined in their distribution to the Champion Bay – Port Grey area, identifying their distributions occurring widely throughout the Central West Coast Region.

Whilst this is still the case, seagrasses, and to a lower extent macroalgae, are still widely considered as important habitats as the provide a variety of ecological functions. Lavery *et. al.* (2019) identifies seagrasses 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;
- 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. There are no particular areas, or species, of conservation significance occurring within the Project area.

4.3.3.5. Predicting Zones of Impact

Light Reduction Impact Studies

The 2002/2003 Geraldton Port Enhancement Project employed a cutter suction dredge technique to complete a channel deepening and widening activity to facilitate larger vessels. During this program the dredging activities produced a very high-density suspended sediment plume associated with the fines produced when cutting and grinding the underlying limestone pavement. This plume was highly persistent due to the very fine sediment particle sizes which were associated with extremely long settlement timeframes. Due to the density of the plume and the duration of the project, benthic light was significantly reduced over an extended time period resulting in an observed decline of seagrass health and distribution.

In response to observed post dredging impacts on seagrasses, a shading study was conducted on *A. griffithii* seagrasses in Jurien Bay, some 200 km south of Geraldton (Lavery *et. al* 2009). This study looked at the cumulative impacts from shading intensity (moderate shading [13-19% of ambient] and high shading [5-11% of ambient]), duration (three-, six- and nine-month periods) and timing (post-summer and post-winter). After each plot of seagrass was subjected to the associated shading and duration, health assessments were conducted through measuring and collecting a variety of seagrass health metrics to determine where sublethal and lethal impacts where observed.

Study results identified the greatest impacts related to timing, with greater impacts recorded from moderate shading after three-months during post-summer (57% loss leaf biomass and 67% reduction in rhizome

carbohydrates) compared to the same light reduction and duration during post-winter (no loss leaf biomass and 25% decline in rhizome carbohydrates).

In a separate, albeit similar study, Mackey (2004), looked at post shading recovery of *A. griffithii* at a similar study site in response to the 2002/2003 Geraldton Port dredge project. This study shaded plots of *A. griffithii* around 10% of ambient light over 106 days (~three months) during post-summer and then measured the physiological responses of recovery. As with the Lavery *et. al* (2009) post summer shading experiment, physiological and morphological changes were recorded. However, whilst this was the case after ~three months of high shading, post impact recovery for most variables measured occurred within 42 days.

Whilst these studies were focused on the high density total suspended solids (TSS) plume associated with the 2002/2003 Geraldton Dredge project, using longer term duration and very high levels of benthic light reduction (80-90%), they are considered applicable to the assessment of impacts related to this dredge Project as they are highly conservative. As previously described this dredge project is estimated to be up to four weeks in length with dredge material typically sand sized particles associated with very low levels of fines, therefore having short length settlement timeframes. Therefore, it is highly unlikely any impacts to seagrasses will occur as a result of this Project based on the short duration and predicted localised, moderate dredging plumes. Interpretation of hydrodynamic modelling undertaken by GEMMS (2021) for the 2021 maintenance dredging project predicted dredge plumes which were highly localised, very short in duration and of a low to moderate suspended sediment concentration (SSC). This was supported by quantitative and qualitative data from targeted TSS sampling and visual observations as reported by O2 Marine (2022b).

Therefore, based on the dredge scenario for this Project, along with experimental knowledge that during post winter *A. griffithii* can withstand high levels of shading for up to three months, it is not predicted that this Project will result in light reduction impacts typically associated with sub-lethal or lethal impacts. Therefore, for this project there are no predicted light reduction Zone of High or Moderate Impacts associated with dredge plume light reduction impacts.

4.3.4. Potential Impacts

During the operational phase of proposed dredging activities, the following activities and resulting impacts have the potential to adversely affect BCH adjacent to dredging and material placement activities:

1. Dredging and seabed levelling within the FBH harbour entrance have the potential to cause:
    a. Direct removal (irreversible loss) of subtidal BCH within the dredge footprint;
    b. Indirect potential impacts (recoverable impacts) on subtidal BCH from increased turbidity, reduced light, sedimentation.

4.3.4.1. Assessment of Impacts

Direct removal (irreversible loss) of subtidal BCH within the dredge footprint (1a)

Dredging and seabed levelling within the FBH entrance channel and adjacent Lives Beach has the potential to remove BCH from a footprint of 26,690 m^2. However, as this program is designed to remove sediments which have recently accumulated, they are not considered to represent any significant BCH as existing BCH has been smothered by the accreting sand. Furthermore, the current sand deposition area of Lives Beach has previously been mapped as bare sand (URS 2001a; AECOM 2020), which has been confirmed recently through visual observations by O2 Marine Scientist during sediment sampling where no observed habitat were recorded from

sample observations (O2 Marine 2020a). The channel entrance is also a highly disturbed environment being modified by land reclamation and constantly impacted by passing vessel traffic and is not considered to represent a significant BCH type.

Therefore, there is no predicted direct removal to existing BCH from this Project.

Indirect potential impacts (recoverable impacts) on subtidal BCH through increased turbidity, reduced light, sedimentation (1b)

Increased turbidity and TSS can impact BCH through smothering and reducing available benthic photosynthetic light required for photosynthesis. The nearest BCH has been mapped as 'Pavement with Sand; High Density Seagrass' and is located approximately 120 m from the closest section of the dredge footprint. Within the LAU this habitat type represents 6% or 3,061,551 m^2.

As aforementioned, there are not predicted to be any moderate or high zones of impact through light reduction from this dredge activity, excluding direct impacts within the dredge footprint (as discussed above). Light reduction investigations conducted during the 2020 and 2021 seabed levelling campaigns also identified no significant reduction in light availability as a result of seabed levelling (O2M 2020b and O2M 2021a).

Therefore, whilst there are known high density seagrasses occurring adjacent to the dredge area, these are not predicted to be impacted based on the following assumptions:

- Leading research suggests impacts during the winter period require three months of continuous shading to reduce up to 80-90% of ambient benthic light. The dredge plume is highly unlikely to reduce light intensity over 80% of ambient benthic light and the entire dredge project will only run for one month;
- Previous dredge projects (GPA 2012a and O2 Marine 2022b) have identified highly localised, short duration dredge plumes associated with dredging sandy material within the main shipping channel;
- No high or moderate zones of impact related to benthic light reduction were predicted during the larger dredging project conducted during 2021 (O2 Marine 2021a) therefore this smaller, shorter duration project is highly unlikely to result in lethal or sublethal impacts;
- Seagrasses are typically dormant during the winter period and are not known to be actively engaged in reproduction;
- Seabed levelling activities which are likely to result in more ground disturbance and occurred closer to the adjacent 'Pavement with Sand; High Density Seagrass' have not been identified to reduce available benthic light (O2 Marine 2020; O2 Marine 2022a);
- Several investigations have described the key seagrass species (*A. grifithii and A. antarctica*) as having multiple growth strategies allowing them to be highly resilient to disturbance (BMT 2021a, Coupland 1997, Lavery *et. al* 2009). These morphological and physiological growth strategies have evolved to allow these species to occur within a highly dynamic environment which experience naturally high disturbances, such as sedimentation loads and light reduction from swell and storm events, but also to anthropogenic disturbance such as reduced light from dredging;
- Studies undertaken post dredging in 2002/2003 identified sub-lethal impacts on seagrass communities from reduced light had occurred, however these communities were seen to recover over a five-year period. The dredging activities during 2002/2003 created a turbidity plume that was far denser and far greater in spatial and temporal duration than any predicted plumes associated with this Project.

When assessed against the naturally high levels of disturbance which occur from severe weather events within Champion Bay, the predicted impacts from dredge plumes associated with this Project are not anticipated to be markedly different from these natural winter storm events that these species are resilient to.

Therefore, given the likely predicted *recoverable impacts* and no *irrecoverable impacts* the proponent considers that the EPA Objective for BCH is met.

4.3.5. Mitigation

Despite the Project presenting a high uncertainty of impacts to BCH, mitigation measures proposed to minimise potential impacts on the environmental factor 'Benthic Communities and Habitats' are described in Table 9 and presented in accordance with the EPA's mitigation hierarchy (Avoid, Minimise, Rehabilitate[1]).

[1] Rehabilitation measures are excluded from Table 10 as these are not expected to be required to mitigate impacts to marine environmental quality.

Table 9 Mitigation measures to minimise impacts on Benthic Communities and Habitats

Potential Impact	Avoidance	Minimisation	Residual Impact
Direct removal during dredging (1a)	> Conduct dredging or seabed levelling in existing footprint only – no new extent.	> Management of dredge operations under the DEMP. > MWPA ongoing seagrass monitoring program.	No residual impacts predicted.
Reduced water clarity due to dredge plumes (1b)	> Hydrodynamic modelling for larger, longer 2021 maintenance dredging project predicted no zones of moderate or high impacts from dredge plume. > Light intensity investigations revealed no significant light reduction from previous seabed levelling. > Timing – dormancy of seagrass and no seeding > Sediment physical characteristics	> Marine habitat mapping. > MWPA ongoing seagrass monitoring program > DEMP: o Light monitoring. o 12 hour dredging operation to allow plume dispersion. o No dredge hopper overflow thus reducing dredge plumes.	No residual impacts predicted.

4.3.6. Predicted Environmental Protection Outcomes

The predicted EPOs of the Project include:

- No direct impacts or irreversible loss of BCH outside the dredge footprint;
- No indirect or irreversible loss of BCH from baseline conditions outside the dredge footprint;

The combined impact of the Project activities and the consequent outcomes are not considered to pose significant residual risks to the protection of BCH and therefore biological diversity and ecological integrity can be maintained. In respect of the proposed design and management of the Project, the Proponent considers that the EPA's objective for BCH has been met.

4.4. Marine Environmental Quality

4.4.1. EPA Objective

The EPA's objective for the factor 'Marine Environmental Quality' is:

> '*To maintain the quality of water, sediment and biota so that environmental values are protected*.'

4.4.2. Policy and Guidance

- EPA (2016c). Environmental Factor Guideline: Marine Environmental Quality, EPA, Western Australia; and
- EPA (2016d). Technical Guidance: Protecting the Quality of Western Australia's Marine Environment, EPA, Western Australia. EPA, Western Australia.

4.4.3. Receiving Environment

Studies of marine environmental quality that are relevant to the Project are identified in Table 10.

Table 10 Receiving Environment Studies – Marine Environmental Quality

Author (Date)	Study
MWPA Database	Marine Water Quality Sampling Results Database
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 Risk Assessment
O2 Marine (2020)	Light Monitoring – Fishing Boat Harbour 2020
Coffey (2021)	Acid Sulphate Soils Management Plan
O2 Marine (2022a)	Light Monitoring – Fishing Boat Harbour 2022
O2 Marine (2022b)	2021 Maintenance Dredge Water Quality Close Out Report
O2 Marine (2022c)	Geraldton Fishing Boat Harbour Preliminary Site Assessment – Sediment Quality

4.4.3.1. Environmental Quality Plan

An Environmental Quality Management Framework (EQMF) has not yet been formerly established for the Port of Geraldton or the wider Champion Bay marine waters. However, MWPA has been implementing a comprehensive Marine Water Quality Monitoring Program and as a prescribed premise is required to conduct annual Compliance Sediment Sampling in accordance with the Environmental Licence at the Port of Geraldton. These programs allow MWPA to monitor and manage potential impacts to marine environmental quality which may arise as a result of Port and FBH operations.

In addition, MWPA are currently developing an EQMF consistent with the EPA's Technical Guidance for Protecting the Quality of Western Australia's Marine Environment (EPA 2016d), which defines the Environmental Values (EVs), Environmental Quality Objectives (EQOs) and spatial Levels of Ecological Protection (LEP) that are appropriate to the Port of Geraldton and adjacent Champion Bay. These are defined in Table 11 and presented in Figure 15.

Table 11 Proposed Environmental Values and Environmental Quality Objectives applicable to the Port of Geraldton and surrounding waters

Environmental Values	Environmental Quality Objectives
Ecosystem Health	EQO1: Maintenance of ecosystem integrity. EQO1 can be split into four sub-objectives, being: Maximum, High, Moderate and Low Levels of Ecological Protection (LEPs). However, the following sub-objectives are applicable to the Project Area: > High LEP: Assigned to all marine waters outside of the moderate LEP, including Champion Bay; and > Moderate LEP: Assigned to a 250m buffer of the operational berths and the inner harbour of Geraldton Port, the Fishing Boat Harbour and Batavia Coastal Marina. LEPs are presented in Figure 15.
Fishing & Aquaculture	EQO2: Seafood (caught) is of a quality safe for human consumption. EQO3: Water quality is suitable for aquaculture purposes.
Recreation & Aesthetics	EQO4: Water quality is safe for primary contact recreation (e.g. swimming and diving). EQO5: Water quality is safe for secondary contact recreation (e.g. fishing and boating). EQO6: Aesthetic values of the marine environment are protected.
Cultural & Spiritual	EQO7: Cultural and spiritual values of the marine environment are protected.
Industrial Water Supply	EQO8: Water quality is suitable for industrial supply purposes.

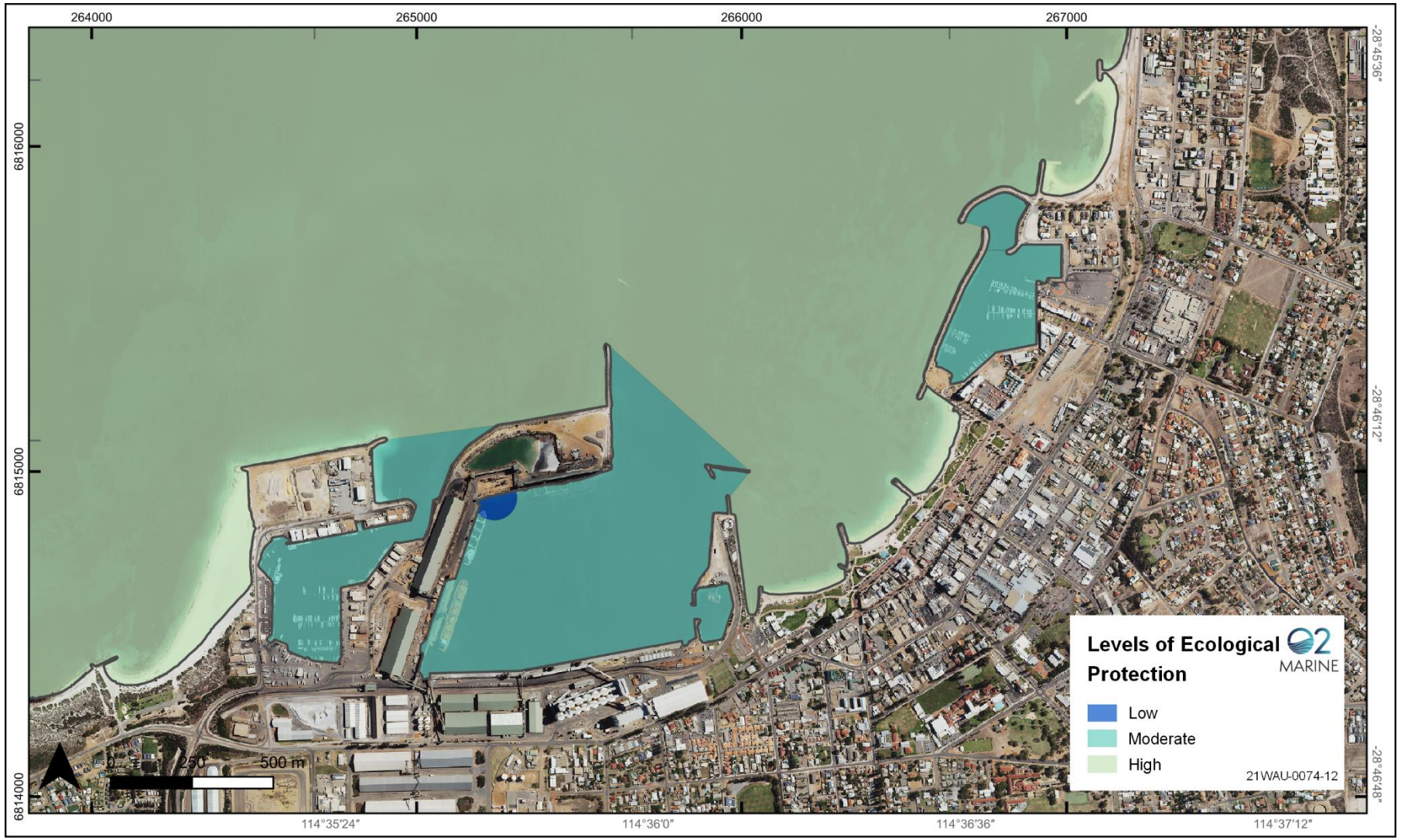

Figure 15 Proposed levels of ecological protection for the Port of Geraldton and surrounding waters including the Fishing Boat Harbour

4.4.3.2. Receiving Environment

Water Quality

Water clarity in Champion Bay is variable during the year as a result of wind driven current strengths and wave energy, as well as intermittent rainfall runoff in the catchments of the rivers, such as the Greenough and Chapman Rivers that drain the hinterland. Typically, the season of lowest water clarity is winter as a higher energy swells mobilising bottom sediments and due to this being the main time during which the intermittent discharge to the Bay of alluvial sediments from river discharge. In wet years, the Bay remains turbid for many months and salinity of nearshore waters slightly decreases as a result of river inflow. Strong winds in summer create waves that also cause an increase in suspended particulate matter which can also reduce water clarity. The period of greatest water clarity 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.

Turbidity within Champion Bay typically increases closer to shore, mostly as a consequence 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.

Limited data is available for the wider Champion Bay marine environment, though there are limited activities which are likely to result in any marine environmental impacts. Identified activities and their potential, temporary impacts may include:

- Aquaculture fish farming within Champion Bay may have a localised impact over short duration on water quality, such as minor nutrient loading[2].
- Shipping and tug movement within the entrance channel result in localised, short duration turbidity plumes on a regular basis.
- Commercial and recreation vessel activities may have minor, highly localised impacts on water quality from hydrocarbon spillages, rubbish or vessel anode deterioration.

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.

[2] It is noted that currently no aquaculture activities are presently occurring within designated Champion Bay Indian Ocean Fresh Aquaculture Leases

However, previous seabed levelling activities occurring at the FBH entrance and dredging activities of sediments from the Shipping Channel provide some indication of the light climate and toxicant concentrations for ambient conditions within Champion Bay. These are summarised below.

Light Climate

Two seabed levelling campaigns have been conducted; one during June 2020 (O2 Marine 2020) and the second during October/November 2021 (O2 Marine 2021a). Seabed levelling activities employed a custom designed underwater 'plough' which effectively drags accumulated sediments from the target area and re-deposits the sediment back into the natural longshore drift area where they re-enter the natural system. This involved removal of sediments accumulated in the entrance channel and Lives Beach with sediments being relocated approximately 250-300 m north/northeast. During these campaigns daily light integral (DLI), recorded as hourly Photosynthetically Active Radiation was measured at two sites including a nearby impact location at the nearest BCH receptor and another reference site located north of Point Moore. Both sampling campaigns identified no significant alteration to the light climate during dredging when statistically compared to pre and/or post seabed levelling periods. Doing the 2020 program DLI was calculated over a 48-day period with a maximum of 5.41 mol/m^2, a minimum of 0.50 mol/m^2 and an average of 3.41 mol/m^2 from the impact location adjacent to the FBH. During the 2022 program DLI was calculated over a 78-day period with a maximum of 5.72 mol/m^2, a minimum of 0.54 mol/m^2 and an average of 3.40 mol/m^2 at the impact site. The reference site reported a DLI maximum of 21.33 mol/m^2, a minimum of 1.79 mol/m^2 and an average of 13.61 mol/m^2.

Toxicant Concentrations

Previous dredging campaigns targeting accumulated sediments within the navigation channel have occurred during 2012 and 2022. Whilst these programs also targeted inner harbour sediments, only the water quality data collected at ambient reference sites is considered applicable for assessment of ambient conditions relevant to Champion Bay and therefore this Project. These are described further below.

2012 Maintenance Dredging

A water quality monitoring program was implemented by MWPA[3] (GPA 2013a) as part of the environmental management program developed for the 2012 maintenance dredging program. The program was typically identified to determine the water quality within the moderate ecological protection area (MEPA) (i.e. the inner harbour) and the high ecological protection area (HEPA) (i.e. Champion Bay). Only data from the HEPA is assessed herein.

The sampling program incorporated collection and laboratory analysis of dissolved metals, tributyltin (TBT) and polycyclic aromatic hydrocarbons (PAH). Sampling events included one round pre-dredging, two rounds during dredging and seven events post dredging.

A summary of the key sampling results is provided below.

- Pre-dredging:
  - Copper exceeded the 99% Species Protection Level (SPL) at six of seven sites in the HEPA;
  - PAH and TBT concentrations were all below the limits of reporting (LoRs).

[3] Then the Geraldton Port Authority

- During Dredging:
  - Copper and zinc exceeded the 99% SPL within the HEPA at several sites on both sampling rounds;
  - Silver (two sites) and nickel (one site) exceeded the 99% SPL on the second sample round only:
  - PAH and TBT concentrations were all below the LoRs.
- Post Dredging
  - TBT and PAH were not samples based upon no detection during or pre dredging;
  - Zinc and copper exceeded the 99% SPL at some sites during the first two rounds;
  - Silver exceeded the 99% SPL at one site during round two;
  - No exceedances occurred within the HEPA sites during rounds three to seven.

2022 Maintenance Dredging

A water quality monitoring program was implemented by O2 marine (O2 Marine 2022b) as part of the dredge environmental management plan (O2 Marine 2021) developed for the 2021 maintenance dredging program. The program was typically identified to determine the water quality within the low ecological protection area (LEPA) (north-western corner of inner harbour), MEPA (i.e. the inner harbour) and the HEPA (i.e. Champion Bay) as presented within Figure 15. Only data from the HEPA is assessed herein.

The sampling program incorporated collection and laboratory analysis of dissolved metals, TBTs, hydrocarbons nutrients and TSS. Sampling events included two rounds pre-dredging, five rounds during dredging and two events post dredging.

A summary of the key sampling results is provided below.

- Pre-dredging:
  - Copper exceeded the 99% SPL at the MEPA/HEPA boundary on both sample events;
  - Zinc exceeded the 99% SPL at all three sites on both sample events;
  - Hydrocarbons and TBT concentrations were all below the LoRs
  - Nutrients levels were typically low at all three sites;
  - TSS results were all reported below the LoR of 5 mg/L.
- During Dredging:
  - Copper exceeded the 99% SPL at all three sites on one sample event and at one site during two sample events;
  - Zinc exceeded the 99% SPL at all three sites during two sample events;
  - Hydrocarbons and TBT concentrations were all below the LoRs;
  - Nutrients levels were typically low at all three sites;
  - TSS ranged from below1 mg/L up to 4 mg/L.
- Post Dredging
  - Copper exceeded the 99% SPL at two sites during the first sample event and at all three sites during the second sample event;
  - Zinc exceeded the 99% SPL at two site on the first sample events and at no sites during the second sample event;
  - Hydrocarbons and TBT concentrations were all below the LoRs;
  - Nutrients levels were typically low at all three sites;

Sediment Quality

A desktop preliminary site investigation was conducted in accordance with National Assessment Guidelines for Dredging (NAGD) (DEWHA 2009) and the National Environmental Pollution (Assessment of Site Contamination) Measure (NEPM) (NEPC 2013), of historical sediment sampling programs undertaken within the FBH and adjacent areas together with a consideration of potential pollutant sources (O2 Marine 2022c). The desktop assessment identified a minimum of 12 sample locations required to satisfy the NAGD sample number requirement, with 50% requiring analytical assessment due to the sediments being catagorised as 'Probably Clean'. Based on the assessment of potential contaminants the target list of Contaminants of Potential Concern (CoPC) was identified as:

- Metals (Cu, Pb, Zn, Cr, Cd, Ni, Hg, As);
- TBTs;
- Hydrocarbons (TRH, PAH and BTEXN); and
- Nutrients (TN, TKN, NH4, NO2+NO3, TP and FRP).

The assessment identified three historical investigations conducted within the past five years which involved collection of suitable sediment samples within the proposed dredge footprint. Across these three investigations a total of seven sediment sampling locations, equating to 16 primary samples collected and analysed within the proposed dredge footprint. All sediment samples were analysed by National Association of Testing Authorities (NATA) accredited laboratories and field and analytical QA/QC protocols determined to be implemented in accordance with NAGD (2009).

Sediments were typically characterised as medium to fine grained, grey sediments of natural origins such as a combination of coastal silicate sands transported along the coast via localised northern longshore drift, or marine carbonate sediments transported from offshore sources via oceanic swell and the longshore current. Sediments were considered clean and contaminant free with no exceedances of applicable guideline values for sediment assessment (ANZG 2018). Physical properties and contaminants assessed across the site were low in vertical and horizontal spatial variability, indicating that accreted material has originated from the same natural source, whilst being continuously redistributed within the defined study area. Sediments were identified to contain nutrients from natural sources, such as seawrack, based on the presence of organic nitrogen and phosphorous. Inorganic nutrient forms were very low, barley being detected above laboratory levels except ammonia. The presence of ammonia indicates that a small proportion of organic nitrogen was being converted under anoxic conditions.

4.4.4. Potential Impacts

During the operational phase of proposed dredging activities, the following activities and resulting impacts have the potential to adversely affect marine environmental quality within the Port and surrounding waters:

1. Dredging and seabed levelling activities in the FBH entrance channel and Lives Beach have the potential to:
    a. Increase localised turbidity and suspended sediment concentrations; and
    b. Reduce water clarity and light over adjacent BCH areas.
2. Tail water discharge from the Berth 7 DMPA to the north-western corner of the inner harbour has the potential to:
    a. Result in localised increases in turbidity and suspended sediment concentrations;

b. Mobilise existing groundwater and soil contaminants to the marine environment;
c. Mobilise existing groundwater and soil nutrients into the marine environment.

3. There is potential for a hydrocarbon release into the marine environment from a vessel spill, refuelling pump skids, earthmoving equipment and or bunkering operations during dredging and reclamation operations.

Assessment of Impacts

Dredging and seabed levelling: Increased Localised Turbidity and Suspended Sediment Concentration (1a)

Dredging and seabed levelling operations are expected to result in highly localised increases to turbidity and TSS associated with the dredge plume. The potential impact on EQO1 for the EV '*Ecosystem Health*', is discussed and assessed in the context of the extent, duration and severity of the potential impact on BCH Section 4.3.

Localised Increases in turbidity may also have the potential to temporarily compromise EQO3 for the protection of the EV '*Fishing and Aquaculture*' at the Indian Ocean Fresh aquaculture sea-cages (located approximately 3,300 m from the FBH Dredge Area) and '*Industrial Water Supply*' at the Live Crays seawater intake (located just within the FBH at the Live Crays jetty facility). Early stakeholder engagement with both facility management identified:

- Indian Ocean Fresh are not anticipating to have any aquaculture stock in the Champion Bay Sea Cages during the August-September 2022 nominated dredge window (Bruce Starling pers.comms.); and
- Turbidity and SSC are considered a low risk to the Live Cray Processing operations based on the knowledge from previous dredging and seabed levelling campaigns as identified during stakeholder engagement and risk assessment workshops with Geraldton Fisherman's Cooperative (Section 3.1).

Furthermore, based on the highly localised and short duration turbidity plumes modelled (GEMMS 2021) and observed (O2 Marine 2022b) during the 2021 maintenance dredge project from channel dredging activities there are not anticipated to be any resultant dredge plumes extending as far as the Indian Ocean Fresh aquaculture sea-cages. The sampled TSS concentrations from the dredging locations also confirmed the dredge plume concentration were low to moderate, were highly localised and dissipated within approximately one hour post dredging (O2 Marine 2022b). TSS results were validated by aerial and visual observation for both the 2012 and 2021 maintenance dredge projects (GPA 2012; O2 Marine 2022b). There were also no reported impacts from Indian Ocean Fresh or the Live Cray Factory during the 2012 or 2022 dredge programs.

Further details regarding proposed monitoring and management to mitigate this risk are provided in Section 4.4.5 and the project's DEMP, currently under development.

Although a localised increase in turbidity and TSS within the dredge footprint are likely to result in a temporary reduction in marine environmental quality, it is not anticipated that the resulting potential impacts will be significant. Therefore, in consideration of potential impacts associated with turbidity and TSS, EQO1 for the EV '*Ecosystem Health*' and EQO3 for the protection of the EV '*Fishing and Aquaculture*' is unlikely to be impacted by the proposed dredge project.

Dredging: Reduced Water Clarity and Light (1b)

Reduction in water clarity and light as a result of increased turbidity and SSC, poses a risk to BCH and to a lesser degree, marine fauna. This potential impact on EQO1 for the EV '*Ecosystem Health*', is discussed and assessed in the context of the extent, duration and severity of the potential impact on BCH in Section 4.3.

Tail Water Discharge: Increased Turbidity and Suspended Sediment Concentration (2a)

Tailwater discharge from the Berth 7 DMPA has the potential to result in localised increases to turbidity and suspended sediment concentration (SSC) within the north-western corner of the inner harbour. To provide for an initial mixing area for tailwater release, a small LEPA has been established immediately adjacent to the release pipes (Figure 15). Increased turbidity and SSC typically reduce the available light in which benthic organisms require for photosynthetic activity. In this case the receiving environment, including the LEPA and MEPA is contained within a working harbour which is highly modified and subject to sporadic turbidity and SSC plumes from ship and tug propwash and regularly experiences low water clarity. There is not considered to be any BCH of ecological significance within the Port's inner harbour.

Furthermore, the 2012 and 2021 dredging projects identified turbidity plumes within the localised region of the outflow and typically confined to the LEPA with a small overflow and temporary reduction in MEQ within the adjoining MEPA. Sampling from the 2021 project identified TSS ranging between <1 mg/L up to 16 mg/L from surface samples collected adjacent to the tailwater discharge (O2 Marine 2022b). Turbidity measured adjacent to the LEPA/MEPA boundary were typically below 20 NTUs during harbour dredging and tailwater release from the centre of the water column which retuned to low levels immediately post dredging (O2 Marine 2022b). Therefore, it was considered that recorded turbidity was typically associated with dredging rather than tailwater release based on both visual observations and turbidity profiling conducted through the water column near the dredge vessel within the inner harbour and at the LEPA/MEPA boundary (O2 Marine 2022b). As the proposed Project is associated with lower volumes, larger sediment particle sizes (compared to inner harbour dredge sediments), short duration and not including 24-hour operations, the likely impacts from tailwater return on turbidity and SCC within the inner harbour are not anticipated to reach these same levels, particularly noting that inner harbour dredging activities were likely responsible for observed and measured plumes.

However, management actions have been identified to manage dredge tailwater to minimise the turbidity and release of suspended sediments to ensure that the HEPA is protected. These typically include:

- Dredge material discharge into Berth 7 DMPA to occur over 12-hour daily shifts only;
- Dredging can be ceased if visible plumes exceed the dredging plumes within the MEPA;
- Dredge material will be placed as far as practicable at the eastern end of the Berth 7 DMPA, which will aid in maximising residence times before discharge;
- A geotextile silt curtain will be installed on the inside of the return water outlet to further reduce turbidity in the released tailwater.

Using this combination of dredging and tailwater release management the level of resulting turbidity release back into the harbour is unlikely to result in plumes which are greater than standard everyday shipping prop wash plumes, and far lower than experienced during harbour dredging during 2012 and 2021. It is anticipated that tailwater release will only occur for a maximum of one month due to the lower volume of material requiring relocation. Therefore, any reduction in water quality within the LEPA and MEPA will be short in duration, and as observed from previous dredging campaigns, any resultant plumes from tailwater discharge likely to remain within the designated LEPA.

Further details regarding proposed management to mitigate this risk are provided in Section 4.4.5 and the project's DEMP, currently under development.

Although uncontrolled tail water discharge poses a moderate risk of increasing turbidity and SSC within the LEPA, the proposed monitoring and management strategies to mitigate this risk are considered sufficient to reduce the likelihood of the risk, such that no resulting potential impacts are predicted. Therefore, in consideration of potential impacts associated with associated with turbidity and SCC, EQO1 for the EV '*Ecosystem Health*' is unlikely to be impacted within the MEPA or HEPA as presented in Figure 15.

Tail Water Discharge: Mobilise existing groundwater and soil contaminants to the marine environment (2b)

Tailwater discharge from the land reclamation area has the potential to remobilise existing contaminants within the Berth 7 DMPA which may result in localised decrease in marine environmental quality within the MEPA or HEPA. To provide for an initial mixing area for tailwater release, a small LEPA has been established immediately adjacent to the release pipes (Figure 15).

The Preliminary Site Assessment undertaken by O2 Marine (2022a) identified concentrations of CoPC (i.e. total metals, hydrocarbons and TBTs) in the material to be dredged and relocated within the Berth 7 DMPA were below the relevant screening levels for both onshore and ocean disposal. These results indicate that onshore disposal and subsequent dewatering of this material is unlikely to result in adverse effects on marine environmental quality. The material is not considered to have any potential for acid sulfate soils therefore there is not considered to be any risk from soil acidification within the Berth 7 DMPA which could mobilise existing contaminants.

Furthermore, water quality monitoring undertaken during the 2012 and 2021 maintenance dredging programs identified only minor concentration increases of dissolved zinc and lead during dredging at sites adjacent to the tailwater return (GPA 2013; O2 Marine 2022b). No other metals, including copper, were identified above assigned screening levels, even though relocated sediments where know to contain heavy metal contaminants. Subsequent post dredge monitoring from both projects identified a return to a moderate level of ecological protection immediately post dredging. As there are no contaminants within the proposed FBH entrance and Lives Beach sediments they are not considered likely to represent any risk to the marine environment from tailwater release above the assigned levels of ecological protection (Figure 15).

Based on the outcome of preliminary site assessment and in consideration of previous monitoring and management implemented during larger inner harbour dredge programs, the risk of contaminant release to the marine environment through tail water discharge is considered to be very low. Therefore, in consideration of potential impacts associated with release of contaminants within tailwater, EQO1 for the EV '*Ecosystem Health*' is unlikely to be affected within the MEPA or HEPA as presented in Figure 15.

Tail Water Discharge: Mobilise existing groundwater and soil nutrients to the marine environment (2c)

Tailwater discharge from the land reclamation area has the potential to remobilise existing nutrients within the Berth 7 DMPA which may result in localised decrease in marine environmental quality within the MEPA or HEPA. To provide for an initial mixing area for tailwater release, a small LEPA has been established immediately adjacent to the release pipes (Figure 15). Nutrient enrichment has the potential to reduce water and sediment quality with possible secondary impacts to marine ecosystems and organisms.

Coffey (2017) identified an existing diffuse nutrient impact across the Northern Reclamation DMPA, typically present as nitrogen likely associated with organic material from previous dredged material and uncontrolled fill placement. Coffey identified the biological attenuation process as degradation of organic nitrogen containing compounds to ammonia, nitrification of ammonia to nitrate where oxygen is present in the tidally influenced

upper portion of the aquifer, and denitrification of nitrate at depth where reducing conditions are present in groundwater. Coffey defined a contribution of ~40 tonnes per/year of nitrogen into the commercial harbour being discharged as nitrate, with the bulk coming from the Berth 5 and 6 vicinity, with groundwater concentrations ranging from 1.1 to 11 µg/L. Both the estimated and measured nitrogen concentration were below the adopted criteria identifying no current impacts to Marine Environmental Quality within the inner harbour.

The preliminary site assessment undertaken by O2 Marine (2022c) identified nutrient concentrations typically occurring as organic nitrogen and phosphorous, with inorganic forms of nitrogen at very low concentrations. Sediments were identified to contain nutrients from natural sources, such as seawrack, based on the presence of organic nitrogen and phosphorous. Inorganic nutrient forms were very low, barley being detected above laboratory levels except ammonia. The presence of ammonia indicates that a small proportion of organic nitrogen was being converted under anoxic conditions. These nutrients concentrations are orders of magnitude lower than existing nutrient concentrations within the land reclamation area. As the current nutrients are not identified as having any current impacts on marine environmental quality (O2 Marine 2022b), it is very unlikely adverse effects on marine environmental quality will occur outside the LEPA.

Interaction between the tailwater and existing groundwater is also unlikely due to the differences in salinity and the short residence times that tailwater will remain within the cell. Therefore, the nutrients that are currently identified within groundwater within the cell are unlikely to interact with, or release nutrients into, the tailwater before it is released. Whilst there is identified groundwater nutrient contamination occurring within the cell, the placement of dredge material and tailwater release through the Northern Reclamation DMPA is not likely to result in any significant alteration of this groundwater regime and nutrient release. Limited interaction between tailwater and underlying groundwater is likely due to short residence times and any additional release of nutrients would likely be significantly diluted due to the dredge tailwater volumes and therefore any impacts would be considered short term and localised.

Therefore, in consideration of potential impacts associated with alteration of physicochemical parameters within tailwater, EQO1 for the EV '*Ecosystem Health*' is unlikely to be affected within the MEPA or HEPA as presented in Figure 15.

Vessel and Plant Operations: Potential Hydrocarbon Spill (3)

There is potential for a hydrocarbon release into the marine environment from a vessel spill and or bunkering operations during dredging. However, this risk is inherent in all dredging and port-based vessel operations and can be effectively managed through application of standard operating procedures. Nevertheless, the project specific DEMP includes proposed monitoring and management strategies to mitigate this risk.

4.4.5. Mitigation

Mitigation measures proposed to minimise potential impacts on the environmental factor 'Marine Environmental Quality' are described in Table 12 and presented in accordance with the EPA's mitigation hierarchy (Avoid, Minimise, Rehabilitate[4]).

[4] Rehabilitation measures are excluded as these are not expected to be required to mitigate impacts to marine environmental quality.

Table 12 Mitigation measures to minimise impacts on Marine Environmental Quality

Potential Impact	Avoidance	Minimisation	Residual Impact
Localised Turbidity increases from dredging (1a)	Impacts upon BCH assessed in Section 4.3		
	> No aquaculture stock contained within offshore sea-cages. > Stakeholder consultation to identify risks and management requirements (Section 3.1). > Interpretation of 2021 hydrodynamic modelling results and visual observations indicate extremely low likelihood of dredge plume extending to sea cages. > Interpretation of light investigations identifying no significant reduction in benthic light availability during 2020 and 2021 seabed levelling activities	> Dredge plumes identified to be highly localised and of short duration. > Ongoing consultation during dredging with aquaculture stakeholders (Section 3.2). > Turbidity and SSC identified as low risk to Live Cray processing facility (Section 3.1). > Daily visual observations and dredge management included within DEMP.	No residual impacts predicted.
Reduced water clarity due to dredge plumes (1b)	Assessed in Section 4.3		
Tailwater discharge resulting in increased turbidity (2a)	> Placement of material into land reclamation avoiding release into natural environment. > Sediments are typically fine-medium particle sand containing very low silt and mud fractions.	> The DEMP will contain the following management actions: o Dredge material relocated over 12-hour daily dredging activity period rather than 24-hour operations; o Dredge material will be placed as far as practicable from the release pipes to	No residual impacts predicted.

		maximise residence times before discharge; o The weir box will be manufactured to allow tailwater discharge to cease if/as required; o The weir box is to be located above HAT to increase the residence time of tailwater within the reclaim pond; and o Outflow pipes will be covered with geofabric to remove remaining fines.	
Tailwater discharge resulting in release of contaminants (2b)	> Preliminary site assessment conducted which identified non-contaminated marine sediments proposed for relocation.	> Review of larger 2012 and 2021 dredge marine quality monitoring programs identified minimal to no impacts from relocation of contaminated material and tailwater return, therefore highly unlikely non-contaminated material will pose a risk. > Material is not PASS so no predicted acidification causing remobilisation of dissolved contaminates predicted. > Tailwater discharge into a temporary LEPA for initial tailwater mixing located within the inner harbour to prevent any potential impacts to the MEPA/HEPA > Dredge material relocated over 12-hour daily dredging activity period rather than 24 hour operations.	No residual impacts predicted.

		> Seawater and groundwater identified to have minimal interaction based on 2021 dredge program and therefore very low risk of remobilising existing groundwater contamination.	
Tailwater discharge resulting in nutrient enrichment (2c)	> Preliminary site assessment conducted to determine risk posed from existing contaminants.	> Tailwater discharge into a temporary LEPA for initial tailwater mixing located within the inner harbour to prevent any potential impacts to the MEPA/HEPA > Dredge material relocated over 12-hour daily dredging activity period rather than 24-hour operations. > Review of larger 2021 dredge and tailwater release program identified no nutrient enrichment from existing (or dredge material) nutrients exiting reclaim into MEPA or HEPA therefore highly unlikely smaller shorter program will result in nutrient related impacts.	No residual impacts predicted.
Hydrocarbon Spills (Vessel and Plant Operations) (3)	> Follow all reasonable directions given by the harbour master to ensure vessel collisions are avoided. > Ensure all construction vessels are compliant with the International Maritime Organisation International Convention for the Prevention of Pollution from Ships (MARPOL).	> Supply and maintain adequate hydrocarbon spill kits on site and within immediate access during refuelling. > Implement procedures to maintain clean and tidy work areas, including the safe storage of all hydrocarbons and chemicals.	No residual impacts predicted.

	> Store all fuels, oils and lubricants on site to ensure that they do not pose a threat to the environment or the safety of staff and the public. > Follow the MWPA Procedural site requirements for all bunkering activities > Vessel Bunkering induction is required for persons involved in bunkering activities. > Inspect and maintain all construction vessels and equipment on a daily basis. > Maintain vessel speeds below 8 knots whilst within the construction zone, to limit the potential for vessel collisions. > Maintain an exclusion zone around the dredging activity to minimise the risk of non-project related vessels entering the area.	> Implement water quality monitoring during and post dredge in accordance with the DEMP.	

4.4.6. Predicted Environmental Protection Outcomes

The Project will result in the following predicted EPOs with respect to marine environmental quality:

- No residual impact on marine environmental quality as a result of the Project activities;

Based on these EPOs, and in consideration of the proposed monitoring and management strategies, the Project activities are not expected to pose any significant residual risks to maintaining the quality of water, sediment and biota and therefore the environmental values can be protected. In relation to the Project, the Proponent considers that the EPA's objective for marine environmental quality has been met.

4.5. Air Quality

4.5.1. EPA Objective

The EPA's objective for the factor 'Air Quality' is:

'*To maintain air quality and minimise emissions so that environmental values are protected*.'

4.5.2. Policy and Guidance

- EPA (2020). Environmental Factor Guideline: Air Quality, EPA, Western Australia; and
- DWER (2021a). EPA Licence L427/1982/15: Conditions 2.3 Fugitive Emissions and 3.2 Ambient Environmental Quality Monitoring

4.5.3. Receiving Environment

Studies and reports relevant to the air quality surrounding Geraldton Port are identified in Table 13.

Table 13 Receiving Environment Reports – Air Quality

Author (Date)	Study
MWPA (Various)	Quarterly Air Quality Reports Q3 2020/2021 Quarterly Air Quality Monitoring Report (Jan – Mar 21) Q4 2020/2021 Quarterly Air Quality Monitoring Report (Apr – Jun 21) Q1 2021/2022 Quarterly Air Quality Monitoring Report (Jul – Sep 21) Q2 2020/2021 Quarterly Air Quality Monitoring Report (Oct – Dec 21)
MWPA (2022)	Air Quality Monitoring Sampling and Analysis Plan
DWER (2022)	Online Air Quality Database https://www.der.wa.gov.au/your-environment/air/air-quality-data
DWER (2021b)	2020 Western Australian Air Monitoring Report

4.5.3.1. Air Quality Management and Monitoring Plans

MWPA's air quality management and monitoring programs are shaped by the conditions of its EPA Licence L427/1982/15 (DWER 2021a). Additionally, the MWPA have in place a Dust Management Plan which aims to identify, manage and reduce fugitive dust emissions from Port -related activities in an overall aim to improve air quality. The Port of Geraldton is situated on the northern side of the Point Moore Peninsular. The Berth 7 Reclamation Area is situated between the main shipping channel on the east and the entrance channel to FBH

on the west. The FBH is situated immediately to the west of the Commercial Harbour and is the centre of the regional aquaculture and commercial fishing fleet. The proximity to handling of bulk granular material makes the FBH a key sensitive receptor for fugitive dust emission from port operations.

During 2020 to 2022 MWPA has received an increased number of complaints from the FBH community with respect to particulate (dust) emissions. MWPA has an active Dust Working Group and dust action plan targeting a reduction in particulate matter <10 µm (PM10) and total suspended particulates (TSP) emissions.

4.5.3.2. Receiving Environment

Geraldton Port and the FBH are located within a coastal environment characterised by strong seasonal winds, sparse vegetation cover and industrial lands which are mostly sealed. Air emissions sources within this setting can be described as natural or operational as per the below examples. Operational sources also include port controlled and non-port controlled sources, including but not limited to:

- Natural dust source examples:
  - Windblow sea spray and salts;
  - Windblown beach sands; and
  - Natural dust storms or pollen.
- Operation dust source examples:
  - Fugitive dust from product handling;
  - Fugitive dust from truck and train unloading;
  - Windblown dust from unsealed lands (port and non-port controlled);
  - Vehicle and vessel exhaust emissions (port and non-port controlled);
  - Windblown dust from regional agricultural activities; and
  - Bushfires, and prescribed burning.

Air quality monitoring is undertaken by DWER at a number of regional and metropolitan locations within WA in accordance with the National Environment Protection (Ambient Air Quality) Measure (NEPM) DWER 2021b). Monitoring of PM10 and particulate matter <2.5 µm (PM2.5) in Geraldton has been undertaken by DWER since in 2005 and 2019, respectively. The Geraldton site was established in the mid-west of the state to monitor windblown crustal material and smoke from bushfires, prescribed burns, agricultural stubble burning and wood-fired home heaters.

24 hour averaged PM_{10} results reported for the Geraldton region for 2020 indicate a maximum of 445.6 µg/m^3 and an annual average of 20.9 µg/m^3 whilst for PM2.5 a 24 hour averaged maximum of 162.3 µg/m^3 and annual average of 8.0 µg/m^3 was reported (DWER 2021a). The NEPM for PM10 is 50 µg/m^3 for a 24-hour averaged period and 20 µg/m^3 annualised average, whilst for PM2.5 the NEPM is 25 µg/m^3 for a 24-hour averaged period and 8.0 µg/m^3 annualised average. Exceedances of the NEPM daily standards from PM2.5 and PM10 are believed to be a result of bushfires, hazard reduction burns and natural events such as windblown regional dust. DWER monitoring shows that elevated particle levels in Geraldton occur predominantly in the afternoons and generally during the drier summer months.

4.5.4. Potential Impacts

During the reclamation phase of proposed dredging activities, the following activities and resulting impacts have the potential to adversely affect air quality within the Port and surrounding community:

1. Earthworks associated with reclamation activities have the potential to create fugitive dust emissions from exposed batters or uncapped dredge material.

Assessment of Impacts

Fugitive dust emissions form land reclamation (1)

The highly exposed nature of the Berth 7 reclamation area creates a potential for windblown dust to be generated from dredged material placed above the water level of the reclamation area. Learnings from the 2021 Maintenance Dredging Operations were that easterly winds dry out and quickly remobilise finer dredge sediments.

The sediment quality as discuss in Section 4.4 indicates the dredge material is clean marine sediments with little to no toxicants present. The particle size distribution is generally larger than the material placed in the reclamation area during the 2021 Maintenance Dredge Program and should therefore be less susceptible to resuspension by prevailing winds.

Fugitive dust emissions are a potential risk during reclamation earthworks and pose a moderate risk of creating impacts to amenity within the FBH however the sediments physical and chemical characteristics mean they pose a very low risk to human health.

4.5.5. Mitigation

This risk of fugitive dust emissions is inherent in all earthmoving operations and can be effectively managed through application of standard operating procedures and capping newly place dredge material as soon as practicable. Nevertheless, the project specific DEMP includes proposed monitoring and management strategies to mitigate this risk.

Table 14 Mitigation measures to minimise impacts on Air Quality

Potential Impact	Avoidance	Minimisation	Residual Impact
Fugitive dust emissions from land reclamation	Impacts upon Public Amenity assessed in Section 4.3		
	> Moisture content of dredge material maintained until compacted and capped. > Stakeholder consultation to identify risks and management requirements (Section 3.1). > Capping material stockpiled on site prior to dredge material being pumped into reclamation area.	> Water cart available on site to maintain moisture content > Reclamation area capped with gravel as soon as practicable after placement of dredge material > Daily visual observations and reclamation management included within DEMP.	No residual impacts predicted.

4.5.6. Predicted Environmental Protection Outcomes

The Project will result in the following predicted EPOs with respect to air quality:

- No residual impact on air quality as a result of the Project activities.

Based on these EPOs, and in consideration of the proposed monitoring and management strategies, the Project activities are not expected to pose any significant residual risks to maintaining ambient air quality and therefore the environmental values can be protected. In relation to the Project, the Proponent considers that the EPA's objective for air quality has been met.

5. Other Environmental Factors

In addition, to those key environmental factors identified in Section 4, nine other relevant environmental factors were also identified. However, due to their being either no risk, or a very low risk of environmental impact on these factors, and in consideration of the mitigation measures that the Proponent proposes to implement to manage any impacts, these factors are not expected to be required for assessment by the EPA. These other environmental factors are presented in Table 15 and included:

- Flora and Vegetation;
- Coastal Processes;
- Landforms;
- Terrestrial Environmental Quality;
- Inland Water Environmental Quality;
- Hydrological Processes;
- Marine Fauna;
- Terrestrial Fauna; and
- Social Surroundings.

Table 15 Other Environmental Factors and Potential Impacts of the Proposed Dredge Project

Environmental Factor	Receiving Environment	Project Activities	Management, Monitoring & Mitigation	Impacts
Marine Fauna	O2 Marine (2021b) conducted a desktop assessment search of the online EPBC Act Protected Matters Search Tool. The desktop assessment revealed that a number of threatened or migratory marine species may occur within the vicinity of the Geraldton Port channel. The main species identified include: > Australian sea lion (*Neophoca cinerea*); > Humpback whale (*Megaptera novaeangliae*); > Indo-Pacific bottlenose dolphin (*Tursiops aduncus*); and > Western rock lobster (*Panulirus cygnus*). Geraldton is home to a small, non-breeding (male) colony of Australian sea lions (*Neophoca cinerea*). Approximately 17 to 20 mainly sub-adult males and the occasional female are known to use the breakwaters of the Port as haul-out sites. The sea lion is native to Western Australia and is listed in Schedule 4 of the WA Wildlife Conservation (Specially Protected Fauna) Notice 1998. Humpback whales (*Megaptera novaeangliae*) are found in the Geraldton area between late-May to early-December with the peak of the southern migration occurring in September to November. The humpback whale is a listed threatened migratory species (Vulnerable) under the Environmental Protection and Biodiversity Conservation (EPBC) Act 1999 and is listed as rare or likely to become extinct under the Wildlife Conservation Act 1950. Western rock lobsters occur widely along the mid-west coastline. Juveniles are observed closer along the shoreline and within the protection of bays, such as Champion Bay and use seagrass area and shallow rocky reef areas for foraging and protection. The Geraldton region supports one of the largest commercial and recreation rock lobster fisheries in Australia, although the range is wide and extends far greater than Champion Bay. The Indo-Pacific bottlenose dolphin (*Tursiops aduncus*) is likely to occur in the area though is considered a key species. It has a low	> Dredging of the FBH entrance channel and Lives Beach. > Tailwater release from the Berth 7 DMPA	> Dredge crew trained in Marine fauna observation. > DEMP, including: • Marine fauna exclusion zones. • MFO recording and reporting of marine fauna observations, injury or death. > Marine fauna desktop assessment completed. > April/May identified as low environmental risk as it avoids key periods such as: Whale migration and rock lobster migration from nearshore reefs to deeper waters (walk of the whites).	Meets EPA Objective Although there are identified marine fauna within the Project area the activities posed to these are typically low risk. Previous dredge projects (2002/2003, 2012 and 2021) did not report any impacts, and with adequate management proposed there are no anticipated impacts to Marine Fauna from this Project.

Environmental Factor	Receiving Environment	Project Activities	Management, Monitoring & Mitigation	Impacts
	conservation status level and is not listed under the EPBC or BC Act. However, it is listed as near threatened according to the IUCN Red List. They occur over a very wide region and are regularly seen within Champion Bay and surrounding waters.			
Flora & Vegetation	There is no significant flora or vegetation within the proposed Project area.	> NA	> NA	Meets EPA Objective
Landforms	No significant landforms occur within the dredge envelope.	> NA	> NA	Meets EPA Objective
Terrestrial Fauna	The Project area only contains the Bert 7 Reclaim area. This is an industrial area and does not contain any significant terrestrial fauna.	> NA	> NA	Meets EPA Objective
Terrestrial Environmental Quality	The onshore land reclamation area is the only terrestrial component of the dredge Project. The existing land reclamation area consist of dredge material from the 2002/2003 and 2012 maintenance dredge projects. A detailed site investigation (DSI) has been conducted by MWPA, of which the land reclamation area was included. The DSI identified numerous contaminants of concern (CoPC) occurring at the site and undertook a detailed sampling program targeting soil groundwater and surface across the site. The main CoPCs confirmed were metals, typically coper and zinc, and nutrients which exceeded the designated trigger levels. Further studies investigated the groundwater to marine water flux and determined that the export of metals or nutrients into the marine environmental was not sufficient to result in any impacts to Marine Environmental Quality.	> Placement of up to 40,000 m^3 of non-contaminated material into the land reclamation area.	> Preliminary site assessment conducted to assess sediments in accordance with industry guidance. > DEMP > Industrial land use zoning at the land reclamation area	Meets EPA Objective The placement of material at the existing land reclamation area is not expected to alter the existing profile of that area as identified within the DSI. The land is designated for future industrial use, commensurate with the placement of clean natural sediments from the proposed dredge area. Tailwater release and the groundwater/marine water interface and impacts to MEQ are assessed under the Factor Marine Environmental Quality.

Environmental Factor	Receiving Environment	Project Activities	Management, Monitoring & Mitigation	Impacts
Hydrological Processes	There are no wetlands or watercourses within the Project footprint & surface water flows are limited to natural stormwater and tidal interface through the existing pipelines.	> NA	> NA	Meets EPA Objective
Inland Waters Environmental Quality	There are no inland waters within the Project footprint.	> NA	NA	Meets EPA Objective
Social Surroundings	Cultural Heritage European: There are no significant European sites located within the Project area. Aboriginal: Two registered Aboriginal Heritage Sites are recorded in the Aboriginal Heritage Inquiry System (AHIS) as being in the vicinity of the Project area. These include site ID 5561 Chapman River Mouth and 5874 Bluff Point Midden. Based on their distance from the FBH dredge project they are not considered at risk from operations. Shipwrecks There are 18 Shipwrecks identified on the WA Museum Shipwrecks database that are located off the coast of Geraldton with eight occurring within Champion Bay. Shipwrecks in State Waters are protected under the MA Act. The exact location of many of these shipwreck sites is unknown. None are identified within the proposed dredge footprint. Vessel Traffic Port waters are utilised already by both commercial & recreational vessels.	> Disturbance of a shipwreck. > Disturbance of an aboriginal heritage site. > Disturbance of public amenity (i.e. mixed-use wharf zone). > Increased vessel traffic & maritime safety.	> DEMP > Timing to avoid key recreation boating times > Consultation undertaken with Fishing Boat Harbour Consultation Committee > Multibeam surveys of the dredge footprint.	Meets EPA Objective No known shipwrecks of significance in the Project footprint. Multibeam survey completed within dredge footprint identified no possible shipwrecks in area. Aboriginal heritage not considered at risk due to distance and location away from project site. Vessel traffic limited to only one additional vessel in Project area which is speed restricted
Coastal Processes	Champion Bay is a semi-sheltered embayment protected from raw ocean swell conditions by a series of shallow subtidal reef	> Removal of natural sediments from the Point	> Sediments are being relocated from an existing modified coastal	Meets EPA Objective

Environmental Factor	Receiving Environment	Project Activities	Management, Monitoring & Mitigation	Impacts
	systems extending off Point Moore and a deeper parallel limestone ridge which runs north towards Drummond Cove. East of the limestone ridge, water depths up to approximately 11 m occur within two kilometres of the coast. To the west of the limestone ridge, water depths rapidly increase to 20-30 m, and then gradually deepen to 50 m before shallowing again at the Houtman Abrolhos Islands located some 50 km offshore. To the north and south of Point Moore, the coast is comprised primarily of sandy beaches generally overlying beach rock. Occasional areas of shallow beach rock and limestone platform are exposed at locations such as at Drummond Cove, Bluff Point, Point Moore and adjacent to the mouth of the Greenough River. Two main rivers, the Greenough River (~10 km south of Point Moore), and Chapman River (~5 km north of Point Moore), periodically discharge into coastal waters in the Geraldton area. These rivers are typically closed at the river mouth discharging only after significant rain falls within the two catchments.	Moore to Glenfield secondary sediment cell	embayment surrounded by rock armour and reclamation	Removal of up to 40,000 m3 of sediments is not predicted to have any impacts on the coastal process which occur within the Point Moore to Glenfield secondary sediment cell or result in coastal erosion.

6. Holistic Impact Assessment

Overall actual and potential impacts of the Project on the environment are not considered to represent a significant environmental risk on the basis that:

- The EP Act principles and relevant Environmental Protection Authority (EPA) guidance documents have been considered in investigating and evaluating potential impacts of the Project on the EPA's environmental factors;
- A comprehensive set of monitoring and management measures have been developed to further mitigate potential impacts of the Project on the EPA's environmental factors;
- The proponent has committed to open and transparent reporting of environmental performance throughout the Project;
- Evaluation of impacts against all relevant environmental factors, including other environmental factors determined that the EPA's objectives were considered to be met. Specifically, for the key environmental factors the following outcomes were predicted:
  - Marine Environmental Quality –
    - Low Ecological Protection Area (LEPA) maintained adjacent to tailwater release returned to a Moderate Ecological Protection Area (MEPA) within one month.
    - A temporary, localised reduction in Marine Environmental Quality during dredging in the immediate vicinity of the dredge footprint.
    - Manage vessel bunkering, chemical storage and spill response to ensure no adverse impacts to the marine environment.
  - Benthic Communities and Habitat:
    - No irreversible loss, or serious damage outside the dredge footprint.
    - No detectible reduction from the baseline state of benthic communities outside the dredge footprint.
- Evaluation of impacts against Matter of National Environmental Significance determined that there are no predicted impacts.

Based on the outcomes of this EIA, it is recommended that MWPA implement a Dredge Environmental Management Plan (DEMP) to ensure all potential impacts are managed in accordance with this EIA to ensure predicted impacts achieved. Through the implementation of the recommended DEMP, this assessment identifies that the associated risks from the project are considered adequately minimised and avoided where possible. The implementation of the Project in accordance with the recommendations is therefore assessed as not resulting in 'Significant Environmental Impact' and does not trigger the requirement for referral under Part IV of the EP Act 1986.

It is therefore recommended that MWPA undertake a comprehensive risk assessment for the project, continue to consult with and engage relevant stakeholders and implement the management and monitoring programs stipulated within the DEMP accordingly.

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