



**Gladstone Ports
Corporation**

Growth, prosperity, community.

Long-term Maintenance Dredging Management Plan for the **Port of Rockhampton**

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List of abbreviations and acronyms (nomenclature)	
ADA	Aquaculture Development Area
CEO	Chief Executive Officer
CPM Act	QLD <i>Coastal Protection and Management Act 1995</i>
Coastal CRC	Cooperative Research Centre for Coastal Zone, Estuary and Waterway Management
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DEHP	QLD Department of Environment and Heritage Protection
DES	QLD Department of Environment and Science
DIWA	Directory of Important Wetlands in Australia
DNPSR	Department of National Parks, Sport and Racing
DSITI	QLD Department of Science, Information Technology and Innovation
EA	Environmental Authority
EEZ	Exclusive Economic Zone
EGM	Executive General Manager
EGM MO	Executive General Manager Marine Operations
EGM SESG	Executive General Manager Safety and Environment, Social and Governance
EIS	Environmental Impact Study
ELT	Executive Leadership Team
EMP	Environmental Management Plan
EMS	Environmental Management System
Environmental MP	Environmental Monitoring Procedure
EP Act	QLD <i>Environmental Protection Act 1994</i>
EPBC Act	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>
EPP Water and Wetland Biodiversity	QLD <i>Environment Protection Policy (Water and Wetland Biodiversity) 2019</i> (EPP Water and Wetland Biodiversity)
ERA16	Environmentally Relevant Activity for Extraction and Screening
EV	Environmental Value

List of abbreviations and acronyms (nomenclature)	
FHA	Fish Habitat Area
FPRH	Fitzroy Partnership for River Health
GBR	Great Barrier Reef
GBR Coast MP	Great Barrier Reef Coast Marine Park
GBRMP	Great Barrier Reef Marine Park
GBRWHA	Great Barrier Reef World Heritage Area
GHG	Greenhouse Gas
GOC	Government Owned Corporation
GPC	Gladstone Ports Corporation Limited
GPS	Global Positioning System
Greentape Reduction Act	<i>QLD Environmental Protection (Greentape Reduction) and Other Legislation Amendment Act 2012</i>
ILUA	Indigenous Land Use Agreement
IMO	International Maritime Organization
IMP	Introduced Marine Pests
LMDMP	Long-term Maintenance Dredging Management Plan
LMDMP Guidelines	QLD Government's Guidelines for LMDMPs
LOA	Length Overall
London Protocol	<i>1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972</i>
LTMMP	Long Term Monitoring and Management Plan
MDS	Maintenance Dredging Strategy for GBRWHA Ports
MDS Framework	Long-term Maintenance Dredging Management Framework
MNES	Matters of National Environmental Significance
MO	Marine Operations
MRA	Material Relocation Area (formerly spoil ground)
MSES	Matters of State Environmental Significance
MSQ	Maritime Safety Queensland
NAGD	National Assessment Guidelines for Dredging 2009

List of abbreviations and acronyms (nomenclature)	
NGO	Non-Government Organisation
NIMPIS	National Introduced Marine Pest Information System
OUV	Outstanding Universal Value
PAH	Polycyclic Aromatic Hydrocarbon
PAST	Port Alma Shipping Terminal
PBPL	Port of Brisbane Propriety Limited
PCIMP	Port Curtis Integrated Monitoring Program
QA	Quality Assurance
QC	Quality Control
QLD	Queensland
QPA	Queensland Ports Association
Reef 2050 Plan	Reef 2050 Long-Term Sustainability Plan
SAP	Sediment Analysis Plan
Sea Dumping Act	Commonwealth <i>Environment Protection (Sea Dumping) Act 1981</i>
SESG	Safety and Environment, Social and Governance
SPD Act	QLD <i>Sustainable Ports Development Act 2015</i>
SPL	Strategic Port Land
SQG	Sediment Quality Guidelines
SSM Project	Sustainable Sediment Management Project
TACC	Technical Advisory and Consultative Committee
TI Act	QLD <i>Transport Infrastructure Act 1994</i>
TMR	QLD Department of Transport and Main Roads
TOC	Total Organic Carbon
ToR	Terms of Reference
TSHD	Trailing Suction Hopper Dredger
TSS	Total Suspended Solids
TUMRA	Traditional Use of Marine Resources Agreement
WQA	Water Quality Action
WQOs	Water Quality Objectives

1. Introduction

Gladstone Ports Corporation (GPC) was formed in 1914, and since inception has been an integral part of the Gladstone community, as well as the epicentre of economic growth for Queensland.

GPC is a Company Government Owned Corporation (GOC), responsible for the import of raw material and the export of finished product associated with major industries in the Central Queensland region.

GPC is the gateway for Australian trade, jobs and prosperity. Our portfolio of assets stretches across key regional locations including Gladstone, Rockhampton and Bundaberg. As a non-trading Port, GPC undertakes limited responsibilities associated with managing the Port of Maryborough. GPC's mission is to responsibly manage, develop and facilitate the prosperity of others through operating our port facilities and services in an economically, environmentally and socially sustainable manner. In consultation with the community, industry and government, GPC undertakes a strategic approach to planning, and setting the vision and direction for all four (4) Ports for the short and long term.

As the Authority for the Port of Rockhampton, GPC's roles include:

- Facilitating appropriate levels of port security and safety with terminal operators
- Planning, developing and operating intergenerational assets to support trade and the local, state and national populace
- Managing tenants
- Coordinating and assisting in emergency response
- Protecting the environment by minimising impact of development and
- Being committed to, and having regard for the interests of the community.

GPC is also responsible for providing and maintaining navigable port depths and pilotage. Channels naturally shallow over time due to siltation and sediment transport processes. Maintenance dredging involves the removal of these sediments that have built up in existing channels to maintain designated channel depths to ensure the continued efficient passage of vessels utilising the Port (TMR 2016).

Most ports cannot sustainably function without maintenance dredging. Maintaining navigation depths is critical for the ongoing operation of our ports and to facilitate export of Queensland's (QLD's) agricultural, pastoral and mineral commodities. In addition, a range of goods on which communities rely including household goods, manufactured products, vehicles, machinery and fuel are all reliant on maintained shipping channels (TMR 2016).

This Long-term Maintenance Dredging Management Plan (LMDMP) is an integral component in GPC's commitment to create and sustain positive Environmental, Social and Governance (ESG) structures and places great value on our natural harbour and channel assets.

1.1 Objectives and Purpose

The aim of the QLD Maintenance Dredging Strategy (MDS) is to provide a standardised framework for sustainable, leading practice management of maintenance dredging at ports in the Great Barrier Reef World Heritage Area (GBRWHA) (TMR 2016). The objective of the framework is to ensure the ongoing protection of the Outstanding Universal Values (OUVs) of the Great Barrier Reef (GBR) and the continued operating efficiency of ports within the GBRWHA. This Long-term Maintenance Dredging Management Plan (LMDMP) for the Port of Rockhampton has been developed in accordance with the MDS framework (Section 1.5, **Figure 1**).

A LMDMP is a plan used by individual ports, developed in a transparent manner, and aimed at creating a framework for continual improvement (TMR 2018). A LMDMP is a plan to ensure a robust and predictable long-term approach to planning, consultation, monitoring and reporting of maintenance dredging activities. The purpose of this LMDMP is to address operational needs, environmental risks, and monitoring and adaptive management actions specific to the Port of Rockhampton. The objective of this plan is to ensure the ongoing sustainability of maintenance dredging at the Port of Rockhampton by improving whole of system understanding, the certainty of environmental outcomes and stakeholder confidence (TMR 2018).

1.2 Scope

This LMDMP is relevant to all planned and potential maintenance dredging activities undertaken by GPC within the limits of the Port of Rockhampton. This includes both the loading and placement elements of maintenance dredging activities.

Maintenance dredging of the main navigational infrastructure at the Port of Rockhampton is undertaken infrequently. It has been undertaken in 2000, 2009, and most recently in 2011, with an average campaign of 28,000 m³. The estimated average future maintenance dredging volume per campaign for the Port of Rockhampton is 30,000 m³ with a predicted frequency of five (5) years (Haskoning Australia 2016), however the frequency may be longer as no channel maintenance has been required in the past five (5) years.

This LMDMP has been developed to satisfy the QLD Government's Guidelines for LMDMPs (LMDMP Guidelines) (TMR 2018) and the Commonwealth of Australia Guidelines for developing Long Term Monitoring and Management Plan (Commonwealth of Australia 2012b). This LMDMP seeks to look beyond the immediate future with a focus of 10 or more years with a continual improvement process as opportunities present, nested within a minimum five (5) year review framework (Section 1.3).

1.3 Review

To facilitate the continual improvement of maintenance dredging practices that maintain and promote ecosystem health and resilience, QLD ports must review their LMDMPs at least every five (5) years, and where necessary make revisions to their LMDMPs to ensure they reflect the most up to date understanding of risk, sedimentation processes, options available for sediment management including re-use or relocation, and the management of any potential impacts from maintenance dredging. Reviews should consider the question of whether the outcomes of managing maintenance dredging activities are consistent with the objectives detailed in the LMDMPs.

In line with the MDS Framework (TMR 2016), GPC's maintenance dredging activities will be reviewed to ensure that they remain consistent with leading practice management. This framework contributes to the ongoing protection of the GBRWHA and the continued operating efficiency of the Port of Rockhampton. Table 1 provides a summary of the review and improvement mechanisms that will be implemented under this LMDMP. Five (5) yearly reviews will include engagement with interested stakeholders (Section 1.7.3) as well as the identified Technical Advisory Consultative Committee (TACC) stakeholders, for the Port of Rockhampton. (Section 1.7.2). GPC's continual improvement framework will also ensure that feedback received within the five (5) year time frame are considered and actioned as appropriate.

Table 1. Review and Continual Improvement Summary

Document	Review context	Interval	Key drivers
LMDMP	<p>To ensure the LMDMP reflects the most up to date understanding of risk, sedimentation processes, options available for sediment management including re-use or placement, and the management of the impacts of maintenance dredging.</p> <p>Reviews should consider the question of whether the outcomes (of managing maintenance dredging and placement impacts) are consistent with the objectives detailed in the LMDMPs.</p>	Every five (5) years or as required	<p>Maintenance Dredging Strategy for Great Barrier Reef World Heritage Area Ports (TMR 2016)</p> <p>Environmental Code of Practice for Dredging and Dredged Material Management (Ports Australia 2016)</p> <p>Guidelines for Long-term Maintenance Dredging Management Plans (TMR 2018)</p> <p>Checklist for Completing Long Term Monitoring and Management Plans for Dredging (Commonwealth of Australia 2012a)</p> <p>Long Term Monitoring and Management Plan Requirements for 10 year Permits to Dump Maintenance Dredge Material at Sea (Commonwealth of Australia 2012b)</p> <p>National Assessment Guidelines for Dredging (Commonwealth of Australia 2009)</p> <p>Declared Fish Habitat Area Network Strategy</p> <p>2015 - 2020 (QPWS 2015)</p> <p>GPC's Environmental Management System (EMS) (Section 6)</p>
<i>Trailing Suction Hopper Dredge (TSHD) Brisbane</i> Schedule and Port Specific Environmental Risk Assessment	<p>To ensure the <i>TSHD Brisbane's</i> schedule is developed to optimise environmental outcomes and operational efficiencies by: ensuring identified environmental windows as well as any restrictions imposed on permits are applied; minimising the net risk of impacts at each port by adopting site specific operating procedures and; avoiding unnecessary dredger travel and</p>	As required*	<p>Maintenance Dredging Strategy for Great Barrier Reef World Heritage Area Ports (TMR 2016)</p> <p>Procedure for scheduling and reporting the annual state-wide maintenance dredging program by <i>TSHD Brisbane</i> (QPA 2021). NB: Visits to the Port of Rockhampton will be included in the schedule in some years, as required.</p>

Document	Review context	Interval	Key drivers
	<p>relocation.</p> <p>In accordance with the MDS and the Queensland Ports Association (QPA) procedure, GPC will define the urgency, volume and extent of maintenance dredging required and complete a port specific environmental risk assessment for maintenance dredging.</p>		GPC's EMS (Section 6)
GPC's Environmental Management Plan (EMP)	<p>To ensure continual improvement by updating the EMP based on the learnings of any previous campaign and ensuring that the EMP reflects the most up to date understanding of risks specific to each campaign.</p> <p>Reviews should consider; the performance of the previous maintenance dredging campaign and monitoring results; the volume and extent of required maintenance dredging; an environmental risk assessment; updates to scientific research and leading practice management and monitoring techniques.</p>	As required *	<p>Environmental Code of Practice for Dredging and Dredged Material Management (Ports Australia 2016)</p> <p>Maintenance Dredging Strategy for Great Barrier Reef World Heritage Area Ports (TMR 2016)</p> <p>Guidelines for Long-term Maintenance Dredging Management Plans (TMR 2018)</p> <p>GPC's EMS (Section 6).</p>
GPC Environmental Monitoring Procedure (Environmental MP)	<p>To ensure that appropriate monitoring and adaptive management is in place for each campaign based on longer-term commitments made in the LMDMP and campaign specific risks and improvement opportunities identified through the EMP review process.</p> <p>The Environmental MP will outline an adaptive management framework which ensures that risks continue to be actively managed during each campaign.</p>	As required*	<p>Environmental Code of Practice for Dredging and Dredged Material Management (Ports Australia 2016)</p> <p>Maintenance Dredging Strategy for Great Barrier Reef World Heritage Area Ports (TMR 2016)</p> <p>Guidelines for Long-term Maintenance Dredging Management Plans (TMR 2018)</p> <p>GPC's EMS (Section 6).</p>

*as required is triggered when dredging is scheduled for the Port of Rockhampton

1.4 Implementation and Release

This LMDMP will be approved by GPC's Executive General Manager Marine Operations (EGM MO) and further details of roles and responsibilities are provided in **Table 2**. If required under an approvals assessment process, GPC may also seek the approval of this plan from relevant QLD and Commonwealth Government regulators.

All relevant employees and contractors will be introduced to and made familiar with the provisions of this LMDMP. This document refers to and should be read in conjunction with the most relevant version of the EMP and Environmental MP for the maintenance dredging activity being undertaken (Sections 8 and 9).

Following the commencement of any maintenance dredging campaign, significant amendments to this LMDMP that may change the environmental risk profile of the activity (Section 6) must be communicated to and re-approved prior to the implementation of the amendments. Significant amendments will also be communicated with the TACC, once established (Section 1.7.2)

Significant revisions requiring re-approval are to be saved as a new version and administrative revisions are to be saved as a new sub-version in GPC's document management system. Each version must be communicated to all relevant GPC employees and contractors as required and kept updated on GPC's website.

GPC will publish approved versions of the LMDMP and its associated management documents on the GPC website for public access (Section 1.7.4).

1.5 Policy Context

The QLD and Commonwealth Governments developed the Reef 2050 Long-Term Sustainability Plan (Reef 2050 Plan) in response to concerns about the management of the GBR by the World Heritage Committee in 2011. The Reef 2050 Plan is aimed at strengthening Australia's management of the GBR, and providing a blueprint for the continuing efforts to preserve it and its OUV (Commonwealth of Australia 2015).

The QLD Government launched the MDS for the GBRWHA in 2016. This addressed requirements of the Reef 2050 Plan Water Quality Action number 16 (WQA16), which requires the following:

"Develop a State-wide coordinated maintenance dredging strategy which:

- Identifies each port's historical dredging volumes and likely future requirements and limits*
- Identifies appropriate environmental windows to avoid coral spawning, seagrass recruitment, turtle breeding and weather events*
- Examines opportunities for the beneficial reuse of dredge material or on-land disposal from maintenance activities*
- Establishes requirements for risk-based monitoring programs."*

The MDS presents a standardised Long-term Maintenance Dredging Management Framework (MDS Framework) as per **Figure 1**.

Principle 1 of the MDS recommended the development and implementation of LMDMPs in accordance with the MDS Framework. Action 1 of the MDS required the development of guidelines to assist each GBRWHA port in the preparation of a LMDMP consistent with the requirements of the QLD Government (TMR 2016).

A LMDMP is to take into account learnings from the full cycle of the MDS Framework to determine the best way to plan and manage the port's maintenance dredging needs. Key elements from the MDS Framework should be addressed in the LMDMP, however it is not expected that all elements will be specifically covered.

The Port of Rockhampton LMDMP is not a statutory document and the QLD government will not have an 'approving' role. However, it is anticipated that the continuous improvement process that they embody, will lead to greater transparency and improved environmental outcomes. Ports may use LMDMPs to support statutory assessment processes for maintenance dredging and any associated activities in consultation with the relevant QLD and Commonwealth Government regulators.

The QLD Ports Association (QPA), of which GPC is a member, will continue to support improvement by identifying and sharing best and good practice approaches to dredging management amongst all GBR ports.



Figure 1. MDS Framework (Source: TMR 2016)

1.6 Approvals and Statutory Obligations

The activity of dredging, the removal of material from the seabed, and the relocation and reuse of this material is subject to International agreements and a broad range of QLD and Commonwealth Government legislative requirements. This regulatory framework attempts to balance the needs of

ports with economic objectives, the protection of the environment and the interests of other stakeholders (TMR 2016).

The permitting process for each activity is subject to different jurisdictional requirements by the various regulators involved, depending on the location of the activity, the way it is to be undertaken and the potential impacts associated with the activity (Section 3.3). Ports undertake a risk-based approach for managing impacts of their maintenance dredging activities in compliance with the process required by each of the regulators involved (Sections 6 and 7).

Following regulators' assessment of the risks and impacts of a proposed activity, approvals are usually granted with conditions. Approvals typically specify details of the approved activity, location, and volume of the material to be dredged, location of the reuse or relocation site(s), methodologies, measures to mitigate impacts, environmental windows, and environmental monitoring and reporting. Once an approval is granted, it is the responsibility of the approval holder to ensure any conditions required under the approval are incorporated into project planning and subsequent ongoing implementation of dredging activities.

Details of the specific approvals applicable to each maintenance dredging campaign are included in GPC's EMPs for specific maintenance dredging activities which are made available on GPC's website for the relevant period of the activity. The most common statutory processes that would be applied for maintenance dredging activities at the Port of Rockhampton are summarised below.

International Agreements

- Australia is a signatory to the **1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972** (London Protocol). The London Protocol is a global convention that aims to protect and preserve the marine environment from all sources of pollution and take effective measures to prevent, reduce and where practicable, eliminate pollution caused by placement or incineration of wastes at sea. Under the London Protocol, member nations may allow the dumping of certain materials in the marine environment (including dredged material) following an assessment of potential impacts, and subject to certain conditions. The International Maritime Organization (IMO) hosts the permanent Secretariat of the London Protocol and Commonwealth Government reports activities involving placement of dredge material at sea to the IMO each year.

Commonwealth Government

- **The Environment Protection (Sea Dumping) Act 1981** (Sea Dumping Act) implements Australia's obligations under the London Protocol to prevent marine pollution by placement of wastes and other matter. Under the Sea Dumping Act, the Commonwealth Government aims to minimise pollution threats by:
 - prohibiting ocean placement of waste considered too harmful to be released in the marine environment and
 - regulating permitted waste placement to ensure environmental impacts are minimised.

Permits are required for all sea dumping operations including the relocation of dredged material in Australian waters which are defined as any waters on the landward side of the Exclusive Economic Zone (EEZ), or the continental shelf of Australia where it extends beyond the EEZ. This excludes waters determined as Internal Waters (Commonwealth of Australia 2009). The existing sea placement site at the Port of Rockhampton is located within Internal Waters (**Figure 2**), and is therefore not subject to the Sea Dumping Act. Through the Sea

Dumping Act, the Commonwealth Government assesses proposals to load and dump wastes and other matter at sea, permits acceptable activities, and places conditions of approval to mitigate and manage environmental impacts.

- **The Environment Protection and Biodiversity Conservation Act 1999** (EPBC Act) is the Commonwealth Government's central piece of environmental legislation which provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places (Matters of National Environmental Significance (MNES)).

The EPBC Act aims to balance the protection of these crucial environmental and cultural values with our society's economic and social needs by creating a legal framework and decision making process based on the guiding principles of ecologically sustainable development.

Under the EPBC Act, an action that is likely to have a significant impact on a MNES must be referred to the Commonwealth Government Minister for the Environment for assessment and approval. GPC undertakes assessments of potential impacts of maintenance dredging activities to determine potential impacts to sensitive receptors including those determined as MNES or Matters of State Environmental Significance (MSES). Additional maintenance dredging requirements, as a result of infrastructure projects, will be considered as part of capital dredging approval requirements.

- In addition to the above Commonwealth legislation, the Commonwealth Government has the **National Assessment Guidelines for Dredging 2009** (NAGD) (Commonwealth of Australia 2009). The NAGD seek to provide clear, consistent standards and criteria for assessment of dredged material, and to facilitate better decision making by regulators, by improving the quality of information on which assessments are based.

The NAGD are actively used by GPC, and form the basis of the approvals process, particularly under the Sea Dumping Act. These require ports to demonstrate that the material to be dredged has been the subject of a detailed site specific assessment to ensure only material considered acceptable is placed at sea.

Importantly, opportunities for alternatives to at sea placement (e.g. beneficial reuse or land-based placement) must be evaluated, which includes assessment of environmental, social and economic impacts, consistent with the requirements of the London Protocol. Where appropriate opportunities exist to reuse, recycle, or treat material, without undue risks to human health or the environment or disproportionate costs, these alternatives must be used. These guidelines are internationally considered to be of a world-leading standard.

State Government

- QLD ports are required to undertake maintenance dredging to fulfil their requirement to provide and operate effective and efficient port facilities and services under the **Transport Infrastructure Act 1994** (TI Act).
- The **Sustainable Ports Development Act 2015** (SPD Act) prohibits capital dredging in the GBRWHA outside of the priority ports. The Port of Rockhampton is not recognised as a priority port by the QLD Government under the Reef 2050 Plan and the SPD Act, and hence capital dredging cannot be undertaken at this Port.
- The **Coastal Protection and Management Act 1995** (CPM Act) provides for the protection, conservation, rehabilitation and management of QLD's coastal zone, including its resources and biological diversity.

- As per the CPM Act, coastal development generally requires assessment under the **Planning Act 2016** to ensure it is managed to protect and conserve environmental, social and economic coastal resources and enhance the resilience of coastal communities to coastal hazards. Where previous approval has been granted authorising a 'lawful structure' as tidal work, the maintenance of this and the subsequent placement of material is not considered development. Lawful structures include the shipping channel, berth pocket, swing basin and the off-shore Material Relocation Area (MRA) in the Port of Rockhampton. In addition any impacts on marine plants and/or the Fish Habitat Area (FHA) not related to maintenance of existing lawful structures (i.e. the shipping channel, berth pocket, swing basin and the off-shore Material Relocation Area (MRA)) may require permits under the *Planning Act 2016*.
- The **Environmental Protection Act 1994** (EP Act) is the key piece of environmental legislation in QLD. It provides for the protection of QLD's environment through an integrated management program that is consistent with ecologically sustainable development

This LMDMP and associated management documents (EMP and Environmental MP) may also be utilised to meet the QLD Department of Environment and Science's (DES's) requirement to comply with the ERA16 dredging common conditions of developing a Dredge Management Plan.

1.7 Governance

1.7.1 Roles and Responsibilities

GPC employees and contractors are responsible for the environmental performance of their activities and compliance with approvals and statutory obligations relevant to their work (Section 1.6). **Table 2.** Roles and Responsibilities provides a summary of the responsibilities and accountabilities of GPC employees associated with the implementation of this LMDMP and maintenance dredging operations at the Port of Rockhampton.

Table 2. Roles and Responsibilities

Position	Responsibility	Reporting to
Chief Executive Officer (CEO)	Ensure that systems are in place to manage environmental aspects and impacts at GPC.	GPC Board of Directors
Executive General Manager Safety and ESG (EGM SESG)	Ensure that systems are implemented to manage environmental aspects and impacts of maintenance dredging.	CEO
EGM MO	Responsible for all aspects of marine operations including maintenance dredging. Responsible for dredge management planning and management of the dredging contracts	CEO
Safety and Environment Manager	Responsible for the provision of support services for maintenance dredging activities, to implement regulatory and internal governance requirements, including Environmental Policy, Strategy and Environmental Management System (EMS) framework and provision of Regulatory Approvals.	EGM SESG
Specialist Harbours and Channels	Implementation of this LMDMP and	EGM MO

Position	Responsibility	Reporting to
	associated management documents. GPC contact for operational issues during dredging.	
Environment Superintendent	Preparation and development of the LMDMP and other supporting documentation in accordance with MDS and other best practice frameworks. Ensure environmental management, monitoring, reporting and auditing responsibilities are met.	Safety and Environment Manager
Environment Specialist	Assist development, implementation and revision of LMDMP and associated documents, review of compliance, and development / review of management documents (e.g. EMP and Environmental MP).	Environment Superintendent
Environment Monitoring Specialist	Responsible for the implementation and coordination of environmental monitoring programs and data as per the Environmental MP.	Environment Superintendent

1.7.2 Technical Advisory Consultative Committee

A TACC is an important consultative mechanism intended to ensure that interested stakeholders have a forum to understand GPC's maintenance dredging activities and to assist GPC and regulatory agencies to access local knowledge and reconcile various stakeholder interests. A TACC stakeholder group has been identified and was established in accordance with the NAGD (Commonwealth of Australia 2009) and the LMDMP guidelines (TMR 2018). This stakeholder group will be engaged in the LMDMP reviews and once maintenance dredging occurs will also be invited to contribute to annual TACC meetings.

The NAGD provide guidance on the purpose, scope and membership of the TACC and in accordance with these guidelines, a TACC is intended to:

- Provide continuity of direction and effort in protecting the local environment;
- Aid communication between stakeholders and provide a forum where points of view can be discussed and conflicts resolved;
- Assist in the establishment, as appropriate, of longer term permitting arrangements, including the development and implementation of LMDMPs, research, sampling and monitoring programs;
- Review ongoing management of maintenance dredging and placement activities; and
- Make recommendations to the proponent and the regulatory agencies as necessary or appropriate.

An effective TACC is acknowledged as best practice maintenance dredging management by the MDS (TMR 2016). The LMDMP guidelines (TMR 2018) recognise a TACC as an appropriate mechanism to engage with stakeholders as part of the development and oversight of LMDMPs.

TACC membership should be drawn from relevant Commonwealth, State and Local Government, non-Government organisations (NGOs) and community groups (Commonwealth of Australia 2009, TMR 2018). To ensure successful outcomes are achieved, it is important that TACC members have

appropriate representation with sufficient skills and expertise. The ongoing role of the TACC includes:

- Review of the performance and effectiveness of dredging campaigns, consideration of key learnings and the provision of advice on whether the LMDMP requires updating, enabling ports to understand from a stakeholder's perspective how effective the options chosen were, and whether there are better ways of undertaking the activities in the future;
- Participation in the updating and renewal of LMDMPs to ensure LMDMPs reflect any learnings or improvements identified during dredging campaigns; and
- Consider and respond to any concerns raised following the finalisation of LMDMPs including those raised by the general public.

TACC function and effectiveness is enhanced by transparency in their membership, their mandate, their access to information during meetings and upon request, their consensus forming and reporting mechanisms, their minutes or communiques, and by the transparency of GPC's responses to TACC recommendations. This is provided for in the TACC Terms of Reference (ToR). The ToR for the Port of Rockhampton TACC are available on GPC's website.

To support the establishment and success of the Port of Rockhampton TACC, GPC has developed a Communication, Engagement, and Project Delivery Strategy. The goal of this strategy will be to effectively engage and communicate with the TACC to understand what values are important and use this stakeholder input to manage maintenance dredging activities in a transparent and sustainable manner. This strategy will aim to ensure engagement is done meaningfully, balancing operational needs and facilitating the continual improvement of this LMDMP and the continuity of GPC's maintenance dredging operations.

The TACC will be instrumental in the establishment and ongoing improvement of GPC's Long-term Monitoring Program for the Port of Rockhampton (Section 9, **Table 7. Port of Rockhampton Long-term Monitoring Schedule**). Contributions will be documented in revisions of this LMDMP.

1.7.3 Independent review

At the five (5) yearly review interval, in addition to the TACC, GPC employees, relevant regulatory agencies, and other interested stakeholders will be given the opportunity to review this LMDMP. While these structured reviews are undertaken at this time period, GPC's continual improvement framework (Section 1.3) will ensure that feedback received within the five (5) year time frame are considered and actioned as appropriate.

Through effective stakeholder engagement, GPC aims to:

- Engage stakeholders in discussion regarding real, perceived or potential issues relating to port operations and development;
- Invite stakeholders to openly participate in engagement;
- Facilitate the two (2) way flow of information between GPC and key interested stakeholders;
- Take a collaborative approach towards achieving the goal of the strategy;
- Develop and enhance partnerships with stakeholders;
- Promote transparency in our operations and development;
- Balance stakeholder and operational expectations and requirements;
- Promote continual improvement of GPC's activities; and
- Educate stakeholders about ports, their role and their required developments.

GPC's Environmental Management System (EMS) framework (Section 8) provides for auditing of this LMDMP for performance monitoring performances by suitably qualified auditors. Auditors may be internal or external third parties.

1.7.4 Access to information

GPC will publish the current approved version of this LMDMP on the internet for public access. In accordance with Principal 16 of the MDS, if maintenance dredging is required, the final approved versions of the relevant EMP, Environmental MP, Sediment Analysis Plan (SAP) and other required monitoring from the Long-term Monitoring Program (Section 9) will also be published on GPC's website.

GPC will facilitate meetings with the TACC established for maintenance dredging for the Port of Rockhampton, where the outcomes of monitoring programs will be reviewed and discussed. TACC meeting minutes will be published on GPC's website. GPC also has a data request process established for external dissemination of environmental monitoring data and reports.

Additional to any statutory requirements to report to or provide information to regulatory authorities, GPC participates in comparative analysis and coordinated maintenance dredging reporting to QLD Department of Transport and Main Roads (TMR) in accordance with Principal 8 of the MDS (TMR 2016). A summary of key information and accessibility is provided in Section 11.

Currently, GPC also provides the data from the ambient monitoring undertaken at the Port of Rockhampton to the Fitzroy Partnership for River Health (FPRH) for incorporation into an annual report card ([Fitzroy Partnership for River Health](#)).

2. Port Locality, Setting and Shipping

2.1 Location and Environment Setting

The Port of Rockhampton includes port facilities located at the mouth of the Fitzroy River within the channels of Raglan and Casuarina Creeks. These facilities known as the Port Alma Shipping Terminal (PAST) are situated 62 km east of the city of Rockhampton, through which the Tropic of Capricorn runs (**Figure 2**). The Port of Rockhampton is a naturally deep water Port designated for dangerous cargoes.

The Port of Rockhampton is located 62 km south-east of Rockhampton, 597 km north of Brisbane, and within the Fitzroy River Delta and covers 18,780 ha of land.

The Port of Rockhampton operates within the GBRHWA as well as the Fitzroy River Delta, QLD's largest catchment. Areas surrounding the Port of Rockhampton include environmental values (EVs) of national and state importance, and are recognised and protected through Commonwealth and State legislation. Key environmental assets of the Port of Rockhampton include intertidal habitats, benthic macroinvertebrates, fish, shellfish, shorebirds, and marine megafauna. The Port is adjacent to the Fitzroy River Declared Fish Habitat Area and the outer channels fall into the General Use Zoning of the Great Barrier Reef Marine Park (GBRMP) and the Great Barrier Reef Coast Marine Park (GBR Coast MP).

The Central Queensland region has a sub-tropical climate with hot, moist summers and warm, dry winters. Rainfall in the Central Queensland region is highly seasonal, with most rain occurring during the summer months (December to February). Climatic data for the Port of Rockhampton is limited

over time with consistent data until recent years only available from the Rockhampton Aero Station located 37.3 km from the township of Port Alma ([Climate Data Online - Map search \(bom.gov.au\)](#)).

The Port of Rockhampton is susceptible to cyclonic activity with 15 cyclones passing within 100 km of the Port between 1906 and 2007 ([Tropical cyclone databases \(bom.gov.au\)](#)). Several cyclones passing along the QLD coastline in the last decade have resulted in the temporary closure of the Port of Rockhampton.

2.2 History

Port activities first commenced in the 1800s with facilities first built at the Port of Rockhampton in 1883, and further upgrades in 1911 and 1969. In the first year following the 1911 upgrade, 22,467 tonnes of cargo were handled with the cargo including grain, cattle, sheep, gold, copper, hides and tallow in the first years of operation.

GPC acknowledges the First Nations peoples Bailai, Gurang, Gooreng Gooreng, Taribelang Bunda, Darumbal, Kabi Kabi and Butchulla whose original land we all share, live, work and play on. GPC acknowledge and pay our respect to all Elders of past, who have made the many sacrifices, contributions and paved the way for us all to be here today. GPC acknowledge our present and emerging Leaders who will continue the fight for a better and united Australia for all our generations of today, tomorrow and in the future. GPC also extend this respect to other Aboriginal, Torres Strait Islander and Australian South Sea Islander Elders and peoples within our operating footprint.

2.3 Current and Future Use

Strategic Port Land (SPL) at the Port of Rockhampton covers 5,812 ha. An additional 5000 ha (approximately) was allocated as an environmental offset as a result of a capital dredging program undertaken in the Port of Gladstone, while there is a further 7000 ha designated as an advanced offset. These offset lands are located on Balaclava Island adjacent to the Port.

In the 2021-2022 financial year, the Port of Rockhampton handled 0.08 Mt of cargo and comprises two (2) wharf facilities (GPC 2022):

1. Berths 1 and 2 — suitable for general cargo operations.
2. Berth 3 — dedicated to tallow, fuel and other cargoes.

The current cargo through the Port of Rockhampton includes fuel, tallow, ammonium nitrate, explosives, Australian and Singaporean military equipment, packaged salt and heavy lift cargoes (GPC 2017). In the 2022-2023 financial year, the Port of Rockhampton handled 165,635 tonnes of cargo, and hosted 73 vessels (GPC 2023, [Port of Rockhampton - Gladstone Ports Corporation \(gpcl.com.au\)](#)).

As Australia's largest facilitator of hazardous goods and explosives, the Port of Rockhampton is uniquely positioned to capitalise on future growth opportunities across the country's mining, construction and defence sectors. The Port of Rockhampton's remote location, robust marine infrastructure and isolated staging areas facilitate the safe transport and handling of dangerous goods. As a national hub for hazardous cargo, the Port of Rockhampton is a strategic asset for Queensland and Australia. With the ability to service growing industry demand in the trade of dangerous goods and explosives, the port is of national security significance and is a critical link in the value chain. We are committed to building on the existing trade and supporting new trade of hazardous goods and explosives so we can continue to service domestic trends and address global shifts (GPC 2022).

As a non-priority Port within the GBRWHA, development at the Port of Rockhampton is limited by the restriction on capital dredging. Into the future, GPC will focus on optimising existing channels, enhancing water-side and land-based facilities to facilitate opportunities for trade growth.

2.4 Navigational Infrastructure

The Port of Rockhampton shipping channel is 100 m wide and 11 km long. The three (3) berths are collinear providing a combined berth face of 608 m with a berth width of 41 m, a swing basin width of 210 m wide and the capability of accepting vessels up to 200 m length overall (LOA). Depths of the channels, berths and swing basins are provided in MSQ Notice to Mariners 369 (T) 2021 ([Rockhampton: Notices to Mariners - Dataset - Publications | Queensland Government](#)) with locations of channels and berths included in **Figure 2**. The minimum under keel clearance is 0.7 m in the channel and 0.5 m in the swing basin and the berths.

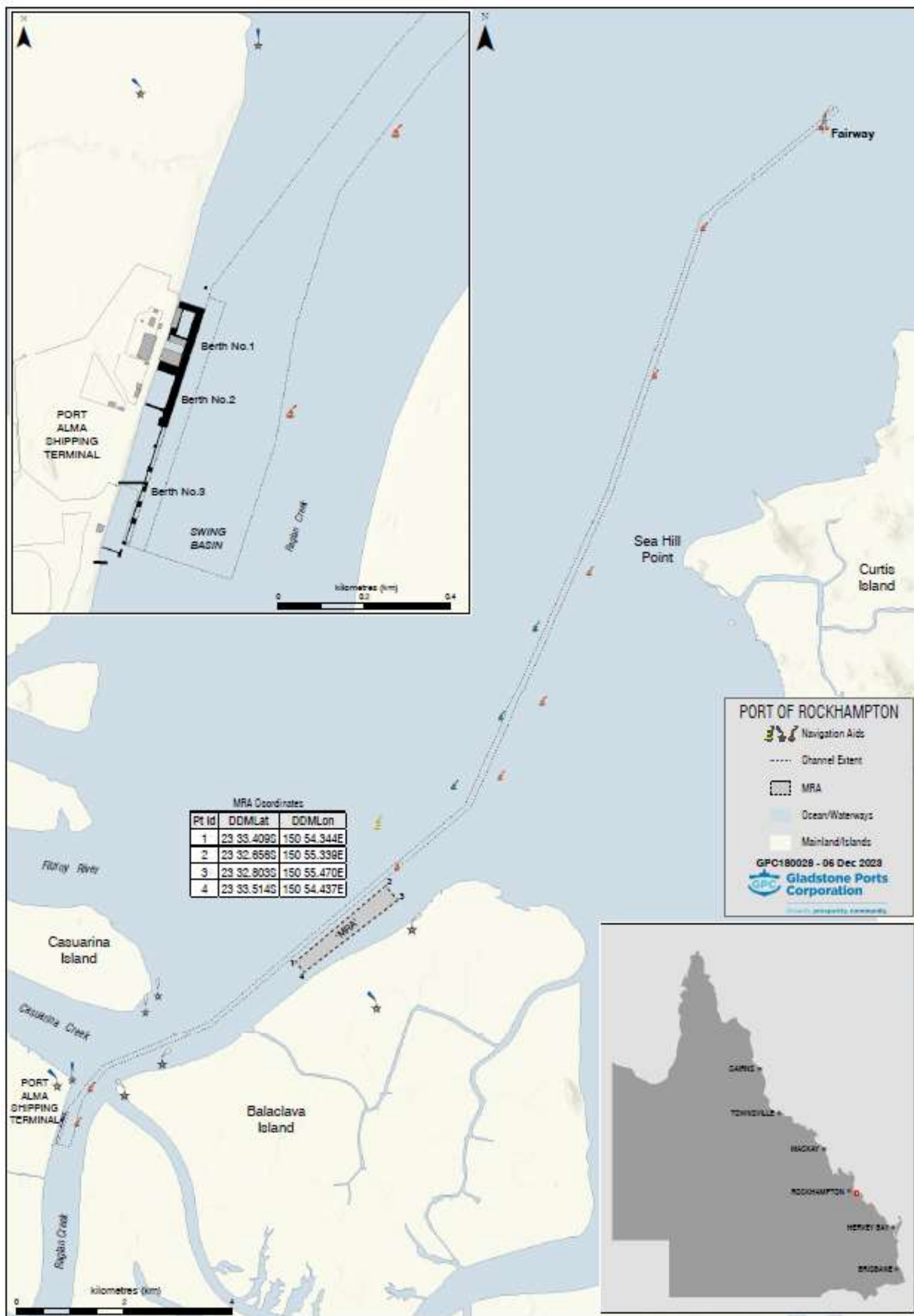


Figure 2. Location of the Port of Rockhampton and Associated Port and Navigational Infrastructure

3. Port Environmental Values

3.1 Great Barrier Reef World Heritage Area Outstanding Universal Value

The GBRWHA was inscribed as World Heritage in 1981 in recognition of the range of natural and cultural heritage that contributes to the OUV of the area. The four (4) natural heritage criteria that the GBRWHA satisfy are its: geological phenomena; ecological and biological processes; its aesthetics and natural beauty and its biological diversity, including the threatened species it supports.

The GBRWHA listing document identifies specific examples of values / attributes underpinning each criterion for OUV. Generally, the examples of values / attributes identified in the GBRWHA listing document are not location specific and therefore, do not specifically define marine ecological values / assets supported in the Port of Rockhampton. Of the criteria for which the GBRWHA is listed, the Port of Rockhampton supports the following:

- Mangrove ecosystems;
- Habitats for threatened species;
- Coastal / continental islands of exceptional natural beauty; and
- Many species of crustaceans, polychaetes, molluscs, phytoplankton, fish, shorebirds, mammals and reptiles.

The integrity of the GBRWHA and the value of these attributes are supported by the size of the area and its potential for effective conservation management. The existing integrity of marine habitats varies throughout the Port of Rockhampton, however nearshore areas around PAST are generally in the most modified condition.

Key sensitive environmental receptors and ecological assets for the Port of Rockhampton are described in **Table 3**. Key Sensitive Receptors and Ecological Assets for the Port of Rockhampton Other relevant values within and surrounding the Port are outlined in Table 4Error! Reference source not found..

Table 3. Key Sensitive Receptors and Ecological Assets for the Port of Rockhampton

Key sensitive receptor / asset	Information relevant to Port of Rockhampton
Coral reefs	The closest significant coral reef communities to the Port of Rockhampton are located at Peak Island, approximately 25 km north east from Port facilities. Extensive coral reef communities can be found in the northern parts of Keppel Bay, with occasional hard and soft corals found on substrates around the northern tip of Curtis Island, approximately 14 km from the Port (BMT WBM 2013, BMT WBM 2015b, Haskoning Australia 2016).
Tidal wetlands	The Directory of Important Wetlands in Australia (DIWA) (2001) includes the Fitzroy River Delta and associated floodplains (WetlandInfo – Queensland Wetlands Information (Department of Environment and Science) (des.qld.gov.au)). The area of intertidal wetlands within the Port region has been previously estimated at approximately 450 km ² . Mangroves have been reported to cover 194 km ² of this intertidal wetland vegetation with nine (9) mangrove species reported to occur in the

Key sensitive receptor / asset	Information relevant to Port of Rockhampton
	<p>area. The most widespread mangrove forests were found to occur predominantly along Connor Creek and The Narrows. Saltmarsh and saltpan communities are estimated to cover over half of the intertidal wetland within the Port Alma region (~254 km²) with two (2) species of saltmarsh recorded and the largest area of saltmarsh occurred near Casuarina Creek, Inkerman Creek, Raglan Creek and Connor Creek. The distribution of intertidal wetlands in the region is reported to have remained relatively stable over the years (BMT WBM 2015b, SKM 2013b).</p>
Seagrass and macroalgae	<p>Historical mapping and monitoring of seagrasses at the Port of Rockhampton area, including outside the mouth of the Fitzroy River, did not detect large areas of seagrass habitat and seagrass has not been observed at Port of Rockhampton in recent monitoring. This is speculated to be due to strong currents and high turbidity. These factors will also limit primary productivity of macroalgae (BMT WBM 2015a, Haskoning Australia 2016, York and Smith 2013).</p> <p>In addition a baseline seagrass survey focusing on the offset potential of Balaclava Island was conducted in 2021. The survey identified seagrass at Balaclava Island formed three (3) meadows, a large intertidal meadow to the south of Balaclava Island (Smith et al 2022).</p>
Benthic fauna	<p>The benthic communities of the Port of Rockhampton are comprised exclusively of marine / estuarine species of polychaetes, malacostracan crustaceans, acorn worms, nemertean worms, ostracod seed shrimps and gastropod molluscs. They also comprised of predominantly uncommon taxa that are small opportunistic and / or mobile. No declared marine pest under the National Introduced Marine Pest Information System (NIMPIS) were recorded (BMT WBM 2015c, Haskoning Australia 2016).</p>
Fish and shellfish communities	<p>The Port of Rockhampton and surrounding areas provide a diverse range of important fish habitat, all which create a regionally significant fish breeding and spawning area and an important area for commercial and recreational fisheries. The area is adjacent to the Fitzroy River Declared FHA as well as the Capricorn Net Free Fishing Zone.</p> <p>The area is also potential habitat for conservation significant fish species. The Vulnerable green sawfish has been recorded in the area (BMT WBM 2015b, DNPRSR 2014, Eberhard 2012, Sheaves et al 2014).</p>
Marine mammals	<p>Dugongs and dolphins have been recorded within the Port of Rockhampton (Sobtzick et al 2013).</p> <p>The Port of Rockhampton region is of predominantly low conservation value for dugongs due to the limited seagrass habitat resulting from turbid waters (BMT WBM</p>

Key sensitive receptor / asset	Information relevant to Port of Rockhampton
	<p>2015b, Haskoning Australia 2016).</p> <p>Three (3) species of inshore dolphin have been recorded in small groups in the area of the Port of Rockhampton. These include the Australian humpback, the Australian snubfin and the inshore bottlenose dolphin. Humpback dolphins formed two (2) geographically discrete social communities, Keppel Bay and Port Curtis based on their preferred geographic distribution. Port of Rockhampton supports a resident population of snubfin dolphins which represents one of the largest populations of snubfin dolphins studied in Australia. Indo-Pacific bottlenose dolphins occur only sporadically within the Port Alma region and mostly in open waters (Cagnazzi 2013, Cagnazzi 2017, Haskoning Australia 2016).</p> <p>Humpback whales and calves are known to utilise surrounding offshore waters during seasonal migrations. The area is not recognised as critical or protected habitat for this species (GHD 2009).</p>
Marine turtles	<p>Several marine turtle species have been recorded in the area. Of these, flatback and green turtles have been most commonly recorded. Peak Island, 25 km north east of Port facilities supports one of the largest populations of nesting flatback turtles in the east Australian stock and is recognised as an index beach for long term monitoring. There are no index beaches with the limits of the Port of Rockhampton however the Port facilities are located within the recommended 60 km internesting buffer for Peak Island. This is recognised by the long-term objective of the Recovery Plan for Marine Turtles in Australia 2017 – 2027 (Commonwealth of Australia 2017, Haskoning Australia 2016, Limpus et al 2013a-f). Observations have also been made of post hatchling flatback turtles and courting green turtles utilising Port of Rockhampton (C Limpus, pers. comm.).</p>
Shorebirds	<p>The Port of Rockhampton and surrounds contain large areas of potential habitat for both resident and migratory shorebirds, including foraging and roosting habitat in intertidal and subtidal areas along the coastline.</p> <p>Several threatened migratory shorebirds are known to frequent the area either as their non-breeding destination or as a migratory stop over site. The Fitzroy Delta and North Curtis Island support a high overall abundance of non-breeding shorebirds. There is evidence that the area in general is used quite intensively on the northward migration by a range of species.</p> <p>No breeding habitat for migratory shorebirds is present within the Port of Rockhampton area or surrounds (BMT WBM 2015b, Choi et al 2017, IMEMS 2013).</p>
Marine water quality	<p>The waters of the Port of Rockhampton are predominantly described as ‘moderately disturbed’ (in terms of management intent / level of protection)</p>

Key sensitive receptor / asset	Information relevant to Port of Rockhampton
	<p>(ANZECC/ARMCANZ 2000, Newham et al 2017, State of Queensland 2013, State of Queensland 2014).</p> <p>Although the marine water quality is moderately disturbed, it is still critical to supporting and sustaining the local expression of several attributes that contribute to the OUV of the GBRWHA, including benthic fauna, fish species diversity and habitat, marine mammals, marine turtles, migratory shorebird habitat, and the total diversity of marine life.</p> <p>The FPRH is a long-term water quality and sediment monitoring program that began in 2010. This program produces an annual report card on the water quality, biological and ecological health for all rivers in the Fitzroy Basin, the estuary, as well as nearshore coastal and marine waters (Fitzroy Partnership for River Health).</p> <p>GPC initiated an ambient near-field water quality program at the Port of Rockhampton in 2014. This program is undertaken quarterly and measures various water quality parameters at two (2) sites (Vision Environment 2018b, 2019, 2020, 2021, 2022). The data from this program is provided to the FPRH.</p>

Table 4. Other Values within and surrounding the Port of Rockhampton

Value	Description
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Value	Description
Cultural values	<p>The Port of Rockhampton and surrounds contain a number of culturally significant sites, and provides access to areas enabling traditional Indigenous use of land and sea. The Port of Rockhampton is located within the lands and sea of the Darumbal people and port waters are within the sea country of the Bailai, Gurang, Gooreng Gooreng, and Taribelang Bunda people.</p> <p>Traditional Darumbal land is considered to encompass an estimated 10,000 km² around most of coastal Central Queensland, running from Arthur Point at Shoalwater Bay to Yeppoon, and taking in the mouth of Fitzroy River and Keppel Islands. From Keppel Bay, these lands extend inland to Boomer Range, and Marlborough, Yaamba, Rockhampton, and Gracemere.</p> <p>The First Nations Bailai, Gurang, Gooreng Gooreng, Taribelang Bunda People Aboriginal Corporation have formalised their aspirations for sea and country through entering into a Traditional Use of Marine Resources Agreement (TUMRA) which covers an area of 26,386 km². The agreement area extends from Burrum Heads, south of Bundaberg, to the Fitzroy Estuary and includes all of Curtis Island. Parts of the Port of Rockhampton are included in this area.</p> <p>GPC has an Indigenous Land Use Agreement (ILUA) with the First Nations Bailai, Gurang, Gooreng Gooreng, Taribelang Bunda People Aboriginal Corporation and is negotiating an ILUA with First Nations Darumbal People, as the traditional owners of the lands and waters where GPC undertakes its operations within the <i>Native Title Act 1993</i>.</p>
Heritage values	World, Commonwealth and National Heritage Places. State and Local Heritage Places.
Social values	Community infrastructure and facilities, local workforce, and housing.
Commercial activities	Additional commercial opportunities including other industries and commercial fishing
Recreational activities	Areas utilised for conservation, environmental management, tourism, open space, and sport and recreational uses. Also includes areas that provide natural scenic amenity.

3.2 Community Environmental Values

In QLD, EVs and Water Quality Objectives (WQOs) are established under the *Environment Protection Policy (Water and Wetland Biodiversity) 2019* (EPP Water and Wetland Biodiversity), which is subordinate legislation under the EP Act. An EV is the value placed on a waterbody by the community. EVs are essentially the goals that the community wants to achieve for their waterways. WQOs are based on local historic data, the condition of the waterway, and are developed in close consultation with the local community in order to protect the relevant EVs. The WQOs have been refined from national and state water quality guidelines. The EPP Water and Wetland Biodiversity describes the waters of the Port of Rockhampton as being moderately disturbed (DEHP 2011; Newham et al 2017).

The EVs established for the Port of Rockhampton include the protection of the following (Newham et al 2017):

- **Aquatic ecosystems** - the intrinsic value of aquatic ecosystems, habitat and wildlife in waterways and riparian areas;

- **Human consumer of aquatic foods** - health of humans consuming aquatic foods — such as fish, crustaceans and shellfish (other than oysters) from natural waterways;
- **Secondary recreation** - health of humans during recreation which involves indirect contact and a low probability of water being swallowed — e.g. wading, boating, rowing and fishing;
- **Visual recreation** - amenity of waterways for recreation which does not involve any contact with water — e.g. walking and picnicking adjacent to a waterway;
- **Industrial Use** - suitability of water supply for industrial use — e.g. food, beverage, paper, petroleum and power industries, mining and minerals refining / processing; and
- **Cultural and spiritual values** - indigenous and non-indigenous cultural heritage — e.g. custodial, spiritual, cultural and traditional heritage, hunting, gathering and ritual responsibilities; symbols, landmarks and icons (such as waterways, turtles and frogs); and lifestyles (such as agriculture and fishing).

3.3 Impact Assessment

To investigate the likely behaviour of any future maintenance dredging plumes at the Port of Rockhampton, a three (3) day dredging campaign was modelled. The modelling included dredging by a Trailing Suction Hopper Dredger (TSHD), the *TSHD Brisbane* running continuously and cycling every three (3) hours, dredging and placing a total of 34,320 m³ at the existing and approved placement area (**Figure 2**). This dredging period was followed by four (4) days of additional simulation where the dredge related sediments were available for resuspension and redistribution. In addition, the modelled dredging occurred during a spring tide when suspended dredge-related sediments had the greatest potential to travel within the prevailing currents beyond the dredge footprint (BMT WBM 2015b).

When developing a monitoring program, it is important that the program has been designed to specifically test the hypotheses (BMT WBM 2015b). This included identifying the EVs to be protected. Key sensitive environmental receptors and ecological assets near the dredge and placement area include: Intertidal habitats, including mangroves, saltpan and intertidal flats and seagrass, benthic macroinvertebrate communities, and fish communities. The Fitzroy estuary, Raglan Creek and north Curtis Island are declared Fish Habitat Area (BMT WBM 2015b), shorebird communities, marine megafauna species and coral habitats (BMT WBM 2015b).

The results of this modelling demonstrated that the extents of the dredge plumes generated during both dredging and material placement operations do not extend to the following sensitive receptors at significant concentrations (BMT WBM 2015b). Given the relatively short duration of the dredge campaign (days) and the small volume of material to be relocated, potential impacts to macroinvertebrate communities (if measureable) would be most likely to occur, on the MRA, directly adjacent to the MRA, within the channel to be dredged, and directly adjacent to the channel to be dredged (BMT WBM 2015b) (also see **Table 3. Key Sensitive** Receptors and Ecological Assets for the Port of Rockhampton) (BMT WBM 2015b).

The preferred indicator groups for monitoring impacts as a results of this simulated maintenance dredging activity at the Port of Rockhampton were identified as benthic macroinvertebrates. Their significance relates to the fact that they represent food resources and regulate a range of marine ecosystem processes. They are also reliable indicators for the detection of any impacts from maintenance dredging and are located within the area of impact of maintenance dredging activities (BMT WBM 2015b). As a result, this indicator group is reflected in the Long-term Monitoring Schedule (Table 9).

GPC will consider the need to undertake further hydrodynamic modelling, impact assessment, and validation prior to the next maintenance dredging campaign to inform an update to this section and maintenance dredging monitoring and management (Section 9, **Table 7. Port of Rockhampton Long-term Monitoring Schedule**). Any future assessment will also consider any potential impacts to MNES and MSES.

4. Consultation and Key Issues

To assist with the development of the LMDMPs, GPC developed a Communication, Engagement, and Project Delivery Strategy. The goal of this strategy was to effectively engage and communicate with identified stakeholders to understand what values are important and use this stakeholder input to develop a quality LMDMP for the Port of Rockhampton. The strategy aimed to ensure engagement was done meaningfully, balancing operational needs and facilitating the development of the LMDMP. The objectives of the strategy were to:

- Engage stakeholders in discussion regarding real, perceived or potential issues within the Port of Rockhampton in relation to maintenance dredging activities;
- Empower stakeholders to openly participate in engagement;
- Facilitate the two (2) way flow of information between GPC and key interested stakeholders;
- Take a collaborative approach towards achieving the goal of this strategy;
- Develop and enhance partnerships with stakeholders;
- Promote transparency in the LMDMP development process;
- Balance stakeholder and operational expectations and requirements;
- Ensure that quality LMDMPs are developed within the required timeframe; and
- Promote continual improvement of GPC's maintenance dredging activities

All feedback received as part of this consultation, including any responses from GPC, is outlined in **Appendix A**.

5. Sediment Assessment

5.1 Improved Port Sediment Understanding and Management

The Sustainable Sediment Management Project (SSM Project) was identified by GPC as a prerequisite, to allow adaptive long-term environmental management of maintenance dredging, understanding maintenance dredging sediments and how best to manage them, supporting sustainable development and identifying sediment movement within the Port of Rockhampton and how this interacts with the environment, the port, surrounding areas and communities.

All Port of Rockhampton infrastructure and activities occur within Port Limits and also the GBRWHA, as inscribed in 1981. Sediment management is conducted to provide and operate safe, effective and efficient port facilities and services. The Port of Rockhampton typically requires annual sediment management via the bed levelling (also known as drag barring) of its berths, channel and swing basin. Maintenance dredging at the Port of Rockhampton is not common, due to the predominance of fine silts and clay making it less efficient.

The MDS was developed for the ports that are situated within the GBRWHA (TMR 2016). It provides a framework for the sustainable, leading practice management of maintenance dredging. It is a requirement of the MDS that each Port within the GBRWHA develop and implement a LMDMP. The LMDMP Guidelines note that the LMDMPs should include, as well as other aspects, the following:

- An understanding of port-specific sedimentation conditions and processes
- Management approaches (including dredge avoidance and reduction)
- An assessment of beneficial reuse options
- Long-term dredging requirements based on sedimentation rates, port safety and port efficiency needs.

The SSM Project at the Port of Rockhampton was therefore aimed at fulfilling the requirements of the LMDMP. The Project has provided a better understanding of the sediment transport and resuspension processes and how these relate to maintenance dredging requirements and activities and the subsequent placement of dredged sediment. In turn, this has assisted in delivering scientifically robust information suitable for internal and external stakeholders and resultant studies such as this are helping to guide the management of relevant GPC activities including permit applications.

5.2 Port Sediment

The Port of Rockhampton is located adjacent to the Fitzroy delta within the naturally deep sections of Raglan and Casuarina Creeks. The natural processes at the Port limit sedimentation, with only coarser material accumulating over time. The distribution of sediment is a result of the delivery of sediment, hydrodynamic forces such as waves and currents, and the underlying geology. Interpolations show that the inshore sediments surrounding the Port are dominated by mud and have very small proportions of gravel. Terrigenous sediments are delivered to Keppel Bay via the Fitzroy River and other creeks. Strong riverine flows, tidal velocities (up to 1.8 m/sec) and relatively large tidal range (up to 5.4 m) prevent fine sediments from settling in the channels, which are instead dominated by sands and gravels. For the most part, the riverine flows / discharge are small and the hydrodynamics are dominated by the tidal currents. However, when monsoonal rains cause large flows and discharges, the riverine and rival currents combine to scour the fine sediments from the estuary, reducing the residence time of water in the estuary, and the potential for biogeochemical recycling. As a result, the sediments are forced seaward away from the estuary (BMT WBM 2015b, Haskoning Australia 2016, Ryan et al 2006, 2009, Webster et al 2003). As a result, maintenance dredging requirements at the Port of Rockhampton are infrequent.

5.2.1 Physical and Chemical Properties

The Port Curtis Integrated Monitoring Program (PCIMP) is the first collaborative monitoring program to be undertaken for the whole of the Port of Gladstone. The Gladstone-based PCIMP program conducts ambient mid to far field monitoring of water bodies for the whole of Port of Gladstone which extends from the northern end of the Narrows to Rodds Bay and includes the harbour and its tributaries (PCIMP 2023). Sediment fine particle content in The Narrows was high, and as such sediment metal and nutrient concentrations were among the highest of the PCIMP zones. However, over three (3) sampling periods from 2013 to 2015, the only exceedance of the sediment guidelines that was recorded was for total nickel in The Narrows. In subsequent sampling in 2016 and 2017, for the metals where Sediment Quality Guidelines (SQG) were available, no exceedances were recorded and thus the sediments in PCIMP zones were deemed as 'Low Risk' (Flint et al 2016, Simpson et al 2013, Vision Environment 2018a,).

The banks north of Curtis Island are mobile beds of sediment with high calcium carbonate concentrations (derived from coral, molluscs, algae and foraminifera) that are moving around Curtis Island in a north-west direction. Sediments with the lowest calcium carbonate concentration occur

in the inshore sediments surrounding the Port, where total organic carbon (TOC) is high (Ryan et al 2006, 2009).

The Cooperative Research Centre for Coastal Zone, Estuary and Waterway Management (Coastal CRC) initiated a monitoring program to quantify concentration and loads of pesticides delivered to the Fitzroy Estuary from the catchment. Polycyclic Aromatic Hydrocarbon (PAH) concentrations in the sediments from the estuary were low and predominantly from natural sources. This is a reflection of the catchment not being highly industrialised or urbanised. Herbicides (e.g. Atrazines, Tebuthiuron, Diuron) were not detectable in benthic sediments. For metals, the level of contamination was low. Levels of Nickel, Chromium and Antimony exceeded trigger levels in several instances. Antimony, Silver, Nickel and Mercury were enhanced in several samples with Antimony and Silver indicating some historical accumulation. Geological sources are likely for Nickel and Chromium, while for the other elevated elements, sources are unknown (Vicente-Beckett et al 2006).

As part of a Capricorn Coast Beaches Study in 1979, over 600 samples from the mouth of the Fitzroy River to Stockyard Point to the north were analysed to provide a distribution of sediment types in terms of the percentage of mud content. The predominant sediment type in the Fitzroy Estuary was muddy sand with a large area of sandy mud in the middle of the estuary to the northwest of the main channel (BPA 1979). More recently, during the benthic fauna pilot monitoring program (BMT WBM 2015c), sediment samples were collected for particle size distribution analysis. This showed that among each of the sites examined that fines (mud and silt) dominated the composition of surficial seabed sediments. Most treatments had similar particle size distributions; however, a control site at the mouth of the Fitzroy River had the most sand, and one of the channel sites contained a sample with gravel. No cobble was recorded.

To understand the potential impacts of any of these properties in relation to maintenance dredging, GPC currently undertakes quarterly water quality monitoring (Section 9). If the need for maintenance dredging was to arise, a SAP would be developed prior to dredging to determine the quality of the sediment to be dredged. The SAP would be undertaken in accordance with the NAGD (Commonwealth of Australia 2009). While GPC has not yet undertaken an assessment of the sediments at the Port of Rockhampton from the NAGD, two (2) previous analyses have been undertaken in accordance with Section 86 of the *Queensland Harbours Act 1955* and the NAGD, respectively. One (1) study undertaken in 1999 found that the majority of compounds were below the maximum acceptable levels defined by the then QLD Environment Protection Agency (Walker and Springer 1999). While in 2009, sediment sampling and analysis showed that as per Table 3 of the NAGD, the sediment to be dredged at the Port of Rockhampton was considered uncontaminated for the purposes of sea placement (unpublished data).

While GPC has a limited ability to prevent contamination from many of the potential sources, GPC takes appropriate steps to prevent or minimise contamination through monitoring and managing all port activities under the EMS (Section 8) and through diligent port planning. GPC's planning functions include: planning future port and port-related development; reviewing and commenting on Environmental Impact Studies (EISs) for proposed development which could utilise the Port of Rockhampton; fulfilling a legislative assessment role for developments on or adjoining SPL under the *Planning Act 2016*; and management of activities undertaken on SPL and at Port facilities.

5.2.2 Biological characteristics

No dedicated Introduced Marine Pest (IMP) surveys have been undertaken at the Port of Rockhampton. However, in the process of undertaking a benthic fauna pilot monitoring program, it was noted that no specimen, identified to species, was a declared marine pest listed by the National Introduced Marine Pest Information System (NIMPIS) (BMT WBM 2015c, NIMPIS 2009).

Seagrass meadows are not well developed in the Port of Rockhampton area, most likely due to high turbidity and fluvial discharges from the Fitzroy River. Any seagrass meadows are likely to be restricted to shallow protected tidal banks, is expected to vary over time in response to changes in ambient water quality (water clarity) conditions. No seagrass has been observed in recent broad-scale surveys. Given the lack of seagrass in the vicinity of the dredged area and MRA, it is unlikely to be affected by port operations and on this basis would not represent a reliable indicator (BMT WBM 2015b).

A baseline seagrass survey focusing on the offset potential of Balaclava Island was conducted in 2021. The survey identified seagrass at Balaclava Island formed three (3) meadows, a large intertidal meadow to the south of Balaclava Island covering 181.24 ± 5.31 ha, and two (2) smaller meadows along the narrow intertidal bank on east of the island that cover 7.66 ± 0.99 ha and 0.18 ± 0.02 ha respectively (Smith et al 2022). For context the shipping channel is located on the northern side of Balaclava Island and was not in the identified seagrass footprints.

5.3 Minimisation of Sediment Accumulation and Dredging Needs

The objectives of the London Protocol and the Sea Dumping Act include minimising pollution caused by sea placement.

The London Protocol requires consideration of measures to prevent, reduce and where practical avoid the relocation of dredge material at sea. The key guiding principles of the MDS also prescribe areas of improvement such as the avoidance or minimisation of maintenance dredging, beneficial re-use and comparative analysis. Ports therefore aim to reduce their maintenance dredging requirements as much as possible and will only undertake dredging when necessary. It is also worth noting that maintenance dredging is considered an expensive and inconvenient requirement (Haskoning Australia 2016) and therefore should either be avoided or undertaken as efficiently as possible.

As part of the SSM Project, GPC undertook an options assessment for completely avoiding sedimentation, maintenance dredging and the placement of sediment at sea (PCS 2021a). As part of the assessment it was also necessary to predict future sedimentation within the Port of Rockhampton and the resultant changes in declared depths.

Based on analysis of historical bathymetric surveys, future sedimentation above design depths in the Port of Rockhampton is predicted to range between approximately 15,000 and 50,000 m³/yr over the next 20 years. These sedimentation volumes are due to the potential migration of outer channel sand banks. Some evidence of this migration has occurred resulting in movement of navigational aids to accommodate for historic migration. Over the initial five (5) years of this period the sedimentation above design depths within the Inner and Outer Port regions are predicted to be comparable, but from 10 to 20 years the sedimentation in the Outer Port region is predicted to be much higher.

After five (5) years of sedimentation with no sediment management, Berth 3 (southern berth) is predicted to no longer be operable and the Swing Basin is also predicted to not be navigable, with

insufficient depth for laden and unladen vessels in both areas. After 10 years the other two (2) berths (Berths 1 and 2) are also predicted to have reduced depths to the point where they would no longer be operable. Therefore, after 10 years of sedimentation with no sediment management the Port would not be able to continue to operate.

Bed levelling has successfully been used to maintain depths in the Inner Port region since 2011 and it is expected that this approach can continue to be used in this region in the future. However, this is not considered a realistic means to manage the future sedimentation which is predicted to result from the morphological evolution of shoals into the channels in the Outer Port region due to the volume requiring management and the sediment type. Therefore, it is predicted that in the order of 800,000 m³ of predominantly sandy sediment will require maintenance dredging from the Balaclava and Sea Reaches of the channel over the next 20 years to maintain the design depths.

The assessment has found that it is unlikely to be possible to completely avoid the placement of sediment from maintenance dredging at the Port of Rockhampton at sea in the lawful MRA over the next 20 years. However, it might be possible to avoid this over the next five (5) to 10 years before the sedimentation in the Outer Port region starts to limit vessel movements. Over 20 years it might be possible to reduce the volume of sediment placed at the MRA as opposed to completely avoiding it.

GPC currently employs a number of strategies to avoid and reduce maintenance dredging activities at the Port of Rockhampton. These are listed below:

- **Hydrographic survey:** repeat hydrographic surveys ensure that maintenance dredging is focused on the areas where sedimentation has occurred and that maintenance dredging is only undertaken when and where it is required. These surveys should comply with the Standards for Hydrographic Surveys in Queensland Waters (MSQ 2009) and the frequency of these surveys is dependent on location within the Port. At the Port of Rockhampton, a full survey is undertaken every five (5) years with annual surveys and bed levelling (see below) undertaken at certain areas with a history of shoaling
- **Bed levelling:** is used to level out high points in a channel and, therefore, help to reduce the frequency of maintenance dredging
- **Tidal windows:** vessel movements are maximised through shallower areas during higher stages of the tide to ensure sufficient under keel clearance. This approach can result in operational inefficiencies however has the potential to result in safety and environmental implications if not managed correctly and
- **Port Management:** ports will typically manage their infrastructure and operations to minimise the requirement for future maintenance dredging including working with port tenants and customers where possible.

Any further opportunities to avoid or reduce maintenance dredging requirements will be considered as part of GPC's continual improvement process for maintenance dredging (Section 1.3) and documented in subsequent versions of this plan

In addition to the above practices, and subsequent to the 'Avoid' assessment, GPC undertook a comprehensive objectives assessment of possible approaches to 'reduce' maintenance dredging (either the volume or duration) within the Port (PCS 2021b).

Reduce approaches that have been considered are based on three (3) broad strategies, (i) to keep sediment out, (ii) keep sediment moving and (iii) keep sediment navigable. A total of 13 possible reduce approaches were identified based on information from global best practise guidance. Of

these, three (3) approaches (bed levelling, nautical depth navigation and channel reconfiguring) were considered to be potentially feasible based on the configuration and natural processes in the Port of Rockhampton and were considered as part of an Objectives Assessment;

The three (3) approaches were assessed along with maintenance dredging combined with bed levelling as part of an Objectives Assessment. This considered objectives for 12 separate aspects which ensured a comprehensive assessment. Based on the Objectives Assessment, the following recommendations were made for the two (2) regions of the Port of Rockhampton:

- **Inner Port Area:** the approaches of bed levelling and nautical depth navigation were proposed as possible alternative approaches to maintenance dredging for the Inner Port area. In addition, there is also a safety risk associated with the nautical depth navigation as the approach potentially increases the risk of vessels grounding. As the approach of bed levelling has been successful in maintaining depths in the Inner Port area since 2011, it is likely that this approach would be successful in maintaining depths in this area for most conditions and as such it is recommended this approach should be considered as the ongoing primary sediment management approach for the area. It is also recommended that further investigation associated with the properties of the sediment, which is deposited in the Inner Port area after an extreme event should be undertaken, as it is possible that the nautical depth navigation approach could be adopted following extreme events combined with ongoing bed levelling. By adopting these two (2) approaches it is possible that the volume of sediment which needs to be placed at the MRA could be reduced by approximately 70,000 m³ over 10 years.
- **Outer Channels:** the approach of channel reconfiguration provides a number of benefits over maintenance dredging, including reduced Greenhouse Gas (GHG) emissions and requiring approval from the Regional Harbour Master. This option would also require additional approvals to be sought including recognition of potential impact to the adjacent FHA. However, there is uncertainty associated with the costs of the approach. In addition, it is possible that if the shoals continue to migrate / grow over time then sedimentation above design depths could occur in the new reconfigured channel after 15 years, which would mean that future maintenance dredging could be required, albeit a much smaller volume than predicted for the existing channel configuration.
By adopting this approach, it is possible that the volume of sediment which needs to be placed at the MRA could be reduced by approximately 125,000 m³ over the next 10 years, and potentially in the order of 800,000 m³ over the next 20 years.

If the alternative approaches detailed for the Inner Port area and the Outer Channels are all adopted, then there could be a reduction in maintenance dredging of approximately 195,000 m³ over the next 10 years. The approaches should mean that no ongoing maintenance dredging is required over the next 10 years, although there is a risk that the approaches might not be able to manage sedimentation due to extreme events which result in very high sedimentation rates. If it is found that the approaches are not be able to manage all future sedimentation, then it is possible that intermittent maintenance dredging might also be required (PCS 2021b).

5.4 Maintenance Dredging and Placement Requirements

Maintenance dredging has occurred three (3) times since 2000 at the Port of Rockhampton with the most recent campaign in 2011. Historical maintenance dredging campaign years and volumes are presented in **Table 5. Maintenance Dredging** Campaign Volumes since 2000 placed at MRA.

Table 5. Maintenance Dredging Campaign Volumes since 2000 placed at MRA

Campaign	Volume (m ³)
2000	20,000
2009	23,316
2011	40,507

There is currently no active environmental authority (EA) under the EP Act to undertake maintenance dredging at the Port of Rockhampton. A development approval for ERA16 has been issued for dredging at the Port of Rockhampton, however this did not transition through the amendments associated with the *Environmental Protection (Greentape Reduction) and Other Legislation Amendment Act 2012* (Greentape Reduction Act) that came into effect in 2013. A conversion application will be required for GPC to obtain an EA prior to dredging. There is an existing S86 approval under the QLD *Harbours Act 1955* for dredging and sea placement.

Loss of depth within the channels due to siltation has a significant impact on the draft of vessels that are able to transit and navigate efficiently and safely within the Port of Rockhampton. The navigational depths of the Port of Rockhampton are particularly affected by flood events, however the natural ability of the Port of Rockhampton to flush itself results in the return of stable natural depths (the design depth) within a few weeks. Any areas where shoaling has occurred require bed levelling over a course of a few days. It is only if the shoaling is too extreme for bed levelling that dredging by a TSHD would be required.

Based on historical volumes, Haskoning Australia (2016) provided an indication of average future dredging volumes per campaign as well as typical maintenance dredging frequency for all QLD Ports. For the Port of Rockhampton, it is expected that an average of 30,000 m³ will be dredged every five (5) years. However, the frequency of dredging may vary as demonstrated by the absence of a need for a campaign since 2011. Maintenance dredging of the main channels has been historically undertaken by the *TSHD Brisbane* (Section 7.1.1). Traditionally all maintenance dredging material from the navigational channels at the Port of Rockhampton has been relocated to the approved placement area (MRA) at the Port of Rockhampton (Figure 2). The MRA has an average depth of 10.5 m and an area of 657 000 m². While this area is mostly used to place small volumes of material (< 50,000 m³), its capacity is 600,000 m³.

The Global Positioning System (GPS) (WGS84) co-ordinates of the site are as follows and the location is illustrated in **Figure 2**:

23° 33' .409S	150° 54' .344E
23° 32' .656S	150° 55' .339E
23° 32' .803S	150° 55' .470E
23° 33' .514S	150° 54' .437E

5.5 Examination of Reuse, Recycle and Placement Options

The first step in the NAGD framework is the evaluation of alternatives to sea placement (Commonwealth of Australia 2009). A number of issues influence the decision regarding material placement options including the likely environmental impacts, social impacts, as well as economic impacts on both a local and regional scale. A summary of the options considered in the Port of Rockhampton SSM Project's Beneficial Reuse Assessment is provided below (PCS 2021c). A detailed

assessment of each shortlisted beneficial reuse option was undertaken against the same agreed evaluation objectives used in the Reduce Assessment. This was to identify any fatal flaws and provide recommendations for the options warranting further consideration.

A total of 16 potential beneficial reuse options were identified and assessed as part of a high level assessment which determined and removed options that are unlikely to be feasible at the Port of Rockhampton either based on suitability of sediment, opportunity, environmental impacts or economic costs. Following the high level assessment of all 16 options, three (3) beneficial reuse options were shortlisted for further assessment. The shortlisted options were for land reclamation, onshore aquaculture and construction. All of these options involve the pumping of sediment ashore and as such the costs associated with them are significantly more expensive than ongoing maintenance dredging and placement at the existing dredge MRA (largely due to the relatively high pipeline mobilisation cost);

An objectives assessment for each of the three (3) shortlisted options has been undertaken against a set of evaluation objectives developed by GPC through stakeholder engagement as part of the Port of Rockhampton SSM Project. A summary of the results specific to each option are provided below:

- **Land Reclamation:** this involves the reuse of predominantly sandy dredged sediments from the Outer Channel areas for increasing land elevations on existing SPL to ensure it is high enough to sustain future sea level rise. The costs for dredging and placement of 125,000 m³ of dredged material at the land reclamation sites is estimated to be two (2) times higher than for dredging with placement at the existing MRA. Similarly, the GHG emissions released for the dredging and placement at the land reclamation are higher (by about two (2) times) than for the dredging and placement at the existing MRA. In addition to the costs and GHG emissions associated with the dredging and placement of sediment, there are some additional costs and GHG emissions from the processing of sediments at the site. With the inclusion of these additional costs and emissions, this option is more than two (2) and a half times more expensive and the GHG emissions are three (3) times higher than for placement at the existing MRA
- **Aquaculture:** this involves the reuse of predominantly fine-grained dredged sediments from the Inner port area for use in aquaculture. Extensive potential aquaculture development areas (ADAs) have been identified within close proximity (20 to 30 km from the Port of Rockhampton) and these are likely to require silts and clays for use as liners or bunds as part of the initial development. There is also a potential ongoing opportunity for reuse of dredged sediment at the ADAs depending on the rate of development and the requirement to replace bunds following harvest. As the ADAs are proposed in areas of previously undeveloped land, there could be potential environmental impacts, which would require detailed assessment as part of the ADA site specific approval process. There is a risk that the ADAs might not be constructed over the next 10 years and even if they are, it is possible that the demand for sediment for construction does not align with the supply from maintenance dredging. The costs for dredging and placement over 10 years is almost five (5) times higher than for dredging with placement at the existing Offshore MRA. The GHG emissions released for the dredging and placement at the new MRA are also slightly higher (by around 50%) than for the dredging and placement at the existing MRA. In addition to the costs and GHG emissions associated with the dredging and placement of sediment, for this reuse option there are additional costs and emissions from the processing (including for the development of a MRA) and onward transport of the dredged material. With the inclusion of these additional costs and emissions, this option is 10 times more expensive and the GHG emissions are two (2) times higher than for placement at the existing MRA and
- **Construction:** this involves the reuse of both fine-grained and sandy dredged sediments from all areas of the Port for use in construction. It is understood that the salt fields located 5 to 10 km to the west of the Port of Rockhampton are either to be decommissioned in the

near future (and therefore would require silt and clay for capping) or would need raising to account for sea level rise if they are to stay operational (requiring silt and clay for lining and sandy material for raising bunds). Due to the close proximity to the Port of Rockhampton (particularly compared to other construction related opportunities, which are mainly focussed around Rockhampton some 50 to 60 km upstream of the dredge areas), this opportunity is considered to provide the most feasible opportunity for reuse of dredged sediment for construction. Not only are the salt fields located in close proximity to the Port of Rockhampton, but they are also located relatively far from other quarries and alternative sources of similar material and as such this option provides a mutually beneficial potential reuse. The costs for dredging and direct placement (via pipeline) over 10 years is five (5) times higher than for dredging with placement at the existing Offshore MRA. The GHG emissions released for the dredging and placement at the salt fields are also increased (by about two (2) times) relative to the dredging and placement at the existing MRA. No other costs and emissions have been included for any on site processing which may be required. In addition to local opportunities for reuse of sediment in construction, there is potentially a high demand for sand overseas, especially from Singapore, which could help mitigate against fluctuations in local demand. However, there remains a risk that the demand for sediment for construction purposes from external parties does not align with the supply of sediment from maintenance dredging. It is noted that land reclamation and aquaculture are not compatible with the adjacent FHA protection and management measures.

5.6 Selected Future Dredging and Placement Strategy

As discussed in Sections 5.2 to 5.5, GPC avoids maintenance dredging at the Port of Rockhampton as far as practical and if maintenance dredging is required, there is currently no alternative to sea placement. GPC's sea placement requirements and future dredging and placement strategy for the Port of Rockhampton will be revised as part of the continual review and improvement framework promoted by the MDS and implemented through this LMDMP (Section 1.3).

Sea placement is GPC's preferred placement method for material from the main navigational channels for following key reasons:

- Sediments transported into the channels are retained within the marine system;
- Important intertidal areas are not replaced by reclamation;
- Placing dredge material into reclamation areas is significantly more costly;
- Placing dredge material into reclamation areas is logistically more complex;
- Clays and other fine material in maintenance dredging material can take years to dry out, delaying the future use of the land;
- The *TSHD Brisbane* has limited pumping ability, necessitating a booster pump with additional cost and fuel usage;
- There are environmental risks specific to each placement method which would need to be considered and managed during maintenance dredging campaigns; and
- Material analysed at the Port of Rockhampton has been previously considered uncontaminated for the purposes of sea placement. This will be reassessed against the NAGD prior to the next maintenance dredging campaign.

6. Risk Assessment Framework

GPC's EMS is the overarching framework for the identification and management of environmental risks and the promotion of continuous improvement in port operations and management (

Figure 3). GPC's EMS first obtained certification under ISO14001 in 2006 and continues to meet the Standards requirements. The scope of the EMS is: *The development, operation and maintenance of the ports, port lands and associated infrastructure controlled by GPC.*

The EMS covers all GPC operational activities at all of its sites, including maintenance dredging activities. This LMDMP and its associated management documents form part of GPC's EMS.

GPC maintains its ISO14001 certification through a commitment to the continual improvement of environmental performance of its operations. GPC regularly conducts internal audits of its operations and undergoes regular external audits to maintain this certification (Section 10).



Figure 3. GPC's EMS Framework

The EMS is the framework used to drive continual improvements across GPC. Continuous improvement is achieved through the ongoing identification and implementation of improvement opportunities. To achieve this, GPC has implemented the following which are reflected in the contents of this plan and its associated management documents:

- A system that promotes behavioural-based environmental management by increasing awareness and encouraging proactive reporting;
- A robust internal and external compliance program based around inspections and audits; and
- Environmental improvement programs based on significant environmental aspects.

GPC's Risk Management Framework (**Table 6. GPC Risk Management Process**) provides the processes to ensure the EMS suitably identifies, analyses, evaluates, manages and monitors all aspects under the control or influence of GPC. The risk management process is an integral component of GPC's organisational and operational decision making and ensures all elements of potential impacts are assessed i.e. environmental, compliance, interested parties (stakeholders), project delivery etc.

Table 6. GPC Risk Management Process

Risk management process	Description
1. Identify risks (what could stop you from achieving your objectives?)	<ul style="list-style-type: none"> • Understand the context of any potential risks. • Review sources and impacts of risks. • Describe risks in clear and concise language.
2. Analyse and evaluate risks	<ul style="list-style-type: none"> • Use the best available information to develop an

Risk management process	Description
(determine the potential impacts of each risk and their likelihood of occurrence)	<p>understanding of the risk.</p> <ul style="list-style-type: none"> Identify controls in place to reduce the consequence or likelihood of the risk. Consider the effectiveness of controls. Evaluate the risk by nominating realistic consequence impacts. Make likelihood assessments for each nominated consequence impact. Map the consequence and likelihood ratings to the GPC Risk Matrix.
3. Manage risks (authorisation and escalation, treatment and recording)	<ul style="list-style-type: none"> Risks with a residual risk score of Medium and above must be escalated for review and authorisation prior to works commencing. Risk treatments to consider the hierarchy of controls, timing and resourcing. Record risks in the approved risk assessment templates.
4. Monitor and review risks	<ul style="list-style-type: none"> Monitor the implementation and effectiveness of controls. Risks assessed as high or extreme require status reports to GPC's Executive Leadership Team (ELT) Team and the Board of Directors.

While each regulator has particular requirements for their assessment processes, a risk assessment for maintenance dredging typically involves consideration of the following:

- Description of the proposed activity, including location, volumes of material to be removed, processes employed, duration and timing;
- Types of environmental risks and emissions, including water, land, air, waste and noise-related risks and emissions;
- The potential impacts of the dredging activity on environmental, social, cultural and heritage values;
- Description of the EVs both on and offsite that may be impacted by the dredging activity;
- Mitigation factors to prevent or minimise impacts on sensitive receptors, or the EVs, including options for monitoring, managing and mitigating the potential impacts of the proposed conduct; and
- An evaluation of all alternatives to sea placement (including all land-based placement and reuse alternatives).

Risk assessments are conducted for all new or changed activities and specifically for maintenance dredging prior to each dredging campaign ensuring risk controls are current, appropriate, communicated, implemented and monitored.

7. Identification and Treatment of Key Risks

The risk assessment process (Section 6) informs the development or review environmental and regulatory risks each maintenance dredging activity. This in turn informs the development or review of the relevant EMP and Environmental MP (Section 8 and 9). This process also informs the review of this LMDMP (Section 1.3).

The key aspects commonly identified for maintenance dredging activities in the Port of Rockhampton include:

- Dredging and material placement directly disturbing marine habitats;

- Dredge and material placement plumes and sedimentation impacting water quality and marine habitats;
- Hydrocarbon, chemical and waste leaks and spills impacting water quality and marine habitats;
- Air, noise or light emissions impacting air quality, megafauna and sensitive places;
- Marine megafauna strike;
- Severe weather events impacting normal operations;
- Marine pest introduction impacting marine habitat and normal operations;
- Non-conformance with statutory obligations impacting normal operations and GPC reputation; and
- Negative stakeholder perception impacting normal operations and GPC reputation.

7.1 Queensland Maintenance Dredging Schedule

The maintenance dredging schedule for the majority of QLD port dredging is determined by the Port of Brisbane Proprietary Limited (PBPL) who own and operate the *TSHD Brisbane*. The *TSHD Brisbane* is utilised by all QLD ports for the majority of maintenance dredging activities and by GPC for maintenance dredging of main navigational channel.

The process for development of the state-wide schedule was reviewed under the MDS. The schedule is developed annually in accordance with a QPA procedure (QPA 2021) which requires each port to define its maintenance dredging requirements and complete a Port specific environmental risk assessment for maintenance dredging. PBPL develops the state-wide maintenance dredging schedule by taking into account:

- Volume of material to be dredged at each port (hence dredging duration);
- Urgency of maintenance dredging required by individual ports (i.e. the degree of siltation, safety issues and schedule of deeper draft ships that may visit the port);
- Any permit specific issues (e.g. permit availability and conditions);
- Need to optimise dredge operation (e.g. avoid backtracking between ports);
- Opportunities to minimise the dredging duration at each port. Dredge operation is expensive and operational efficiency is a key management objective; and
- Important ecological and environmental timings.

This process is generally completed by late April once wet season effects (e.g. cyclones, floods) to EVs and siltation levels can be confirmed. The schedule, once complete, is provided to TMR and published on their website in accordance with the requirements of the MDS.

If maintenance dredging is required for the Port of Rockhampton, an abstract of GPC's Risk Register will be prepared and provided to the PBPL to inform the development of the state wide maintenance dredging schedule. The most recent version of this abstract is provided on GPC's website. The following key factors are generally considered for the Port of Rockhampton through this process:

- Marine megafauna (including fish) and breeding, interesting and migratory seasons;
- Extreme weather seasonality; and
- Dredging requirements.

7.1.1 TSHD Brisbane

TSHDs have typically undertaken the majority of the maintenance dredging at QLD Ports as they are the most suitable type of dredger. They have high production rates, can operate in offshore areas and heavily trafficked areas, have a hopper allowing offshore placement, and are well suited to dredging soft unconsolidated sediment typically associated with maintenance material (Haskoning Australia 2016).

The *TSHD Brisbane* was specifically designed for the maintenance dredging of QLD ports and has been the equipment of choice for QLD ports to undertake their maintenance dredging programs since it was commissioned in 2000 (Haskoning Australia 2016). Whilst it is noted that future maintenance dredging could be undertaken by other TSHDs with similar equipment features, the maintenance of GPC's main navigational channels has been undertaken by the *TSHD Brisbane* since 2000 and as such GPC's impact assessment and management measures for maintenance dredging presented in this LMDMP are primarily focused on this vessel.

The *TSHD Brisbane* was also designed with mechanisms to mitigate the environmental impacts caused by the dredging operations. These mechanisms are equivalent to the features installed in the latest TSHD models used around the world. Since the commissioning of the *TSHD Brisbane*, it has been updated regularly to incorporate the latest environmental advances in dredging technology, ensuring the *TSHD Brisbane* operates at the same level as the most recent built TSHDs (Haskoning Australia 2016). The environmental impact mitigation features are described below:

- **Central weir discharge system (green valve or anti turbidity function):** this system works by controlling discharge from the dredger to limit the turbidity of overflow waters entering the receiving environment. The *TSHD Brisbane* has five (5) equally spaced conical valves in the floor of the hopper which when opened release the material. The middle valve (DV3) is surrounded by a set of six (6) cylindrical rings stacked on top of each other to form a weir of adjustable height. When dredging light material such as silts, only the top ring is lifted to create the largest possible hopper capacity and settling time for the material. When the hopper reaches point of overflow, DV3 is partially opened to allow excess water to escape. The aperture of DV3 is regulated to maintain a water column within the circular weir stack and thereby minimise the entrapment of air in the overflow water. This reduces the amount of air bubbles which can act to carry material to the water surface and generate excessive plumes.
- **Below keel discharge point:** the discharge of sediment from the hopper occurs at keel level in order to prevent unnecessary turbidity and dispersal of fine sediments.
- **Turtle deflection devices:** a flexible chain deflector is attached to the drag heads to prevent the entrainment of marine turtles during dredging operations. The device design has been evolving for the last twenty years and its efficiency confirmed by several research projects.
- **Low wash hull design:** by minimising the size of wash waves created by the vessel movement, the low wash hull design reduces agitation on the water surface, minimising the interference with the sediments suspended in the water column during discharge. This design can also reduce fuel consumption and damage to riverbank environments.
- **Electronic positioning system:** the *TSHD Brisbane* is equipped with a DGPS which is used during the operations. The positioning data is used during the discharge operations to identify the beginning and end of the material placement locations and provide evidence to the regulators to ensure compliance with the material placement boundaries. The DGPS data also assists the contractor and clients to identify the areas of origin of the sediment for each cycle.
- **EMP:** PBPL maintain a Dredge Management Plan which addresses standard operational procedures to minimise environmental impact. Separate EMPs are also developed by PBPL for each specific port / project where it undertakes dredge works. Each EMP addresses matters specific to the project including possible risks and their associated mitigation and management actions, roles and responsibilities, local regulations, sensitivities and specific permit conditions. It is submitted for review and approval by each port prior to commencement of the work.

In accordance with Principal 10 of the MDS, any other TSHDs undertaking maintenance dredging works in the future at ports within the GBRWHA should result in environmental performance that is equal to or better than current equipment or methods used for navigational channel maintenance.

8. Environmental Management

Consistent with the MDS framework, GPC will utilise three (3) tiers of documentation for the management and monitoring of maintenance dredging activities at the Port of Rockhampton as detailed below and shown in **Figure 4**. These documents provide a comprehensive approach for planning and managing maintenance dredging over both the long term and for short term specific dredging campaigns. This structure provides consistency in achieving a comprehensive and strategic approach with respect to maintenance dredging and associated environmental management, which will provide benefits to port authorities and regulators over the longer-term. Additional key inputs to this process are the results of stakeholder engagement which are summarised in Sections 1.7.2, 1.7.3 and 4.

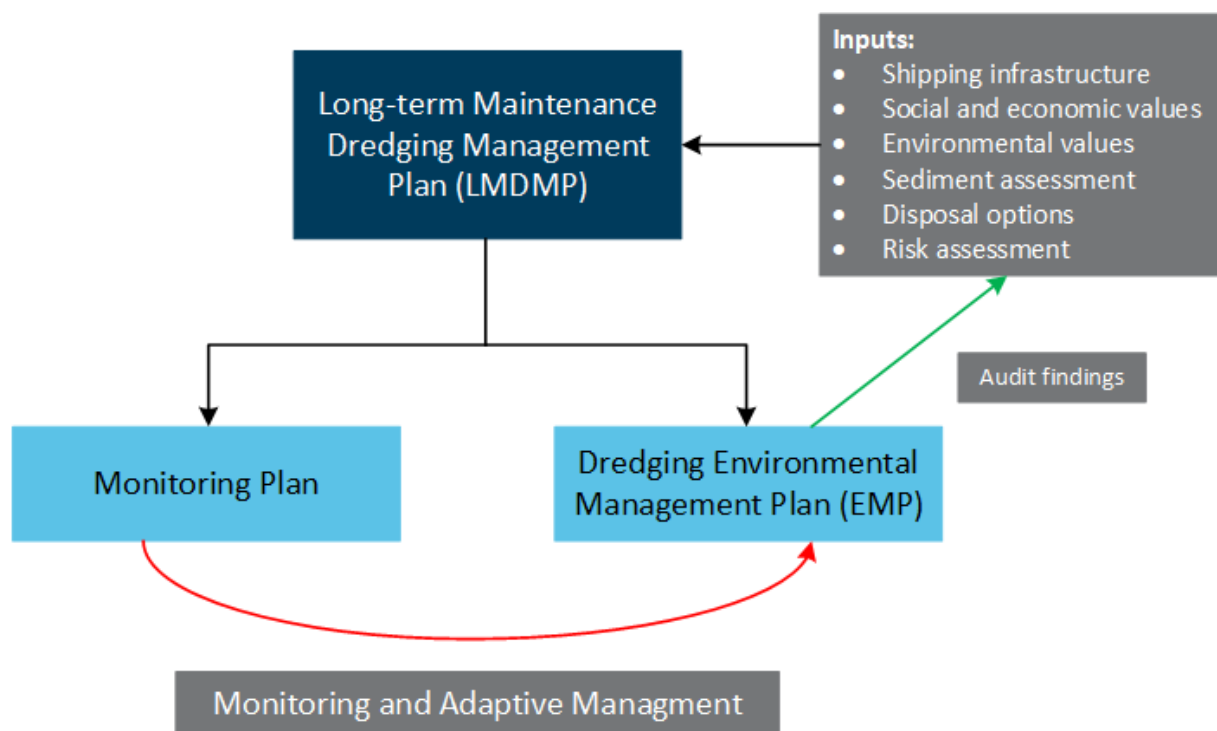


Figure 4. Elements of Dredging Management and Monitoring (TMR 2018)

The Port of Rockhampton's Maintenance Dredging EMPs will be developed in alignment with GPC's EMS and Risk Assessment Framework (Sections 6 and 7) to ensure an appropriate standard of risk assessment, quality assurance and document control. EMPs detail the specifics of managing each dredging campaign and include the following:

- Roles and responsibilities;
- Location and description of the activity;
- Scheduling and timing of the dredging operations;
- Statutory obligations and approvals;
- Measures to meet permit conditions;
- Pre-dredging actions such as notifications, linkages to monitoring plans, and dredge selection;
- Standard management measures relating to:
 - waste management
 - ballast water management
 - bunkering of fuel
 - vessel wash-down
 - marine pest monitoring and management

- adjacent FHA, marine parks and wildlife
- other key risks identified by the risk assessment process (Section 6 and 7);
- Adaptive management measures relating to:
 - water quality
 - marine fauna
 - climate conditions;
- Operation and incident reporting;
- Post-dredging actions such as surveys, monitoring, auditing and reporting; and
- Emergency provisions and contacts

In particular, the EMP outlines strategies and actions to minimise impacts and to avoid contamination and pollution and provide linkages to the environmental monitoring program (Section 9). This should include (TMR 2018):

- Specific and auditable measures to avoid or reduce impacts (for both the dredge and material relocation sites);
- Triggers and adaptive responses where necessary;
- Contingencies for natural events such as cyclones and floods;
- Compliance monitoring and reporting;
- Corrective actions for impacts identified by monitoring; and
- Responsibilities and timing for management and monitoring activities (refer to **Table 2 and Table 7. Port of Rockhampton Long-term Monitoring Schedule**).

The implementation and effectiveness of risk controls are monitored through EMS processes such as periodical risk reviews, audits, inspections, incident and complaint investigations, and reporting (Section 10) to ensure learnings are applied appropriately and continual improvement is facilitated.

9. Monitoring Framework

An Environmental MP is developed to monitor the effects of dredging activities and inform adaptive management. A key input into this procedure is the stakeholder engagement outlined in Section 1.7.2. The procedures implement relevant monitoring programs for each maintenance dredging campaign and include:

- A port-specific program addressing values and risks;
- Appropriate Quality Assurance and Quality Control (QA / QC);
- Data management and reporting requirements;
- Responsibilities and timing for management and monitoring activities (**Table 2 and Table 7. Port of Rockhampton Long-term Monitoring Schedule**); and
- The identification of monitoring containing three (3) parts:
 1. ambient monitoring programs: ongoing and related to key environmental parameters, used to inform impact assessment
 2. impact monitoring: before and after dredging analysis to confirm and refine impact management
 3. real-time monitoring: during dredging to inform adaptive management response actions

GPC focusses monitoring of the marine environment where:

- Sensitive or particularly high EV habitats may be adversely affected through the maintenance dredging activities; or
- There are gaps in knowledge or some uncertainty regarding the extent of potential impact and confirmation of assumptions or previous monitoring is considered warranted.

GPC's Long-term Monitoring Schedule (**Table 7. Port of Rockhampton Long-term Monitoring Schedule**) envisaged for the Port of Rockhampton includes sediment sampling, water quality sampling, benthic fauna monitoring, hydrodynamic modelling, impact assessments as well as

hydrographic surveys. Baseline water quality monitoring has been undertaken since 2014 to establish a valid ambient data set to use for comparative purposes during dredging campaigns. This monitoring regime was originally developed in line with PCIMP monitoring and has included analysis of physicochemical parameters (temperature, conductivity, pH, turbidity, dissolved oxygen, light attenuation). Other parameters measured have included total suspended solids (TSS), total and dissolved metals, nutrients and chlorophyll *a* (Vision Environment 2018b, 2019, 2020, 2021, 2022). Further refinements to **Table 7. Port of Rockhampton Long-term Monitoring Schedule** and the monitoring regime will be developed through consultation with the TACC (Section 1.7.2) and regulatory authorities, and will take into account any modelling and / or impact hypotheses made by BMT WBM (2015b) and any subsequent revision/s to this impact assessment (Section 3.3).

Table 7. Port of Rockhampton Long-term Monitoring Schedule

Monitoring component	Ambient, Impact detection, Real-time	Monitoring Objective	Activity	Impact Severity Zones *	Description	Monitoring period					
						2025	2026	2027	2028	2029	2030
Sediment quality	Impact detection	Placement of dredged material will not result in contaminant related impacts to the marine environment.	Placement	Dredge Footprint.	Sediment sampling and analysis in accordance with approved SAPs and comparison of levels to screening limits outlined in NAGD.	(1)	(1)	(1)	(1)	(1)	(1)
Water Quality	Impact detection	Sediments generated during dredging and placement do not subsequently reach sensitive areas in amounts that would be harmful to the ecological value and amenity of the area.	Dredging and Placement	Dredge footprint and outside dredge footprint.	Water quality monitoring adjacent to loading and / or placement activities.	(2)	(2)	(2)	(2)	(2)	(2)
Water Quality (Plume Validation)	Impact detection	Sediments generated during dredging and placement do not subsequently reach sensitive areas in amounts that would be harmful to the ecological value and amenity of the area and / or Pollutant concentrations within dredge plumes at the loading and placement sites do not reach levels where toxic effects or algae blooms could occur.	Dredging and placement	Dredge footprint and outside dredge footprint.	Water quality measurements and samples collected from within the plume.	(3)	(3)	(3)	(3)	(3)	(3)
Benthic fauna	Impact detection	Maintenance dredging activities do not result in impact to sensitive receptors.	Dredging and Placement	Dredge footprint and outside dredge footprint.	Benthic fauna and flora sampling and particle size analysis at sites within and adjacent to placement area.	(4)	(4)	(4)	(4)	(4)	(4)

Monitoring component	Ambient, Impact detection, Real-time	Monitoring Objective	Activity	Impact Severity Zones *	Description	Monitoring period					
						2025	2026	2027	2028	2029	2030
Hydrographic survey	Impact detection	The deposited material does not result in navigation hazards within and adjacent to the placement area.	Placement	Dredge footprint.	Hydrographic survey of placement area.	(5)	(5)	(5)	(5)	(5)	(5)
Marine pests	Impact detection	Maintenance dredging does not result in the introduction of marine pests into new environments within the port area.	Dredging and Placement	Dredge footprint and outside dredge footprint.	Survey of the location of and status of marine pests within the port.	(6)	(6)	(6)	(6)	(6)	(6)
Ambient water quality data sets	Ambient	N/A	Baseline	N/A	Development of a baseline dataset.	X (7)	X (7)	X (7)	X (7)	X (7)	X (7)
Real-time turbidity monitoring	Ambient	N/A	Baseline	N/A	Development of a baseline dataset.	(8)	(8)	(8)	(8)	(8)	(8)
Hydrodynamic modelling and impact assessment	Impact detection	Maintenance dredging does not negatively impact identified key sensitive receptors.	Baseline	Dredge footprint and outside dredge footprint.		(8)	(8)	(8)	(8)	(8)	(8)

*Predicted impact zones to be determined by the hydrodynamic modelling and impact assessment scheduled to be undertaken prior to the next maintenance dredging campaign

- (1) Prior to the commencement of dredging and then undertaken every five (5) years.
- (2) Prior to the commencement of dredging, water quality sites will be selected and monitoring will occur before, during and post dredging activity.
- (3) During 1st instance of dredging, contingent on maintenance dredging occurring during this period.
- (4) Benthic fauna survey every five (5) years pending commencement of maintenance dredging within the five (5) year time period.
- (5) Prior to the commencement of dredging activities and at a frequency outlined in approvals.
- (6) Marine pest survey if a detection occurs at Port of Gladstone and in consultation with the TACC (if required).
- (7) Ambient water quality monitoring.
- (8) Prior to the commencement of dredging or upon any significant changes to scope of dredging activities thereafter.

10. Performance Review

GPC's EMS (Section 6) provides the framework for governance by setting the rules and expectations for environmental management. This framework ensures the objectives of this LMDMP and its associated management documents are being met to better inform future risk assessment and impact assessment processes for maintenance dredging activities at the Port of Rockhampton. This framework also ensures enhanced environmental performance and the fulfilment of compliance obligations.

GPC's environmental performance monitoring processes include; but are not limited to:

- Performance indicators;
- Audits and inspections;
- Non-conformity and corrective action;
- Environmental monitoring and data;
- Reporting – internal and external;
- Document and record control; and
- Contingency planning.

All of these processes detailed further below support the EMS's contribution to the continual improvement framework outlined in Section 1.3 of this LMDMP which includes re-evaluation of GPC's options for managing port sediments.

10.1 Performance Indicators

Performance indicators allow GPC to determine the effectiveness of the dredging operations against risk-based criteria and statutory approval conditions. Performance indicators employed by GPC to manage each dredging operation would be detailed for each potential risk category in the EMP (Section 8). This would also incorporate monitoring undertaken through the MP (Section 9).

10.2 Audits and Inspections

Audits and Inspections will be undertaken to confirm that activities are carried out in line with the defined requirements set out in this LMDMP and associated management documents, including performance indicators as audit criteria. Audits and Inspections may also include assessing GPC's compliance with relevant legislation or other compliance obligations.

Audits and Inspections will be initiated and completed by the relevant GPC Department or by a suitably qualified auditor nominated by the SESG Department. Audit reports may be provided to external regulatory authorities as and when required. The SESG Department shall provide audit findings and reports to the GPC MO Department, as the department responsible for the dredging works.

10.3 Non-Conformity and Corrective Action

Events such as incidents, complaints and monitoring exceedances result in investigations to determine root cause and corrective action. The processes for responding to non-conformances are detailed in the EMP (Section 8). Reporting to regulatory authorities is undertaken in accordance with the conditions of statutory authorities relevant to maintenance dredging as described in the EMP.

Corrective actions ensure that GPC mitigates the reoccurrence of environmental incidents, complaints and monitoring exceedances and ensures continuous improvement of dredging operations. Corrective actions identified by GPC to manage the dredging operations are detailed for

each potential risk category in the GPC EMP. This incorporates monitoring undertaken under the MP (Section 9).

10.4 Monitoring Data

Monitoring and data analysis conducted by GPC provides the information required to inform the risk assessment framework, adaptively manage operations, demonstrate compliance and promote continual improvement. GPC's data management process ensures QA and QC. These processes are described in the Environmental MP (Section 9). Monitoring reports and data availability are discussed in Section 1.7.4 and Section 11.

10.5 Internal and External Reporting

To ensure that GPC ELT are fully informed, as appropriate, of the risks associated with maintenance dredging, reporting is undertaken in accordance with the Risk Management Framework (Section 6). Reporting to regulatory authorities is undertaken in accordance with the conditions of statutory authorities relevant to maintenance dredging described in the EMP (Section 8).

GPC participates in comparative analysis and coordinated maintenance dredging reporting to TMR in accordance with Principal 8 of the MDS and communicates with the TACC and other relevant stakeholders as detailed in Sections 1.7.2, 1.7.3 and 4. A summary of key information and accessibility is provided in Section 11.

10.6 Document and Record Control

All documents and records required by this LMDMP will be managed in accordance with GPC's Information, Document and Records Policies Standards and Procedures.

These include:

- Records of continual improvement processes including review of management and monitoring program outputs (Section 1.3)
- LMDMP implementation including employee and contractor familiarisation, approval by GPC representatives and regulatory authorities, review of the plan, version control and publication (Sections 1.3 and 1.4)
- Statutory approvals (Section 1.6)
- TACC membership, consultation records and outcomes (Section 1.7.2)
- Availability of reports and data and reporting under the MDS (Section 1.7.4)
- Stakeholder consultation in the development and review of this LMDMP (Section 4)
- Risk assessments and the identification and treatment of risks (Section 6)
- Assessment of maintenance dredging and placement options including efforts to minimise maintenance dredging and placement (Sections 5.2 to 5.5)
- GPC input into the development of the state-wide maintenance dredging schedule including the consideration of relevant ecological timings (Section 7.1)
- The environmental performance of any alternate TSHD (Section 7.1.1)
- Monitoring and management controls including implementation of the Long-term Monitoring Schedule, EMPs and Environmental MP (Sections 8 and 9).
- Governance records (Section 10)

Further document and record requirements are described in the GPC's EMPs and Environmental MPs.

10.7 Contingency Planning

Although management measures employed by GPC and dredging contractors during maintenance dredging cover most potential impacts, contingency arrangements are required in the event of emergency or abnormal operations. Potential emergency or abnormal operations are assessed in accordance with the GPC Risk Management Framework (Section 6). Contingency planning and emergency response during dredging operations is detailed in the EMP.

11. Supporting Information

A range of studies relevant to maintenance dredging informed the preparation of this LMDMP and will assist in the development of associated management documents. These include the outcomes of any monitoring programs commissioned by GPC at the Port of Rockhampton (Section 9) as well as by independent bodies. **Table 8. Synthesis of Key Supporting Information** provides a summary of the key studies and their accessibility. This information will be updated and revised periodically taking into account recent investigations in response to changes in risk or as a result of the completion of further monitoring. This section also provides the details of the information sources cited throughout this LMDMP.

Table 8. Synthesis of Key Supporting Information

Document	Author	Description	Availability	Next scheduled revision
External Information				
Reef 2050 Long-term Sustainability Plan (2018)	Commonwealth of Australia	<p>In 2015, the Commonwealth and Queensland governments released the Reef 2050 Plan. The Reef 2050 Plan responds to the World Heritage Committee's recommendation that Australia develop a long-term plan for sustainable development to protect the OUV of the GBR.</p> <p>Since the Reef 2050 Plan was released in 2015, the GBR has been deeply impacted by recent unprecedented climate driven mass coral bleaching events..</p> <p>In light of these events the GBR Ministerial Forum brought forward the scheduled mid-term review of the Reef 2050 Plan to ensure it addresses current pressures and remains effective. The updated Reef 2050 Plan is the result of the mid-term review.</p>	Department of Climate Change Energy, the Environment and Water (DCCEEW)	2020 (every five (5) years)
Maintenance Dredging Strategy (2016)	TMR	The aim of the MDS for GBRWHA Ports is to provide a framework for sustainable, leading practice management of maintenance	TMR website	Not specified

Document	Author	Description	Availability	Next scheduled revision
		dredging at ports in the GBRWHA.		
Maintenance Dredging Strategy for Great Barrier Reef World Heritage Area Ports: Technical Supporting Document (2016)	Haskoning Australia Pty Ltd	The MDS is based on the findings of a Technical Supporting Document providing a scientific and technical evidence basis for the guiding principles and actions.	TMR website	Not specified
Guidelines for Long-term Maintenance Dredging Management Plans (2018)	TMR	The Guidelines for LMDMPs support the MDS by providing State guidance on long term planning and management approaches which should be applied to maintenance dredging of ports in the GBRWHA. The Guidelines assist each GBRWHA port in preparing a LMDMP.	TMR website	Not specified
Long Term Monitoring and Management Plan Requirements for 10 year Permits to Dump Maintenance Dredge Material at Sea (2012)	Commonwealth of Australia	A Long Term Monitoring and Management Plan (LTMMMP) that covers the management of dredging at the port over the life of the permit needs to be submitted along with the permit application and approved DCCEE prior to the issuing of the sea dumping permit. LTMMMPs set out both the framework and specific measures for management, mitigation and monitoring of impacts and provide port authorities and other port managers with the opportunity to showcase their role as stewards for the marine environment. With reference to maintenance dredging the LTMMMP needs to demonstrate how the environment at the port and surrounds will be protected over the longer term and should identify responsible parties and include mechanisms for the regular review of compliance with permit conditions, as well as a process for continuous improvement of environmental management and performance.	DCCEE website	Not Specified
Schedule for State-wide	QPA	The Schedule for State-wide Maintenance Dredging for	TMR website	2023 (annual)

Document	Author	Description	Availability	Next scheduled revision
Maintenance Dredging of Queensland Ports (2022)		Queensland Ports describes the schedule for maintenance dredging of Queensland ports by the <i>TSHD Brisbane</i> . The Schedule is prepared by the QPA before maintenance dredging activities commence. The Schedule is based on information provided by individual ports and the dredge operator.		
Maintenance Dredging of Queensland Ports Review of Activities (2022)	QPA	The QPA prepares an annual review of the outcomes of the maintenance dredging program in relation to environmental performance, including timelines, volumes, evaluation of dredge material placement options and material placement locations, and outcomes of monitoring. The results of the annual review are incorporated into the dredging schedule for the following year.	TMR website	2023 (annual)
Environmental Code of Practice for Dredging and Dredged Material Management (Ports Australia 2016)	Ports Australia	Leading practice management of environmental risks associated with dredging is well defined and recognised internationally and nationally. This Code of Practice sets out a series of environmental principles that Australian ports follow when undertaking dredging and when reusing, relocating or disposing of dredged material.	Ports Australia website	2021 (every five (5) years)
National Assessment Guidelines for Dredging (Commonwealth of Australia 2009)	Commonwealth of Australia	The NAGD set out the framework for the environmental impact assessment and permitting of the ocean placement of dredged material. The framework includes: evaluating alternatives to ocean placement; assessing loading and material relocation areas; assessing potential impacts on the marine environment and other users; and determining management and monitoring requirements.	DCCEEW website	Not specified
GPC Information				
Port Alma Section 86 of	QLD Government	Approval for Channel Maintenance and Material	DES	N/A

Document	Author	Description	Availability	Next scheduled revision
Harbours Act (document number #117930)		Placement at Port Alma		
LMDMP (2023) (document number 1433446 v5)	GPC	<p>The QLD Ports MDS provides a framework for sustainable, leading practice management of maintenance dredging at ports in the GBRWHA (TMR 2016). The objective of the framework is to ensure the ongoing protection of the Reef's OUV and the continued operating efficiency of ports within the GBRWHA.</p> <p>This LMDMP for the Port of Rockhampton has been developed in accordance with the MDS framework.</p> <p>In addition, this LMDMP for the Port of Rockhampton has been developed in accordance with the MDS framework and considers the Checklist for Long-term Monitoring and Management Plans for Dredging (Commonwealth of Australia (2012). It is supported by the relevant EMP and / or Environmental MP.</p> <p>This LMDMP is relevant to all potential maintenance dredging activities undertaken by GPC within the limits of the Port of Gladstone.</p>	GPC website	2023 (every five (5) years or as required)
EMP	GPC	The Maintenance Dredging EMP for the Port of Rockhampton will be developed in alignment with GPC's EMS and Risk Assessment Framework to ensure an appropriate standard of risk assessment, quality assurance and document control. EMPs detail the specifics of managing each dredging campaign. In particular the EMP outlines strategies and actions to minimise impacts and to avoid contamination and pollution and	GPC website	To be developed when required

Document	Author	Description	Availability	Next scheduled revision
		<p>provide linkages to the environmental monitoring program.</p> <p>The EMP will be specifically developed to manage GPC's maintenance dredging and sea placement activities at the Port of Rockhampton and will be approved by the relevant regulatory agencies.</p>		
Environmental MP	GPC	<p>An Environmental =MP is developed to monitor the effects of dredging activities and inform adaptive management. The procedure implements relevant monitoring programs for each maintenance dredging campaign.</p> <p>An Environmental MP will be specifically developed to manage GPC's maintenance dredging and sea placement activities at the Port of Rockhampton. It implements the requirements of the Long-term Monitoring Schedule and will be approved by the relevant regulatory agencies.</p>	GPC website	To be developed when required
TACC ToR (document number #1314897)	GPC	<p>GPC will establish a TACC for Port of Rockhampton maintenance dredging operations, when required. A TACC is an important consultative mechanism intended to ensure that interested stakeholders have a forum to understand GPC's maintenance dredging activities and to assist GPC and regulatory agencies to access local knowledge and reconcile stakeholder interests.</p> <p>The TACC ToR will include important information about the scope, objectives, membership and administration of the TACC.</p>	GPC website	2025
TACC Minutes	GPC	Outcomes of the most recent TACC meeting proving an operations update, environmental update, LMDMP discussion and an introduction to	GPC website	As required

Document	Author	Description	Availability	Next scheduled revision
		the SSM Project.		
Risk assessment for scheduling annual maintenance dredging at the Port of Rockhampton	GPC	<p>This risk assessment is conducted to inform the Schedule for State-wide Maintenance Dredging for Queensland Ports and provides information to:</p> <ul style="list-style-type: none"> • Determine if there are any Port of Rockhampton specific risks associated with the scheduling of maintenance dredging by the <i>TSHD Brisbane</i> with a focus on environmental windows impacting on key EVs; • Identify if any changes in current control measures are required; and • Demonstrate GPC's maintenance dredging activities are managed in accordance with the principles of the MDS. <p>GPC's assessment and performance reporting to TMR for the Port of Rockhampton will be undertaken in accordance with the QPA procedure which ensures consistency between ports (QPA 2021).</p>	GPC website	To be developed when required
Implementation Report, Sediment Sampling and Analysis Plan for the Port of Rockhampton Maintenance Dredging	GPC contractor	<p>Maintenance dredging sediment sampling and analysis in accordance with approved an SAP and comparison of levels to screening limits outlined in NAGD and other relevant guidelines.</p> <p>The aim of the investigation will be to allow for a statistically valid evaluation of the physical and chemical sediment properties of the sediments to be dredged. The results of this assessment will assist in determining the suitability of sediment unconfined offshore placement.</p> <p>GPC's impact detection sediment sampling and analysis ensures that the dredging and material placement will not result in contaminant-related impacts to</p>	GPC website	To be developed when required

Document	Author	Description	Availability	Next scheduled revision
		the environment.		
Port of Rockhampton Ambient Water Quality Monitoring (2022) (document number #1883780)	Vision Environment	Near-field water quality monitoring to assess loading and placement activities at the Port of Rockhampton.	GPC website	2024
Port Alma Receiving Environment Monitoring Program Design Report. (2015b) (document number 1173716 v3)	BMT WBM	Initiation of the development of a Receiving Environment Monitoring Program to document procedures to monitor, identify, and describe potential impacts of dredging and dredged material placement activities on ecological receptors within the receiving waters of the Port of Rockhampton.	GPC website	Not required
Port Alma Benthic Fauna Pilot Monitoring Program. (2015c) (document number 1173715 v4)	BMT WBM	Pilot study was to characterise spatial patterns in benthic macroinvertebrate assemblages at the Port of Rockhampton.	GPC website	Not required

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Appendix A. Consultation Feedback and Responses

Issue	Feedback	GPC response
Department of Agriculture and Fisheries		
'options available for sediment management including re-use or placement'	Ensure any re-use or placement is undertaken in a way that avoids impacts on marine plants and/or the Fitzroy River declared fish habitat area (FHA).	FHA Network Strategy included as a key driver in Table 1. Review and Continual Improvement Summary.
GPC may seek the approval of this plan from relevant QLD and Commonwealth Government regulators to meet statutory approval requirements for management documentation	Any impacts on marine plants and/or the FHA not related to maintenance of existing lawful structures (i.e. the shipping channel, berth pocket, swing basin and the off-shore Material Relocation Area (MRA)) may require permits under the <i>Planning Act 2016</i> . For further information, seek pre-lodgement advice from the State Assessment and Referral Agency .	Noted: GPC is committed to ensure it undertake its activities in a lawful manner.
The LMDMP is not a statutory document and the QLD government will not have an 'approving' role for them	This seems to contradict the statement referred earlier from s. 1.4 (second row of this comments table). Perhaps 'endorsement' or even 'acknowledgment' would be a more accurate term for the previous reference.	It is a TMR requirement under the <i>Maintenance Dredging Strategy</i> (MDS) to develop an LMDMP in GBR ports in alignment with TMR guideline. While this document is developed and consulted there is no formal approval mechanism unless provided as an accompanying document to a required statutory approval where the regulator may endorse.
DAF Forestry requests that a reference to the <i>Forestry Act 1959</i> be included.	Reference to the <i>Forestry Act 1959</i> as follows: The <i>Forestry Act 1959</i> provides for the management of State forests and forest resources but also relates to the management of State owned quarry resources. Where dredging of State owned quarry material occurs, including within leases over tidal waters, and the resultant spoil is being beneficially reused or being disposed of outside of port lands, consideration should be given to the need for an authority under the Forestry Act.	Port of Rockhampton does not have any placement to land nor is there any plans to therefore the <i>Forestry Act 1959</i> has not been included in this review.
A TACC stakeholder group has been identified and was established in accordance with the NAGD	Include planningassessment@daf.qld.gov.au on list of TACC stakeholders.	The DAF Planning Assessment has been added to the Port of Rockhampton Technical and Consultative Committee (TACC) membership.

Issue	Feedback	GPC response
(Commonwealth of Australia 2009) and the LMDMP guidelines (TMR 2018)		
The Port is also included in the Fitzroy River Declared Fish Habitat Area (FHA).	This wording could potentially mislead or confuse some readers. Suggest that the authors confirm the port facilities and maintenance dredging footprint are outside the declared FHA. DAF understands that a specific channel has been excised from the FHA for this purpose and notes that maintenance dredging within a declared FHA is generally not in accordance with relevant policy.	Amendment to 2.1 Location and Environment Setting: The Port is also adjacent to the Fitzroy River Declared Fish Habitat Area.
Figure 2 – location of port infrastructure	Suggest to revise this figure to ensure— <ul style="list-style-type: none"> • Inclusion of a legend • Depiction of FHA boundary/layer • MRA terminology is reflected (the obsolete term ‘spoil ground’ appears in the draft version) Clear demonstration that the MRA and all port infrastructure is outside the FHA	<ol style="list-style-type: none"> 1. Legend has been included 2. The FHA boundaries will not be included as this figure relates to port infrastructure only. The Information on the FHA has been included in Section 3. 3. Map will be updated to use new terminology (MRA)
Key sensitive receptor / asset	Suggest including a discrete section relating to the Fitzroy River declared fish habitat area. The FHA is briefly mentioned in relation to item ‘Fish and shellfish communities’, however as a protected area with significant restrictions on development it should be highlighted in its own right. For relevant details please see the relevant DES FHA plan .	The Fitzroy River FHA is included in Table 3. Key Sensitive Receptors and Ecological Assets for the Port of Rockhampton as part of Fish and shellfish communities (sentence amended), and due to no direct impacts has not been included as a discrete section. FHA Network Strategy included as a key driver in Table 1. Review and Continual Improvement Summary
The results of this modelling demonstrated that the extents of the dredge plumes generated during both dredging and material placement operations do not extend to the following sensitive receptors at significant concentrations (BMT WBM 2015b): tidal wetlands, seagrass, benthic fauna, fish and shellfish communities, marine mammals,	Did this modelling consider the impacts of dredge plumes on the adjacent FHA? If so, provide this information in the LMDMP.	Additions to 3.3 Impact Assessment: When developing a monitoring program, it is important that the program has been designed to specifically test the hypotheses (BMT WBM 2015b). This included identifying the environmental values to be protected. Key sensitive environmental receptors and ecological assets near the dredge and placement area include: Intertidal habitats, including mangroves, saltpan and intertidal flats and seagrass, benthic macroinvertebrate communities, fish communities (The Fitzroy estuary,

Issue	Feedback	GPC response
marine turtles, shorebirds and coral reefs		<p>Raglan Creek and north Curtis Island are declared Fish Habitat Areas (BMT WBM 2015b), shorebird communities, marine megafauna species and coral habitats (BMT WBM 2015b).</p> <p>In addition given the relatively short duration of the dredge campaign (days) and the small volume of material to be relocated, potential impacts to macroinvertebrate communities (if measureable) would be most likely to occur, on the MRA, directly adjacent to the MRA, within the channel to be dredged, and directly adjacent to the channel to be dredged (BMT WBM 2015b).</p> <p>Addition to 5.2.2 Biological characteristics: Seagrass meadows are not well developed in the Port Alma area, most likely due to high turbidity and fluvial discharges from the Fitzroy River. Any seagrass meadows are likely to be restricted to shallow protected tidal banks, is expected to vary over time in response to changes in ambient water quality (water clarity) conditions. No seagrass has been observed in recent broad-scale surveys (Rasheed). Given the lack of seagrass in the vicinity of the dredged area and MRA, it is unlikely to be affected by port operations and on this basis would not represent a reliable indicator (BMT WBM 2015b).</p>
Port of Rockhampton biological characteristics.	Fisheries Queensland recommends commissioning a marine plants survey to determine marine plants' extent within the Port limits.	<p>Addition to 5.2.2 Biological characteristics: Seagrass meadows are not well developed in the Port Alma area, most likely due to high turbidity and fluvial discharges from the Fitzroy River. Any seagrass meadows are likely to be restricted to shallow protected tidal banks, is expected to vary over time in response to changes in ambient water quality (water clarity) conditions. No seagrass has been observed in recent</p>

Issue	Feedback	GPC response
		<p>broad-scale surveys (Rasheed). Given the lack of seagrass in the vicinity of the dredged area and MRA, it is unlikely to be affected by port operations and on this basis would not represent a reliable indicator (BMT WBM2015b).</p> <p>A baseline seagrass survey focusing on the offset potential of Balaclava Island was conducted in 2021. The survey identified seagrass at Balaclava Island formed three meadows, a large intertidal meadow to the south of Balaclava Island covering 181.24 ± 5.31 ha, and two smaller meadows along the narrow intertidal bank on east of the island that cover 7.66 ± 0.99 and 0.18 ± 0.02 respectively (Smith et al, 2022). For context the shipping channel is located on the northern side of Balaclava Island and was not in the identified seagrass footprints.</p>
<p>The assessment has found that it is unlikely to be possible to completely avoid the placement of sediment from maintenance dredging at the Port of Rockhampton at sea over the next 20 years.</p>	<p>Note that the FHA restricts any placement of sediment from maintenance dredging.</p>	<p>Amendment to 5.3 Minimisation of Sediment Accumulation and Dredging Needs: GPC may need to undertake maintenance dredging in the next 20 years and we intend to utilise the lawful MRA which is inside the approval footprint and outside of the FHA.</p>
<p>The approach of channel reconfiguration provides a number of benefits over maintenance dredging, including reduced Greenhouse Gas (GHG) emissions and approvals only expected to be required from the Regional Harbour Master.</p>	<p>It is possible that any channel reconfiguration would intersect the FHA. Note that the 'Boundary line (is) 300m from and parallel on each side of the centre line of marked navigation channel' (DES FHA plan) therefore any works beyond this extent would impact on the FHA.</p> <p>Any such impacts on the FHA would require a resource allocation authority (RAA) under the <i>Fisheries Act 1994</i> and development approval under the <i>Planning Act 2016</i>. However, it is unlikely that such an action could meet a prescribed development purpose for the FHA and therefore there would be significant complexity in securing relevant approvals for this proposal. Fisheries Queensland recommends consulting with the DES Marine Policy team to discuss potential issues</p>	<p>Noted: GPC is committed to ensure it undertake its activities in a lawful manner.</p>

Issue	Feedback	GPC response
	<p>and/or identify appropriate pathways for this proposal.</p> <p>In addition to the RAA and FHA requirements, there may be other State approvals needed, for example in relation to marine plants and tidal works; i.e. it may not be the case that approvals are only required from the Regional Harbour Master. If GPC intends to pursue this option, it is recommended that they seek pre-lodgement advice from the State Assessment and Referral Agency.</p>	
Shortlisted option – land reclamation	Note that Fisheries Queensland generally does not support filling of tidal lands for non-marine dependent development. Marine dependent development consists of infrastructure that is functionally required to be situated on tidal lands, such as boat ramps, pontoons and jetties. Non-marine dependent development is any infrastructure that can carry out its intended function without being situated on tidal land. See section 9 of the relevant policy position for more information.	Noted: GPC is committed to ensure it undertake its activities in a lawful manner.
The Plan could further address the potential impacts of climate change on dredging activities and vice versa.	<p>Integrating climate change considerations can help anticipate and manage changes in water availability, temperature, and weather patterns, which directly affect agricultural productivity. Improved resilience and adaptation strategies in dredging activities can minimise adverse impacts on agriculture due to altered hydrological cycles.</p> <p>DAF would like to continue to be consulted on such projects and their development stages that provide opportunity to comment.</p>	Noted: GPC is committed to ensure it undertake its activities in a sustainable manner.
<p>It is noted that the statement that no marine pests have been reported at the port, however this is based on dated surveys (2015).</p> <p>In the impacts management table it is noted that marine pest surveillance will be undertaken if needed but this is not defined.</p>	<p>It is recommended that marine pest surveillance should be undertaken in response to reports of any other Australian detections.</p> <p>The risk of introduction of marine pests via the dredge and any support vessels should also be noted as well as mitigating actions.</p>	Table 7. Port of Rockhampton Long-term Monitoring Schedule updated to reflect that GPC will undertake marine pest surveillance at the Port of Rockhampton if there is marine pest detection at the Port of Gladstone. GPC undertake marine pest surveillance under the Q-SEAS program and on a five (5)-yearly basis at our Port of Gladstone MRA.
Queensland Parks and Wildlife Service		

Issue	Feedback	GPC response
General	Limited recognition of the Fitzroy River declared Fish Habitat Area (FHA) and the adjacent Great Barrier Reef Marine Park and Great Barrier Reef Coast Marine Park.	Refer to responses for DAF in regards to FHA. Addition to 2.1 Location and Environment Setting : The outer channels are within the GBRMP and the GBR Coast MP. The Port and inner channels are adjacent but not within.
Consultation	The Port of Rockhampton Port Limits are within the Fitzroy River declared FHA, however the Marine Protected Area Policy unit of the Department of Environment and Science were not consulted. No feedback recorded in Appendix A.	The Marine Protected Area Policy Unity has been added to our Technical and Consultative Committee (TACC) membership.
Inner Port Area	Consideration should be given to impacts on the fish habitat values of the FHA and any flow on effect to the adjacent marine parks and wildlife.	FHA is included in Table 3. Key Sensitive Receptors and Ecological Assets for the Port of Rockhampton as part of Fish and shellfish communities (sentence amended), and due to no direct impacts has not been included as a discrete section. FHA Network Strategy included as a key driver in Table 1. Review and Continual Improvement Summary
Outer Channels	'..approvals only expected to be required by the Regional Harbour Master' – Other approvals may be required such as for damage to marine plants. Should the channel reconfiguration be proposed to extend outside of the channel corridor that is currently excluded from the FHA and impinge upon the FHA, a proposal would be required to adjust the FHA boundary. This would require detailed justification and is a significant process.	Amendment to 5.3 Minimisation of Sediment Accumulation and Dredging Needs : GPC may to need to undertake maintenance dredging in the next 20 years and we intend to utilise the lawful MRA which is inside the approval footprint and outside of the FHA.
Land Reclamation; Aquaculture	The locations for these potential options are not provided, however please note that land reclamation and aquaculture are not compatible with an 'A' management FHA.	Addition to 5.5 Examination of Reuse, Recycle and Disposal Placement Options : It is noted that land reclamation and aquaculture are not compatible with the adjacent FHA.
Environmental Management	Specific mention of the FHA, adjacent Marine Parks and wildlife and the necessity to reduce impacts on them should be included in this section.	Dot point added to Standard Management Measures: adjacent FHA, marine parks and wildlife
Monitoring Framework	'A port-specific program addressing values and risks' The Long-term Monitoring Schedule does not mention impact monitoring of the FHA or adjacent Marine Park, which are specific to the Port of Rockhampton.	Revise Table 7. Port of Rockhampton Long-term Monitoring Schedule plume monitoring to validate impacts on adjacent FHA and Marine Park – upon dredging activity commencing in the plan period.

Issue	Feedback	GPC response
		<p>Addition to 3.3 Impact Assessment:</p> <p>When developing a monitoring program, it is important that the program has been designed to specifically test the hypotheses (BMT WBM 2015b). This included identifying the environmental values to be protected. Key sensitive environmental receptors and ecological assets near the dredge and placement area include: Intertidal habitats, including mangroves, saltpan and intertidal flats and seagrass, benthic macroinvertebrate communities, fish communities (The Fitzroy estuary, Raglan Creek and north Curtis Island are declared Fish Habitat Areas (BMT WBM 2015b), shorebird communities, marine megafauna species and coral habitats (BMT WBM 2015b).</p>