Port of Townsville Limited
Long-Term Maintenance Dredging Management Plan
For Port of Townsville and Port of Lucinda
2019 - 2029
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### Acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Full Form</th>
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<tbody>
<tr>
<td>ASS / PASS</td>
<td>Acid Sulphate Soils / Potential Acid Sulphate Soils</td>
</tr>
<tr>
<td>ATSIHP</td>
<td>Aboriginal and Torres Strait Islander Heritage and Protection Act 1984</td>
</tr>
<tr>
<td>CCU</td>
<td>Channel Capacity Upgrade</td>
</tr>
<tr>
<td>CLG</td>
<td>Community Liaison Group</td>
</tr>
<tr>
<td>Cth</td>
<td>Commonwealth</td>
</tr>
<tr>
<td>DES</td>
<td>(QLD) Department of Environment and Science</td>
</tr>
<tr>
<td>DMPA</td>
<td>Dredge Material Placement Area</td>
</tr>
<tr>
<td>DNRM</td>
<td>(QLD) Department of Natural Resources and Mines</td>
</tr>
<tr>
<td>DoEE</td>
<td>Department of Environment and Energy (Commonwealth Department)</td>
</tr>
<tr>
<td>DPA</td>
<td>Dugong Protection Area</td>
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<tr>
<td>DTMR</td>
<td>(Qld) Department of Transport and Main Roads</td>
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<tr>
<td>DUKC</td>
<td>Dynamic Under Keel Clearance</td>
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<tr>
<td>EA</td>
<td>Environmental Authority</td>
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<tr>
<td>EIS</td>
<td>Environmental Impact Statement</td>
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<tr>
<td>EMP</td>
<td>Environmental Management Plan</td>
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<tr>
<td>EMS</td>
<td>Environmental Management System</td>
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<tr>
<td>EPBC</td>
<td>(Cth) Environment Protection and Biodiversity Conservation Act 1999</td>
</tr>
<tr>
<td>ERA</td>
<td>Environmentally Relevant Activity</td>
</tr>
<tr>
<td>FHA</td>
<td>Declared Fish Habitat Area</td>
</tr>
<tr>
<td>GBR</td>
<td>Great Barrier Reef</td>
</tr>
<tr>
<td>GBRMP</td>
<td>Great Barrier Reef Marine Park</td>
</tr>
<tr>
<td>GBRWHA</td>
<td>Great Barrier Reef World Heritage Area</td>
</tr>
<tr>
<td>GOC</td>
<td>Government Owned Corporation</td>
</tr>
<tr>
<td>IMO</td>
<td>International Maritime Organisation</td>
</tr>
<tr>
<td>LMAC</td>
<td>(Townsville) Local Marine Advisory Committee</td>
</tr>
<tr>
<td>LTMDMP</td>
<td>Long Term Maintenance Dredging Management Plan</td>
</tr>
<tr>
<td>LTMMMP</td>
<td>Long-term Monitoring and Maintenance Plan for Maintenance Dredging</td>
</tr>
<tr>
<td>MDS</td>
<td>Maintenance Dredging Strategy</td>
</tr>
<tr>
<td>MNES</td>
<td>Matters of National Environmental Significance</td>
</tr>
<tr>
<td>NAGD</td>
<td>National Assessment Guidelines for dredging 2009</td>
</tr>
<tr>
<td>OUV</td>
<td>Outstanding Universal Values</td>
</tr>
<tr>
<td>PIANC</td>
<td>Permanent International Association of Navigation Congresses</td>
</tr>
<tr>
<td>POTL</td>
<td>Port of Townsville Limited</td>
</tr>
<tr>
<td>SAP</td>
<td>Sediment Sampling Analysis Plan</td>
</tr>
<tr>
<td>TACC</td>
<td>Technical Advisory and Consultative Committee</td>
</tr>
<tr>
<td>TMP</td>
<td>Townsville Marine Precinct</td>
</tr>
<tr>
<td>TSHD</td>
<td>Trailer Suction Hopper Dredge</td>
</tr>
<tr>
<td>WQA</td>
<td>Water Quality Action</td>
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</table>
1. Introduction

Port of Townsville Limited (POTL) is a statutory Government Owned Corporation established under the Government Owned Corporations Act 1993 and the Government Owned Corporations Regulation 2014. POTL manages both the Port of Townsville and the Port of Lucinda (see Figure 1).

Under the Transport Infrastructure Act 1994, POTL is required to establish, manage and operate efficient port facilities and services. This legislative responsibility extends to the provision of safe navigational access to marine facilities and infrastructure such as harbours, berths and channels under POTL’s jurisdiction.

In order to comply with the Transport Infrastructure Act, POTL must maintain navigable areas within the port’s jurisdiction to target design depths to the greatest extent possible, which at the Port of Townsville, means regular maintenance dredging activities to remove natural accumulations of sediments within the existing port facilities. The Port of Lucinda does not require maintenance dredging activities to meet the Transport Infrastructure Act, due to the natural characteristics of the bay in which the 5.6 km long jetty and conveyor system sits in naturally deep water.

Both the Port of Townsville and the Port of Lucinda are considered World Heritage Ports. Neither are located within the Great Barrier Reef Marine Park, however, are both within the Great Barrier Reef World Heritage Area, and as such, under Queensland State legislation, requires a Long-Term Maintenance Dredging Management Plan (as described under the Queensland Government’s Maintenance Dredging Strategy). The Port of Townsville also requires a Long-Term Monitoring and Maintenance Plan for Maintenance Dredging under the Environment Protection (Sea Dumping) Act 1981 as a supporting document for an application for sea placement of maintenance material is required.

This document – the Long-Term Maintenance Dredging Management Plan (LTMDMP), is intended to meet the requirements for both the State and Commonwealth Long-term maintenance dredging management plans. This document is separated into two schedules for clarity, as different governmental requirements exist at the two World Heritage Area Ports:

- **Schedule 1** is for the Port of Townsville (covering both State and Commonwealth requirements for maintenance dredging, sea and land placement); and

- **Schedule 2** is for the Port of Lucinda (State requirements only – noting that no maintenance dredging or sea/land placement activities occur at this port).
1.1 Policy Context

The requirement of a Long-term Maintenance Dredging Management Plan (LTMDMP) has been implemented through the Queensland Department of Transport and Main Road’s Maintenance Dredging Strategy (MDS). As part of the Commonwealth Government’s Reef 2050 Plan, the principles of decision making seeks a standardised LTMDMP framework for all World Heritage Area Ports to follow.

The use of the LTMDMP is expected to provide Ports and Regulators with a standardised, coherent document that ensures a leading practice, consistent, transparent, and accountable process has been applied to both the selection of maintenance dredging placement options (by Ports), and the assessment of such options (by regulators); see Figure 2 which depicts the Long-Term Maintenance Dredging Management Framework.
The requirement for a long-term plan under Commonwealth legislation was implemented under the objectives of the London Convention (Convention on the Prevention of Marine Pollution by Dumping Wastes and Other Matters 1972) and the 1996 Protocol to the London Convention. These initiatives aimed to adopt a uniform approach to the disposal of dredge material at sea in Australia by way of the Commonwealth Long-term Monitoring and Maintenance Plan for Maintenance Dredging. The Cth LTMMMP is to set out a framework of specific measures for the management, mitigation and monitoring of the impacts from maintenance dredging and placement activities. The Cth LTMMMP also aims at providing Ports with the opportunity to make available to the public their role as stewards for the marine environment.

1.2 Objectives

Port of Townsville Limited’s objectives for this Long-term Maintenance Dredging Management Plan for the Port of Townsville and Port of Lucinda are:

a) Maintaining safe navigation for the continued operation of both Ports;

b) Ensuring the Outstanding Universal Characteristics (OUV’s) of the GBRWHA and sensitive receptors surrounding both the Port Townsville and the Port of Lucinda are maintained

c) Ensuring a robust, transparent long-term planning approach to the management of sediments within Port infrastructure

d) Continue the long-term proactive and environmentally responsible management approach of maintenance dredging and material placement at the Port of Townsville;

e) Capture and communicate operational controls for best management; and

f) Support local and regional communities, ensuring the health, wellbeing and connectivity to the global market is maintained.
1.3 Scope

This document covers both the Port of Townsville and the Port of Lucinda, as both ports are managed under Port of Townsville Limited (POTL) and both are World Heritage Area Ports.

The Port of Townsville:

Routine maintenance dredging is undertaken regularly, at the Port of Townsville, within the following areas:

- Sea Channel
- Platypus Channel
- Outer Harbour
- Inner Harbour
- Berths 1, 2, 3, 4, 8, 9, 10, and 11
- Townsville Marine Precinct (TMP)
- Ross River (adjacent to TMP)
- Ross Creek (sporadically and only when necessary)

All material required to be removed during as part of maintenance dredging is tested in accordance with the National Assessment Guidelines for Dredging (NAGD) 2009. This document is a federal document that is also utilised by state regulators. Material approved for sea placement is placed in an approved Dredge Material Placement Area (DMPA) as depicted in Figure 3; other material that cannot be placed at sea is then placed on land (Figure 4).

Full details for the Port of Townsville see Schedule 1; Section 2.4 of Schedule 1 outlines the Navigation infrastructure and capacity diagrams for the Port of Townsville.

The Port of Lucinda:

Maintenance Dredging is not required at due to the natural characteristics of the bay, including the 5.6 km long jetty and conveyor system, which moves sugar from the terminal out to berthed ships, sitting in deep water (~14 meters). Whilst there is no requirement for dredging at this facility, this document outlines the values, considerations, and processes to be undertaken prior to any dredging be approved from both State and Commonwealth Governments.

Full details of the Port of Lucinda can be found in Schedule 2. Section 2.4 in Schedule 2 outlines the Navigational infrastructure and capacity of the Port of Lucinda.
Figure 3. Location of DMPA within Cleveland Bay, Townsville

(Google earth imagery, 02/04/2016)
Figure 4. Onshore placement areas for maintenance dredge material, stockpile and reclamation areas
1.4 Review timeframe and process

As per the LTMDMP Guidelines, POTL will formally review the document at the end of the first five years (December 2023). This review will include:

- Engaging with stakeholders to discuss how the document is or is not meeting the objectives
- Update the document to include any new development approval permits, and reflect any relevant legislation updates
- Incorporate research and monitoring updates, including any knowledge learnt from programs undertaken
- Formally review POTL’s risk assessment, and updating any developments into the LTMDMP
- Incorporate the revised Sediment Sampling and Analysis Plan (SAP), due to be completed by 2022.

POTL also intends to undertake regular reviews through the duration of the lifespan of this document, to ensure any updates, results, or other factors identified which could change the outcomes of this document (e.g. new beneficial reuse options).

1.5 POTL Governance

Port of Townsville has a number of approvals to undertake maintenance dredging and placement activities within Cleveland Bay, these are:

<table>
<thead>
<tr>
<th>Permit type</th>
<th>Reverent Legislation</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental Authority (EA)</td>
<td>Environmental Protection Act 1994</td>
<td>State Authority to undertake maintenance dredging in approved areas of the Port of Townsville</td>
</tr>
<tr>
<td>Sea Dumping Permit</td>
<td>Environmental Protection (Sea Dumping) Act 1981</td>
<td>Commonwealth approval for Port of Townsville’s placement of maintenance dredging material at sea in the designated and approved DMPA</td>
</tr>
<tr>
<td>Operational Works (Tidal works)</td>
<td>Planning Act 2016</td>
<td>State Approval for Port of Townsville’s placement of maintenance dredging material at sea in the designated and approved DMPA</td>
</tr>
<tr>
<td>Allocation of Quarry Material</td>
<td>Coastal Protection and Management Act 1995</td>
<td>State Approval for Port of Townsville’s maintenance dredging material to be placed on land</td>
</tr>
</tbody>
</table>

POTL does not hold any approvals to undertake maintenance dredging or placement activities at, or for, the Port of Lucinda.

1.5.1 Maintenance dredge and placement legislation and statutory obligations.

The following is the list of legislation and statutory obligations under which POTL currently operates for the purposes of maintenance dredging and placement activities:
International Legislation


- This protocol is a global convention aimed at the protection of the marine environment, promoting the sustainable use and conservation of marine resources. Under the Protocol, member nations may allow dumping of particular material, including dredge material, following an assessment of impacts. POTL reports (via the Department of Environment and Energy) sea placed dredge material volumes to the International Maritime Organisation, (IMO), each year.

Commonwealth Legislation

Environment Protection (Sea Dumping) Act 1981;

- This act: implements Australia’s obligations under the London Protocol. It applies to all vessels, aircraft and platforms in Australian Waters, and to Australian vessels/aircraft in any part of the sea.

POTL is required to seek approval for the placement of dredge material at sea (in the designated Dredge Material Placement Area) under this act, to the DoEE.

National Assessment Guidelines for Dredging (NAGD) 2009

- The NAGD: aims to provide a clear set of standards for assessment and permitting of dredge material proposed for sea disposal.

POTL uses these guidelines in determining the sediment suitability of sea placement development applications for maintenance dredge material to both State and Commonwealth governments.

Environment Protection and Biodiversity Conservation (EPBC) Act 1999

- The EPBC: provides a legal framework for the Australian Government to protect and manage Internationally and nationally important flora, fauna, ecological communities, and heritage place, (matters of national environmental significance).

Sea placement of maintenance dredge material for the POTL does not trigger a referral to the EPBC, however, all considerations for Matters of National Environmental Significance (MNES) are incorporated in POTL’s Environmental Management System (EMS). Considerations of World Heritage Values are an intrinsic part of Port of Townsville’s risk assessment, including options and management controls.


- POTL entered into an agreement with the Commonwealth Department of Environment and Energy in 2015 under Section 19 of the Sea Dumping Act, to undertake a number of research and monitoring programs. This agreement and associated programs were intended to replace the commitments previously included in the then Long-Term Dredge and Disposal Management Plan.
Great Barrier Reef Marine Park Act 1975

- This Act: is an important piece of Commonwealth legislation in providing long-term protection and conservation of the environment, biodiversity, and heritage values of the Great Barrier Reef.

POTL’s operational areas are not within the GBRMP for either the Port of Townsville or the Port of Lucinda; both exclusion zones do however directly abut the park. In 2015 the GBRMP Regulations banned the sea disposal of capital dredge material.

Queensland State Legislation

Transport Infrastructure Act 1994, and Transport Infrastructure (Ports) Regulations 2016

- This Act aims to establish a regime under which a ports system is provided and can be managed within an overall strategic framework.

POTL is bound by this act to establish, manage and operate effective and efficient port facilities and services at both the Port of Townsville, and the Port of Lucinda.

Sustainable Ports Development Act 2015

- This Act aims to provide for the protection of the Great Barrier Reef World Heritage Area, through management port-related development in and adjacent to the area.

The Port of Townsville has been listed as a Queensland Priority Port, where master port planning is required to optimise the use of infrastructure and address operational, economic, environmental and community relationships as well as supply chains and surrounding land uses (as required under the Actions of the Reef 2050 Long-term Sustainability Plan).

Lucinda has not been listed as a priority port, there are no changes to operational requirements, or for the need for master planning (as yet).

Environmental Protection Act 1994

- This Act is for the protection of Queensland’s environment; with the objective to protect Queensland’s environment while allowing for development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends (ecologically sustainable development).

The Port of Townsville holds an Environmental Authority (EA) for a number of Environmentally Relevant Activities (ERA’s) including ERA16d (maintenance) Dredging >1,000,000t/yr; as covered under this Act.

POTL does not hold an ERA16d for the Port of Lucinda.

Planning Act 2016, and Regulations 2017

- This Act aims to provide for an efficient, effective, transparent, integrated, coordinated and accountable system of land use planning and development assessment to facilitate the achievement of ecological sustainability.
POTL is bound by this Act for Development Applications for the placement of maintenance dredge material at sea (Tidal works).

Coastal Protection and Management Act 1995, and Regulations (2017)

- One of the four main objectives of this Act is to provide for the protection, conservation, rehabilitation and management of the coastal zone, including its resources and biological diversity.

POTL is bound by this Act as the operational areas of both the Port of Townsville, and Port of Lucinda, Townsville’s channels and placement area (DMPA), and Lucinda’s Jetty, all sit within Coastal Management Districts. The Port of Townsville is required to seek approval for the placement of maintenance dredge material on land (Allocation of Quarry Material) under this Act, to the Department of Environment and Science.

Fisheries Act 1994, and Regulations 2008

- This Act is to provide for the use, conservation and enhancement of the communities’ fisheries resources and fish habitats.

This Act provides the provisions about development offences against Fisheries resources (including unlawful marine plant disturbances) for the Planning Act 2016; (penalties for carrying out development without a permit; and penalties for non-compliance with particular development approvals).

Aboriginal and Torres Strait Islander Heritage and Protection Act 1984

- The ATSIHP Act is to protect areas and objects that are of particular significance to Aboriginal and Torres Strait Islander people.

The Port of Townsville has a Cultural Heritage Management Plan registered with the Queensland Department of Aboriginal and Torres Strait Island Partnerships.

Marine Parks Act 2004

- This Act’s main purpose is to provide for the conservation of the marine environment (which includes the declaration of marine parks). POTL Port Limits are not within the Queensland Marine Park, however, the line of Port limits and the edge of the DMPA boundary are both directly adjacent to the Marine Park. POTL ensures no impact upon the Marine Park occurs – including when placing maintenance dredge material in the DMPA.

Other Relevant Governance

Maintenance Dredging Strategy

- Launched by the Queensland Government to address the requirements of the Reef 2050 Water Quality Action (WQA)16. The MDS aims to provide certainty to the ports industry and wider community that the economic and social contribution of ports is maintained while ensuring the continuing protection of Queensland’s environmental assets.

POTL has created this document (Long-term Maintenance Dredging Management Plan) to address the requirements of the Maintenance dredging strategy, for both the Port of Townsville and Port of Lucinda.
Port of Townsville’s Dredge Material Placement Area (DMPA)

- DMPA is legislated over by both Queensland State and Commonwealth legislation. The whole DMPA is defined to be within Australian Waters, and as such is regulated by the Commonwealth Department of Environment and Energy. The section of the DMPA that lies within Port limits is considered to be coastal waters, and as such is also regulated by the Queensland Government, under the Environmental Protection Act – see Figures 5 and 6.

Ports Australia Environmental Code of Practice for Dredging and Dredge Related Material, 2016

- Ports Australia has developed the Code of Practice which sets out a series of environmental principles that Australian ports follow when undertaking dredging, and when reusing, relocating or disposing of dredge material.

POTL follows the principles of this Code, given the outstanding ecological values of Cleveland Bay, and the greater Great Barrier Reef Marine Park.

Figure 5. Port of Townsville, Port limits within Cleveland Bay
DoEE has legislative jurisdiction over the whole DMPA, both inside and outside of Port Limits

Queensland State legislative jurisdiction lies over the section of the DMPA within Port Limits

Commonwealth Government jurisdiction covers the whole DMPA due to being wholly within Australian waters. Whereas Queensland State Government jurisdiction covers the lower section of the DMPA, as this is within State waters.

1.5.2 Roles and responsibilities

Port of Townsville Limited is a Government Owned Corporation (GOC) established in its current form on the 1st July 2008 as per the Commonwealth Corporations Act 2001 and the Queensland Government Owned Corporations Act 1993. Being a GOC, POTL has two Queensland Shareholding Ministers and a board of directors within our reporting structure. Figure 7 shows the current POTL Governance Structure framework.

POTL has a Corporate Governance Manual which details the responsibility for fulfilling the legislative corporate governance obligations that rest with the Directors and Officers of POTL. Please refer to the POTL website Governance page for more detailed information on Corporate Governance, Roles and Responsibilities, and all associated documents, [https://www.townsville-port.com.au/about-us/governance/](https://www.townsville-port.com.au/about-us/governance/)
Figure 7. POTL governance structure flow chart (as per the 2017/2018 POTL Annual Report)
POTL leases both land and infrastructure to different companies and industries to utilise and operate their businesses from. Port Customers, users, and leaseholders responsibilities are:

- Abide by the conditions of their lease;
- To act and undertake their business lawfully (including obtaining all relevant approvals to their work, including Environmentally Relevant Activates [ERA’s] under state legislation);
- Abide by the Environmental Protection Act and do no environmental harm
- Report all exceedances of regulated activity to their relevant authority and to POTL.

1.5.3 Stakeholder consultation

POTL has undertaken stakeholder engagement in the preparation and delivery of this Plan, including undertaking a detailed risk assessment analysis, and public review period. POTL recognises the full public review period was short, however, this document is the culmination of years of research and consultation, including being granted development approvals for maintenance dredging placement on land and at sea by both State and Commonwealth Governments. Noting that a full public submission period was a voluntary process of the POTL, to ensure all aspects of the document were provided, and gave consideration to all of Cleveland Bay.

POTL is committed to continuing consultation via the already established pathways of the:

- Technical Advisory and Consultative Committee (TACC)
- Community Liaison Group (CLG)
- Port Working Group (PWG)
- Port Advisory Body (PAB)
- Townsville Local Marine Advisory Committee (LMAC); and
- Queensland Ports Association (QPA)

Including contact with:

- Maritime Safety Queensland (MSQ)
- The Australian Defense Force (ADF)
- Townsville City Council (TCC)
- North Queensland Conservation Council (NQCC)
- A number of Not Government Organisations (NGO’s) and Not-for Profit organisations
- CSIRO,
- AIMS,
- JCU,
- GBRMPA,
- DoEE, and
- The Queensland Government - DES, DAF, DNRM, and DTMR,

POTL’s LTMDMP is a living document, in which the addition of new information, research and monitoring results, adaptive management options, and regulatory requirements can be included outside the designated review periods.
2. Port Locality, Setting and Shipping

2.1 Location and environmental setting

The Port of Townsville (19°15'S, 146°50'E) is situated in the centre of the growing city of Townsville, the leading population centre in tropical North-East Queensland, approximately 1,359 kilometres north of Brisbane, Queensland's capital city. The port is located in the southwest of Cleveland Bay, in between the mouths of Ross River and Ross Creek (Figure 8). Magnetic Island, a continental island located approximately 8 km offshore, lies at the northern entrance to the bay.

Cleveland Bay is a naturally broad and shallow bay; it is bounded to the east and west by Cape Cleveland and Cape Pallarenda respectively, which are approximately 26 km apart. The bay is north facing, and a naturally turbid water body enhanced by significant sediment loads received from the Burdekin catchment and maintains significant sediment mobility through natural re-suspension. Dominant winds from south to east means the bay is relatively protected from prevailing breezes (Kettle et al. 2002).
2.2 Port of Townsville Overview

The Port of Townsville was founded in 1864, born out of the need for a close and obstacle-free access to the harbour by the pastoral industry of the day.

The Port of Townsville currently has eight (8) operational berths which service both imports and exports for Northern Queensland, including (imports) vehicles, fuel, furniture, electrical goods, cement, bitumen and minerals; and (exports) agricultural products, mineral concentrates, sugar, and cattle. The Port of Townsville also maintains an international cruise terminal and the port is critical to Defence operations (POTL, Web, 2018).

2.3 Current and future uses

Current uses:

In the 2017-2018 financial year, the Port of Townsville totalled a trade throughput of 6,757,148 tonnes (POTL 2018). This volume accounted for Containerised cargo (819,999t), dry bulk (4,149,458t), liquid bulk (1,415,533t), break bulk (372,158t). The Port of Townsville also docked 12 cruise ships with 13,000 passengers.
and crew; and 24 (combined) Australian, New Zealand and the United States Defence Force vessels were berths at the Port. Figure 9 details the 2017/2018 trade snapshot.

Future uses:
The Port of Townsville was designated as a Priority Port in 2015, under the Sustainable Ports Development Act 2015. Under this Act, as a Priority Port, and as a port-related action of the Reef 2050 Long-Term Sustainability, the Port of Townsville is required to undergo Master Planning. Master Planning is set out to support the sustainable development of critical economic infrastructure, the state’s priority ports, in a way that will balance growth, job creation, environmental values, and community interests (DTMR, 2018).

The Department of Transport and Main Roads has undertaken Master Planning for the Port of Townsville, with the Draft Master Plan open for public consultation from the 5th November to 17th December 2048. Following the consideration of public submissions and the finalisation of the master plan, the Queensland Government will then release the draft Port Overlay for public consultation. Once the Master Plan and Port Overlay have been finalised, any additional relevant information will be included in the LTMDMP.

A number of cruise ships have been booked in over the coming three years, a cruise ship schedule is available on the POTL website. Currently 11 ships with 14,745 passengers and crew are booked in for 2019; 9 ships with 10,939 passengers and crew are booked in for 2020, and currently, 4 ships with 3222 passengers and crew are booked in for 2021.

Commodities are likely to remain highly diverse due to the catchment and area the Port of Townsville supports. It is likely that containers, fuel and cars will continue to increase in response to the regional population demands.
Figure 9. Trade Snapshot for the 2017-2018 financial year (2017/2018 Annual Report, POTL 2018)

(note dry bulk volume include Lucinda’s volumes)

TRADE SNAPSHOT

SUGAR AND MOLASSES
As Australia’s largest sugar exporter POTL moved a combined tonnage of 1,695,112 of sugar.
Townsville exporting 1,060,099 (grown predominately in the Burdekin area) and Lucinda exporting 675,013 product grown in the Herbert region.

MINERALS AND FERTILISERS
Dry bulk comprises cement, coke, mineral concentrates, fertiliser, sulphur, sugar and zinc fertilisers. In 2017/18, the dry bulk sector accounted for 4,730,224 tonnes.

MOTOR VEHICLES
Motor vehicle imports improved by 22% to a record-breaking 17,659 vehicles, the highest import figure since 2009/10.

CATTLE
In 2017/18, the Port facilitated the first shipment of live cattle from Northern Australia to China.

COPPER, LEAD AND ZINC
Copper concentrate exports also increased by more than 160,000 tonnes, up 51% from 2016/17.
Break bulk which includes lead and zinc ingots, comprised 5% of trade volumes in 2017/18.

LIQUID BULK
Liquid bulk comprises of petroleum, bitumen, sulphuric acid, caustic soda, bauxite and molasses. In 2017/18, liquid bulk accounted for 1,415,533 tonnes.

CRUISE SHIPPING
With two vessels accommodating the budget/families market the majority of vessels that visited the Port were luxury/boutique.

CONTAINERS
75,827 TEUs in 2017/18. Record-breaking growth in containerised cargo trade was driven by general cargo imports, linked to ongoing demand for renewable energy project cargo in north and central Queensland.

DEFENCE
The Australian, New Zealand and United States Defence Forces visited the port with a combined total of 24 vessels.
2.4 Navigational infrastructure and capacity

Routine maintenance dredging is undertaken regularly at the Port of Townsville in order to maintain effective and safe port operations – including shipping. Maintenance dredging occurs within the following areas:

- Sea Channel
- Platypus Channel
- Outer Harbour
- Inner Harbour
- Berths 1, 2, 3, 4, 8, 9, 10, and 11
- Townsville Marine Precinct (TMP)
- Ross River (adjacent to TMP)
- Ross Creek (sporadically and only when necessary)

Figures 10 and 11 show the areas the Port of Townsville has been granted for dredging, these areas are described as lawful structures, in which maintenance dredging can occur.

Figure 11 and Table 1 list the approved depths in which maintenance dredging can occur.

Figure 11 also shows the location of the Dredge Material Placement Area, in which the majority of maintenance material is placed. For those areas of the port in which maintenance dredging cannot be placed at sea, this material is placed on land, in the areas as shown in Figure 12, this includes minor volumes at a local council waste facility, on an agreement with the council.

Figures 13 and 14 are representative of the shape of the two channels – the Platypus and Sea Channels for optimum capacity for vessels entering and exiting the Port of Townsville.
Figure 10. Lawful Structures within the Port of Townsville
Figure 11. Lawful Structures Within the Port of Townsville and Cleveland Bay
Figure 12. Onshore maintenance material stockpile and Reclamation Areas
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Figure 13. Platypus and Sea Channel Typical cross section

Figure 14. Ross River Channel cross section
3. Port of Townsville Environmental Values

The Port of Townsville has a standalone *Environmental and Social Values* document which provides a detailed assessment of the values of Cleveland Bay, which is due for release on the Port of Townsville’s website in the first quarter of 2019. The following section is a detailed snapshot of the Environmental and Social Values of Cleveland Bay.

3.1 Environment (and Social) values

3.1.1 Climate and coastal processes

Located within a dry tropical region, Townsville is characterised by a tropical, seasonal wet and dry climate. High humidity and frequent storms, with occasional cyclones, typically occur during the wet season (November to April). The dry season (May to October) produces mild and moderate temperatures. The temperature ranges from a mean maximum of 31.5°C in December to a mean minimum of 13.7°C in July. Relative humidity is highest in the morning and monthly averages range between 60% during September/October and up to 75% in the wet season (peaking in February). Average annual rainfall in Townsville is approximately 1,128 mm, with the majority typically recorded during the wet season (December to March).

Cleveland Bay is a relatively low energy wave environment as it is sheltered from the predominant south-east waves by Cape Cleveland. Accumulated sediments make the bay relatively shallow, deepening to only 10 to 11 m (below chart datum) along its northern aspect, and averages 2-6 m across the bay. The coastline continues to be shaped by the prevailing waves at a slower rate, determined by the generally low energy waves and punctuated by the occasional higher energy cyclone waves that are able to penetrate across the bay onto the shoreline.

The Port of Townsville and surrounding coastal areas have been extensively modified over time. The port lands have been increased significantly by land reclamation and the placement of both maintenance and capital dredged material, dating back to the establishment of the port in 1864. The surrounding waterways have also been modified, The Ross River has been dammed, along with the installation of three instream weirs, and Ross Creek has been shortened and no longer connects with the Ross River. The Strand Beach is a significant coastal feature located immediately west of the port. It is a man-made public area which was redeveloped in 2000, with the construction of five beach units separated by artificial rocky headlands, to control the natural longshore transport of sand. The Strand Beach has large grain-sized imported sands and steep beach fronts, again to minimise the loss of these constructed areas.

Climate change projections indicate that the region’s future climate is likely to be characterised by:

- increased average annual temperature and increased number of days with maxima over 35°C;
- increased annual potential evaporation, and more drought-like conditions;
- increase in the frequency and severity of tropical cyclones;
- increased average wind speeds;
- elevated sea level and increased frequency and height of storm surge.
Careful planning of the potential effects of natural events such as cyclones and floods including predicted climate change risks are a key consideration in port planning, design and operations.

3.1.2 Marine ecosystem values of Cleveland Bay

Cleveland Bay supports numerous rich and diverse coastal habitats with varying ecological sensitivities, typically abundant in north-east Australia’s coastal wet-dry tropics including:

- Soft bottom communities, occupying over 85% of the Bay;
- Intertidal and subtidal seagrass beds, are present in about 10% of the Bay and provide food for the threatened dugong and turtles and are also a nursery for prawns and fish;
- Mangrove and saltmarsh communities, containing twelve species of mangrove and 15 species of saltmarsh, all of which:
  - provide a nursery and shelter for fish, mud crabs and prawns;
  - trap tide-borne sediments and help control coastal erosion;
  - provide vital protection from strong winds, tidal surges and heavy rainfall associated with cyclones, which occasionally affect this part of Queensland’s coastline;
- Forested, brackish and freshwater swamps; and
- Corals which occupy only around 1% of the Bay.

There has been a substantial amount of research on the marine ecology of Cleveland Bay and the surrounding Great Barrier Reef. The following sections provide a brief description of the major aspects of the marine ecosystem values of Cleveland Bay.

Reef communities

Reef communities comprised of hard corals exist around Magnetic Island, Middle Reef and Virago Shoal, located between Magnetic Island and Cape Pallarenda, see Figure 15). A large number of hard corals have been recorded in these communities, including extensive areas of *Montipora digitata*. The distribution and abundance of coral species vary in the fringing reefs and is related to the physical characteristics of the substrate and energy environments.

Coral cover, species diversity and aesthetic quality are generally considered higher in the fringing reefs on the northern side of Magnetic Island (Horseshoe Bay) than in other fringing reefs. The Cockle Bay reefs, located on the south-western side of Magnetic Island, are characterised by species that are better adapted to high siltation and turbidity, with a general trend toward decreasing coral density in comparison to reef habitat in Geoffrey Bay, located on the south-eastern side of Magnetic Island (Bell & Kettle 1989). A previous study of the fringing reefs on the south-eastern side of Magnetic Island between Florence Bay (north) and Geoffrey Bay (south) indicates that these areas are qualitatively similar (Mapstone et al. 1989). Magnetic Island reefs also show more pronounced depth gradients compared with most other reefs of the GBR due to the high water turbidity in Cleveland Bay.
Figure 15. Reef communities around Magnetic Island (extract from Port Expansion AEIS, 2016)
Benthic Communities

Soft sediment communities dominate the seabed of Cleveland Bay (Kettle, Dalla Pozza, & Collins 2001). The most common groups of benthic infauna present in the area include polychaetes, sipunculids, bryozoans and crustaceans such as amphipods and tanaids (Cruz Motta & Collins 2004). Benthic communities provide a significant food source for many species of fish, including higher order consumers, which are also targets for recreational fishing.

A number of additional baseline studies have been undertaken as part of the Port Expansion Project Environmental Impact Statement (AECOM 2009) to characterise the benthic environments in and around the Outer Harbour, the entrance channels and at the offshore DMPA. These studies characterised sediment type as well as epifauna and infauna communities in these areas – the following is an excerpt from PEP EIS Section B6 Marine Ecology and Conservation.

The breakwaters and revetments of the port provide hard substrates that support a range of algal and sponge dominated communities, as well as corals in more quiescent areas. Video-based surveys suggested that sparse and patchy epibenthic communities (i.e. organisms living on the seabed) occurred throughout the port and surrounding areas. Mid-shore assemblages were comprised of occasional hydrozoans, sea pens, crinoids and ascidians. Channel assemblages were the most depauperate, with only one feather star (crinoid) recorded. Hydrozoans were the most abundant taxon in the nearshore areas and were much less common in the DMPA, mid- and offshore control areas. Assemblages were dominated by plumulariid and sertularellid stinging hydroids, with occasional alcyonid soft corals, ascidians, and bryozoans.

Epibenthos assemblages in the DMPA were dominated by a type of burrowing goby. Of the 149 fish observed in video transects, 142 (95%) were burrowing gobies, and 124 of these were observed in the DMPA. Sea pens (Pennatulaceae) were particularly common at the DMPA but were only occasionally observed in the mid-shore and Outer Harbour area and absent elsewhere. Bryozoans, sponges, polychaetes, ascidians (sea squirts), echiruans (spoon worms), hydrozoans and alcyoniid soft corals were occasionally observed. The small patches of rock in the DMPA provide habitat for reef-associated taxa such as sea pens, ascidians and some crinoids, and represent areas of locally higher biodiversity in the DMPA. In comparison to the DMPA, epibenthic assemblages were generally similar at other offshore areas, although sea pens and many hard substrate/gravel associated taxa recorded at the DMPA were not observed and very few Alcyonacea soft corals were recorded at the DMPA.

Seagrass Communities

Seagrass meadows occur in parts of Cleveland Bay and provide both important habitat and food resources for a range of species of conservation significance, including dugong and turtles as well assisting in stabilising sediment and trapping and recycling nutrients (Roelofs et al. 2003). With the exception of the DMPA, seagrass is not known to occur in the existing port infrastructure, although shallow water and intertidal seagrass beds can occur nearby (e.g. near the Ross River mouth and along The Strand). Seagrass beds are extensive in the eastern portion of Cleveland Bay, away from almost all of the City’s development. Smaller beds occur across the Strand, Kissing Point, Pallarenda Beach, and some bays fringing Magnetic Island (Wells and Rasheed, 2017). The seagrass habitats within this region are of high ecological significance and provide a regionally important foraging habitat for threatened species such as dugongs and turtles and economically important fishery species.
The primary locations within Cleveland Bay for seagrasses tend to be in areas that are less than 4 m in depth, between the mainland and Magnetic Island, and adjacent to Cape Cleveland (Lee Long et al. 1993).

A number of studies of the spatial and temporal distribution of seagrass in Cleveland Bay have been undertaken over the years, but most recently baseline and annual surveys of seagrass, commissioned by Port of Townsville Limited (POTL), have been undertaken by James Cook University these these have been undertaken since 2007. The baseline surveys identified large and continuous seagrass meadows in Cleveland Bay, most commonly in lower intertidal and shallow sub-tidal areas. The best quality shallow seagrass meadows occur as shallow beds near Cape Cleveland, The Strand, Cape Pallarenda and around Magnetic Island. The dominant species in shallow waters include *Halophila ovalis*, *Halodule uninervis*, *Zostera capricorni*, and *Cymodocea serrulata*. The reef flats surrounding Magnetic Island support areas of *Thalassia hemprichii*.

The distribution, extent and density of seagrass assemblages in near-shore areas can show great variation over a range of temporal scales (particularly seasonally and inter-annually) in response to variations in a range of environmental factors. In particular, changes in the light availability, that result from wave-driven bed sediment remobilisation and turbidity associated with catchment discharges, are key drivers of temporal change in seagrass meadows (Taylor & Rasheed 2009). Previous surveys found that the near-shore seagrasses had also significantly diminished in biomass over the years since monitoring started. However, the most recent seagrass surveys conducted in Cleveland Bay (Davies et al. 2014) found that Townsville remains one of the few coastal areas in the Wet and Dry Tropic regions where seagrasses continue to show substantial recovery from the climate-related losses that occurred in 2011.

Cleveland Bay, and on occasion the DMPA, contains ephemeral deep-water seagrass beds. These deep-water meadows are typically patchy (non-contiguous, fragmented beds) with a sparse cover and low species richness. The deep-water meadows also show seasonal and inter-annual variability, with the surveys from 2007 to 2016 showing a decline in biomass of these communities. The restricted deep-water meadows suggest that either the light environment has not improved enough, or that some other factor is more influential in meadow recover in deeper habitats (Wells and Rasheed, 2017); including those attributed to effects derived from seasonal flooding.

**Mangrove Communities**

Mangrove communities represent diverse communities growing in the intertidal zone of tropical to temperate coastal rivers, estuaries and bays (Lovelock 2003). They are most extensive in the South-east portion of Cleveland Bay between Sandfly and Cocoa creeks, and in the Ross River, south of the port. Smaller, structurally simpler mangrove stands occur in Rowes Bay and at Three Mile Creek. Predominant threats to mangrove ecosystems arise from land use conflicts and local effects on water quality.

The occurrence of particular mangrove species is dependent on environmental factors such as salinity (Sam and Ridd 1998), nutrient availability (Walker and O’Donnell 1981), oxygen levels in the sediment and wave energy (Brinkman et al. 1997). At least seven direct studies have been undertaken on the mangroves of Cleveland Bay and twelve species of mangroves have been recorded.
Saltmarsh Communities

Cleveland Bay is also home to over 15 species of saltmarsh species. Saltmarshes are ecologically important habitats, as they link the marine environment to terrestrial, and provided habitat for both marine and terrestrial organisms (Goudkamp and Chin, 2006).

Saltmarsh communities tent to occupy the areas of low energy, intermittent, tidal inundation areas, on sheltered soft substrates, and often occurring behind mangrove communities (Creighton, Gillies and McLeod, 2015). Different saltmarsh community types produce different benefits to the ecosystem, including sediment trapping, nutrient cycling, dissipation of wave energy, fish and prawn nursery, carbon sequestration, and feeding areas for birds (Creighton et al, 2015).

Distribution throughout the bay depends on the site microhabitat and seasonal influences from both land and sea direction. Saltmarshes play an important role in the ecosystem by providing organic matter, a rich supply of nutrients, and support a great diversity of both marine and terrestrial life (adapted from RIVER Group, 2004).

Marine Megafauna

Cleveland Bay is recognised as a key foraging area for the flatback turtle (*Natator depressus*) and a key feeding and nesting area for the green turtle (*Chelonia mydas*) (GHD 2011). The port footprint is not an area of high utilisation for turtles (GHD 2012), however the following marine megafauna species, as listed under the *Nature Conservation (Wildlife) Regulation 2006*, have been observed within proximity of the port:

**Endangered:**
- Loggerhead Turtle (*Caretta caretta*);
- Leatherback Turtle (*Dermochelys coriacea*);
- Olive Ridley Turtle (*Lepidochelys olivacea*);

**Vulnerable:**
- Dugong (*Dugong dugon*);
- Green Turtle (*Chelonia mydas*);
- Hawksbill Turtle (*Eretmochelys imbricate*);
- Flatback Turtle (*Natator depressus*);

**Near Threatened:**
- Australian snubfin dolphin (*Orcaella heinsohni*);
- Indo-Pacific humpback dolphin (*Sousa chinensis*).

Other commonly sighted native marine fauna in and around the Port of Townsville include whales, saltwater crocodiles, and various species of sea snakes.

The waters of Cleveland Bay are entirely within a Dugong Protection Area (DPA) and dugongs are known to be relatively abundant in the bay. Megafauna monitoring undertaken by GHD for the Townsville Marine Precinct and Port Expansion Projects, (GHD 2009 and 2012), found that dugongs were found most often in areas with a greater concentration of seagrass in Cleveland Bay; including the meadows near the southern and eastern shores of the bay. Boat-based and aerial marine megafauna surveys have been conducted in Cleveland Bay
between 2008 and 2012. Turtles, dugongs, rays, sea snakes and dolphins were observed as part of these surveys. Both the Australian snubfin dolphin and the Indo-Pacific humpback dolphin were also observed as part of these surveys and were reported to be highly mobile and move in and out of Cleveland Bay, both of these near-threatened species, are considered to be opportunistic generalist feeders on fish and cephalopods. The species is an opportunistic generalist, feeding on fish and cephalopods (octopus, squid etc.) from coastal, estuarine and nearshore reef habitats (PEP EIS, Section B6).

**Fish and Fisheries**

The mangroves, seagrasses, reef and soft bottom benthic communities present in Cleveland Bay provide habitat for a variety of fish species. Fishing for target species is a common practice in Cleveland Bay, undertaken by traditional owner, commercial and recreational fishers within the tidal creeks and estuaries. Prawn trawling, coastal net setting and crab pot fishing occur on a commercial scale, in and beyond Cleveland Bay. The net and crab pot fisheries target species such as mud crabs, barramundi, threadfin salmon, grunter and flathead.

Fish habitat areas have been established in Cleveland Bay, the Bohle River, and in Bowling Green Bay. These areas provide protection and breeding grounds for target indigenous, recreational, and commercially important species (including barramundi, grunter, mud crabs and prawns). While these species are highly mobile, it is recognised that the loss of important habitats such as for feeding or breeding associated with habitats, including seagrasses, and reef and benthic habitat, may affect long-term stock levels and abundance. Commercial fishing has been restricted within parts of Cleveland Bay since the implementation of Dugong Protection Areas in 1998. Other limitations are placed on commercial and recreational fishing through the Great Barrier Reef Marine Park (GBRMP) boundaries and zoning maps and limited access within identified secure areas for shipping. No major aquaculture facilities are currently operating in the Cleveland Bay area.

**Birds**

Cleveland Bay is home to over 450 different species of birds, including migratory and coastal species, (wildlife online 2018). Of the 452 species identified in and around the Townsville Region, 22 species were listed as Endangered, Vulnerable under the State’s Nature Conservation Act; of these 22 species 3 were listed as Critically Endangered, 8 as Endangered, and 5 as Vulnerable under the EPBC Act.

**Table 2. Threatened species of Cleveland Bay**

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<th>Commonwealth EPBC Status</th>
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<td>Beach Stone-Curlew <em>Esacus magnirostris</em></td>
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<td>Glossy black-cockatoo (northern) <em>Calyptorhynchus latham erebus</em></td>
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<td>Major Mitchell’s cockatoo <em>Cacatuidae Lophochroa leadbeateri</em></td>
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Document Type  Plan  Document No.  POT 2128

Revision  0  Date  17/12/2018

Page  35  of  106
Greater Sand Plover  
*Charadrius leschenaultii*  
Vulnerable  Vulnerable

Lesser Sand Plover  
*Charadrius mongolus*  
Endangered  Endangered

Squatter Pigeon (southern subspecies)  
*Eophaps scripta scripta*  
Vulnerable  Vulnerable

Gouldian Finch  
*Erythura gouldiae*  
Endangered  Endangered

Star Finch (eastern subspecies)  
*Neochmia ruficauda ruficauda*  
Endangered  Endangered

Grey Falcon  
*Falco hypoleucos*  
Vulnerable

New Caledonian Fairy Tern  
*Sterna nereis exsul*  
Endangered

Southern Giant-Petrel  
*Macronectes giganteus*  
Endangered  Endangered

Wedge-Tailed Shearwater  
*Ardeenna pacifica*  
Vulnerable

Macleay’s fig-parrot  
*Cyclopsitta diophthalma macleayana*  
Vulnerable

Australian painted snipe  
*Rostratula australis*  
Vulnerable  Endangered

Red Knot  
*Calidris canutus*  
Endangered  Endangered

Western Alaskan Bar-Tailed Godwit  
*Limosa lapponica baueri*  
Vulnerable  Vulnerable

Eastern Curlew  
*Numenius madagascariensis*  
Endangered  Critically Endangered

Curlew Sandpiper  
*Calidris ferruginea*  
Endangered  Critically Endangered

Great Knot  
*Calidris tenuirostris*  
Endangered  Critically Endangered

Masked Owl (northern subspecies)  
*Tyto novaehollandiae kimberli*  
Vulnerable  Vulnerable

Black-Throated Finch (White-Rumped subspecies)  
*Poephila cincta cincta*  
Endangered  Endangered

The remaining 431 species are listed under the Nature Conservation Act as of Least Concern (LC). Of these 431 however, 60 species are listed as *Special Least Concern* (SL), which (under the Nature Conservation Wildlife Regulations 2006), means there is an agreement to protect these species either under:

- The agreement called ‘Agreement Between the Government of Australia and the Government of Japan for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment’ and signed at Tokyo on 6 February 1974; or
- The agreement called ‘Agreement Between the Government of Australia and the Government of the People’s Republic of China for the Protection of Migratory Birds and their Environment’ and signed at Canberra on 20 October 1986; or
Cleveland Bay has a diverse range of habits and protected areas in which are of regional importance in supporting wading and migratory bird species. Areas of importance of the Bay for migratory or coastal bird species are Magnetic Island, The Town Common, the Ross River sand spit, Cape Cleveland and the RAMSAR listed Bowling Green Bay.

Clear mudflats within the bay provide suitable habitat for Radjah Shelducks, Black-necked Storks, and White Rumped Swiftlets. The Ross River sandspit in the river’s mouth supports a nationally significant proportion of several migratory shorebirds – Red-Necked Stint, Lesser Sand Plover; as well as being home to Beach-stone curlews, Eastern curlews, Little Terns, Caspian Terns, Gull-billed Terns, and Silver Gulls. Magnetic island also provides for foraging and habitat for migratory shorebirds, like the East Asian – Australasian Flyway (CG report PEP 2017).

A number of targeted bird studies and surveys around the Port of Townsville have been undertaken for a number of projects. These include the Port Access Road, Townsville Marine Precinct project, Port expansion project, and most recently the Channel Capacity Upgrade project.

### 3.2 Protected Areas within Cleveland Bay

The Port of Townsville’s sea jurisdiction is within the Great Barrier Reef World Heritage Area (GBRWHA), which is also a national heritage place. However, the port and its marine infrastructure are in an exclusion area from the Central region of the Commonwealth GBRMP and the State Great Barrier Reef Coast Marine Park (Figure 16), but some port infrastructure abuts the marine park, e.g. the Sea Channel and the DMPA. Existing shipping channels accessing the Port of Townsville approach within approximately one kilometre of Bremner Point on Magnetic Island.

Some of the key conservation areas, as well as other features of the region as shown in Figure 16, include:

- the GBRWHA, a world and national heritage place;
- the GBRMP and the State Great Barrier Reef Coast Marine Park (including a number of different zones of protection) noting the area depicted with a red boundary is the port exclusion area;
- Declared Dugong Protection Areas (DPA), in Cleveland Bay and around Magnetic Island;
- A declared Fish Habitat Area (FHA) in the east of Cleveland Bay;
- The neighbouring Bowling Green Bay, a RAMSAR-listed wetland and major wetland area of significance to migratory and wading birds; and
- Magnetic Island National Park.
Figure 16. Coastal Habitats in and around Cleveland Bay
4. Consultation and key issues

4.1 Long-term maintenance dredging management requirements and associated issues at the port

Similar to all north facing bays in the Great Barrier Reef Lagoon, Cleveland Bay has naturally high turbidity levels, due to there being a deposition zone as currents flow past the tip of Cape Cleveland; and with regular and sustained resuspension from wind and wave action. This resuspension of sediments is the primary driver for requiring for and volumes of routine maintenance dredging.

The key issues for the Port of Townsville are the generation of turbidity and its impacts upon the sensitive receptors found in the Bay, including those of Magnetic Island. This concern sits with many stakeholders within the Townsville Region.

Dredging and material placement, has occurred in Cleveland Bay since the Port was first established in 1864. Historically placement within the bay had occurred near areas of high sensitivity, places like Middle reef and Cockle Bay, between Magnetic Island and Cape Pallarenda. These areas are shallow and have high resuspension values given their close proximity to shore. This method is no longer practiced, given its negative impact on the environment. The Port of Townsville uses one placement area, the DMPA, which sits below the 10 m contour line to limit resuspension and prevent material from being placed on or near corals and seagrass meadows.

Although Cleveland Bay is a naturally turbid bay, with resuspension occurring on more than a monthly basis throughout the year, many within the community, however, consider this turbidity to be generated by dredging. Dredging at the Port of Townsville occurs generally between a period of five to six weeks, and most often only once a year. On occasion, the dredge campaign is required to be split, depending on the scheduling of the Trailer Suction Hopper Dredge TSHD Brisbane and its work along the Queensland coastline, only then are the campaigns between two and three weeks each.

Over many years of sampling, monitoring, and modelling, we are confident that turbidity and dredge plumes (including those generated by placement activities) are only ever localised to the vicinity around the dredge, and then only move away to a distance of approximately 800m (from where it was first generated). Although confidence in both the monitoring and modelling is high, the Port of Townsville is undertaking near real-time water quality monitoring throughout the year, which includes during dredging and placement activities. This monitoring is conducted by in water marine buoys that monitor turbidity on 15-minute increments to ensure impacts from Port activities are not impacting on the sensitive receptors and visibility around Magnetic Island and within Cleveland bay.

4.2 Stakeholder engagement / outcomes / feedback

As mentioned in section 1.5.3, Port of Townsville has undertaking stakeholder engagement in the preparation of this Plan, which included seeking public review and submissions to improve this 10-year Plan.

The public review period resulted in 11 submissions on the Plan, totally in 129 lines of comment, with many comments covered by multiple submitters.
Given the comments receive through the public submission process, POTL has provided a plan for addressing the gaps and issues raised, on our website. This plan list the major issues identified, along with the expected timeframes in which the required information will be included in this Plan.

4.3 Accessibility of reports and information the LTMDMP is based upon for the community to access

The Port of Townsville website is currently undergoing update in order to host all the associated documents that accompany the Long-Term Maintenance Dredging Management Plan.

Once this page has been updated, it will remain operational for the duration of the plan, being updated with relevant reviews; ensuring access and currency of reports and data.
5. Port Sediment Characteristics

5.1 Port Sediment

Coastal Processes and sediment behaviour

Cleveland Bay is a relatively low energy wave environment as it is sheltered from the predominant south-east waves by Cape Cleveland. Accumulated sediments make the bay relatively shallow, deepening to only 10 to 11 m (below chart datum) along its northern aspect, and averages 2-6 m across the bay. The coastline continues to be shaped by the prevailing waves at a slower rate, determined by the generally low energy waves and punctuated by the occasional higher energy cyclone waves that are able to penetrate across the bay onto the shoreline.

South-easterly trade winds dominate the North Queensland coastline particularly in the dry season and are the driving force for waves within Cleveland Bay. Water-motion within Cleveland Bay is dominated by the effects of refracted southeasterly-generated waves (mostly 0.5-1.2 m high, 4-6 s period) and by semi-diurnal tidal currents, which reach speeds of 15-30 cm/s during spring tides.

A combination of the natural swell and wind-driven waves, are capable of resuspending bed sediments and producing high turbidity conditions in Cleveland Bay. Wave-induced bed stress is the most significant long-term contributor to sediment resuspension and elevating suspended sediment concentrations within the water column.

North moving long-shore drift also adds to both the volume of sediments in the bay and the volume of sediments being suspended in the water column. Long-shore drift is created by tidal, wind-driven, and three-dimensional currents, which move sediments parallel to the shoreline, moving and resuspending sediment as the currents move north along with the inner shelf and coastline.

Bathymetry

The seabed of Cleveland Bay, to the offshore boundary that encompasses Magnetic Island, is approximately 325 km². Water depths in most of the bay are generally <10 m with a large section (closer to shore) <4 m (Figure 17). Port infrastructure is deeper with the Inner and Outer Harbour, Platypus and Sea Channels all dredged and maintained to varying depths, greater than 10m.
Seabed Sediments

The geology of the Townsville Region comprises Quaternary aged alluvium and colluvium sediments underlain by Late-Palaeozoic age granite. Sediments generally in Cleveland Bay are characterised as “slightly gravelly, muddy sand” and have a high content of fine fraction (silts and clay) material (Cruz Motta 2000). The soft, surface sediments are variable and are thought to arise from tidal and seasonal movement of the seabed sediments.

Study and characterisation of marine sediments have been undertaken many times in the history of the Port of Townsville. Every five years a Sediment Sampling and Analysis Plan is implemented to assess sediments against the NAGD 2009 for approval for unconfined sea placement (by DoEE). The Port of Townsville also undertakes twice-yearly sediment grab sampling grab sampling both to support the findings of the SAP.

Golder Associates in 2008, undertook one study to define the sediments. In the Outer Harbour basin and in the Platypus and Sea Channels identified the following broad material types:

- A surface layer of recent seabed sediments consisting of a mixture of very soft to soft silty clay to clayey silt with very loose and loose sand to silty sand to clayey sand. Shell fragments and organic materials commonly occur in this layer. The seabed sediments are easily identified by their dark hue and very soft and very loose nature. Preliminary investigations indicate that some of the surface materials are
potential acid sulphate soils and, due to their soft and compressible nature, are generally unsuitable for use as reclamation fill or as the foundation material for structures.

- A subsurface layer of geologically older stiff to hard clays and sandy clays and medium dense to very dense clayey sands and sands. These materials are much lighter in colour than the seabed sediments. The subsurface material was not identified as potential acid sulphate soil and is considered suitable, although not ideal, as reclamation fill.

The surface layer has a thickness of approximately 1 m to 1.5 m in the Outer Harbour basin. A lesser thickness of the surface layer, typically in the order of 0.5 to 1 m occurs in the Platypus and Sea Channels.

Sediment sampling undertaken in early 2017 found (Geochem 2017): -

- Sediments in the Approach Channels were predominantly muddy with variable sand content and some gravel.
- Sediments in the Outer Harbour were predominantly muds and sandy muds. These sediments overlay clay and densely packed green sands.
- Sediments in the Inner Harbour were predominantly comprised of grey muds, with trace to minor amounts of sand, overlaying green/orange clay or sandy clay.
- Sediment textures in the Ross River, including the Marine Precinct, were generally coarser (i.e. gravelly sands) in the up-river sections of the dredge area, and muds and sandy muds near the mouth of the Ross River.

Sediment Sources

Cleveland Bay is located about 50 km north of the Burdekin River, about halfway between the Burdekin and Herbert Rivers which provide the dominant sediment supply to the central Great Barrier Reef coast (Belperio 1983; Moss et al. 1993). At the coast, bedload sediment (predominantly sand) from these rivers and from the much smaller Houghton and Ross Rivers, moves northwards along the shoreline by longshore drift processes. During summer floods, suspended loads of mud and fine sand are transported directly onto the inner shelf, where they either accumulate or are adverted back into the tidal mangrove systems which fringe the coastal plain (Belperio 1978 and 1983; Larcombe and Ridd 1994; Larcombe 1995). Fabricius et al. (2014) demonstrated that river discharges significantly affect marine water clarity in shallow bays of the central Great Barrier Reef region at intra- and inter-annual time scales and that fine river-derived sediments remain available for resuspension for years after floods.

The Cleveland Bay catchment incorporates an area of 1,770 km² and there are several significant watercourses (Table 3) discharging storm and surface water into Cleveland Bay and supplying some sediment to the beach system and further offshore during floods. The main watercourses, all of which influence Cleveland Bay locally, include:
• Ross River;
• Ross Creek;
• Three Mile Creek;
• Captains Creek;
• Sandfly Creek;
• Alligator Creek;
• Crocodile Creek; and
• Cocoa Creek.

Table 2. Drains and Creeks Discharging to Cleveland Bay

<table>
<thead>
<tr>
<th>Cleveland Bay Section</th>
<th>Creeks</th>
<th>Drains</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rowes Bay / Pallarenda</td>
<td>2</td>
<td>12</td>
</tr>
<tr>
<td>The Strand</td>
<td>0</td>
<td>12</td>
</tr>
<tr>
<td>East of Port to Cape Cleveland</td>
<td>12</td>
<td>-</td>
</tr>
<tr>
<td>Ross River / Ross Creek</td>
<td>-</td>
<td>131</td>
</tr>
<tr>
<td>Magnetic Island</td>
<td>9</td>
<td>12</td>
</tr>
</tbody>
</table>

Source: Townsville City Council stormwater GIS layer

Natural Sand Supply

Much of the land in the Cleveland Bay catchment has been cleared or modified of its remnant vegetation (GBRMPA 2014). The sediment yield of Ross River has been estimated at 330,000 t/y (Belperio 1983), but this amount fluctuates depending upon climatic conditions and input sources. Changes in catchment drainage due to urbanisation and agriculture may lead to an increase in runoff, and in some cases soil erosion (Pringle 1989). It is noted that Ross River is heavily regulated, which impacts the amount of material that is discharged into Cleveland Bay. Persson (1997) assessed anthropogenic activities disrupting the natural hydrodynamics and transport of coarse sediments and the related effect on channel morphology and sediment supply to Cleveland Bay. This study found that the Ross River Dam and three downstream weirs have reduced the delivery of coarse sediments to the coast, but the outcome for finer sediments is different, these smaller, more mobile sediments are kept within the suspension zone and pass over the weirs.

The Strand Beach is a manmade beach which can be considered as a “pocket” beach, except that it has an inadequate volume of sand within the headlands to maintain a beach along the full length of its foreshore. The existing alignment of Rowes Bay is in general far from a state of equilibrium, with respect to zero net movements of sand along the beach. In order for these beaches to remain in equilibrium and not undergo long-term erosion, Townsville City Council undertakes an ongoing beach monitoring, and sand nourishment project to assist in the rehabilitation of beaches along Rowes Bay and Pallarenda.
Chemical Composition

The sediment chemical composition is variable within Cleveland Bay. Calcium carbonate-rich sediments occur in the western section of the bay close to coral reef colonies formed on the fringes of Magnetic Island and Middle Reef, while the central section of the bay is characterised by terrigenous, muddy sand. Sources of terrigenous sediment to the bay include discharges of sediments from local creeks and rivers, as well as sediment inputs from the East coast longshore drift (e.g. the Burdekin River) from the eastern section of the bay.

Coastal sediments are generally uncontaminated even with the strong industrial and coastal history of Townsville. Some locations may contain detectable hot spots, albeit below published guideline limits under the National Assessment Guidelines for Dredging (NAGD 2009). Due to the nature of the soft sediments, there is potential for acid sulphate soils if oxidised. Results from POTL’s long-term marine sediment monitoring indicate that the more industrialised areas of Ross Creek, the port, and Ross River show higher levels of contaminants than the surrounding bay, with Ross Creek, in particular, being an upstream diffuse source of contaminants (POTL 2014b).

Sources of contaminants to water and sediment

Water quality in the bay is the result of a number of factors, particular the source of incoming waters, which include: the chemical and physical characteristics of historic contamination of water bodies, stormwater discharge and runoff from the wider catchment, groundwater impacts, as well as product handling operations and accidental spillage (both at the Port of Townsville, and from both urban and industry inputs upstream of the bay). Townsville is a long established township with a history of urbanisation and industrial activities in the Ross River and Ross Creek drainage systems.

Contaminants liberated by industrial activities may be transported by stormwater to the end of the catchment, port areas and Cleveland Bay, particularly during the wet season. Areas of potential contaminants in Townsville include refineries, manufacturing and repair facilities, old rail sidings, industrial areas, and urban inputs (including roads). Multiple industrial sites are licensed to discharge waste streams into Cleveland Bay east of Ross River (refineries, sewage treatment plant, meatworks etc.), and several landfills (both operating and rehabilitated) are also present in the Ross River catchment.

Volumes and changes in quality (over time)

The volume of maintenance dredging has increased very little since 1988, Table 3 below shows the list of dredging approvals granted to POTL since 1988 (including capital and maintenance dredging). The material quality has not changed, only material that has been fully assessed against the NAGD and approved for sea placement via the SAP from DoEE is placed at sea.

An increase in maintenance dredge volumes is predicted for when the Channel Capacity Upgrade (CCU) staged projects are completed and require maintenance dredging. The predicted volumes also account for the sand removed from the Ross River Channel. Although this material meets the NAGD, this material has traditionally been brought to land (used in some TMP reclamation), as land for onshore placement has
become restricted, this material may require sea placement. This material (140,000m³ every three years) has now been included in sea placement volumes – see Table 4.

**Table 3. A complete list of dredging approval received since 1988, for both maintenance and capital dredging.**

<table>
<thead>
<tr>
<th>Permit number</th>
<th>Volume approved for disposal (cubic meters)</th>
<th>Type</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>03/04/2018 Extension SD2016/3322 09/08/2016</td>
<td>Addition of 150,000m³ 1,075,000m³</td>
<td>Maintenance</td>
<td>12 months 20 months</td>
</tr>
<tr>
<td>SD2015/2982 03/08/2015</td>
<td>600,000 m³ (plus 100,00 m³ cyclone contingency)</td>
<td>Maintenance</td>
<td>1 year</td>
</tr>
<tr>
<td>SD2012/2223 05/09/2014</td>
<td>600,000 m³ (plus 100,00 m³ cyclone contingency)</td>
<td>Maintenance</td>
<td>1 year</td>
</tr>
<tr>
<td>SD2011/1944 30/11/2011</td>
<td>1,303,000 m³</td>
<td>Capital Berth 12</td>
<td>5 years</td>
</tr>
<tr>
<td>SD2011/2042 29/09/2011</td>
<td>548,000 m³</td>
<td>Capital Navigational Channels</td>
<td>5 years</td>
</tr>
<tr>
<td>SD2011/1943 14/06/2011</td>
<td>96,000 m³</td>
<td>Capital Berths 8 and 10</td>
<td>5 years</td>
</tr>
<tr>
<td>28/03/2013 3rd Extension 19/12/2012 2nd Extension 28/09/2012 Extension SD2007/0602 09/10/2007</td>
<td>2,750,000 m³</td>
<td>Maintenance</td>
<td>3 months 4 months 1 month 5 years</td>
</tr>
<tr>
<td>12/12/2002</td>
<td>236,380 m³</td>
<td>Maintenance Inner Harbour Only</td>
<td>1 year</td>
</tr>
<tr>
<td>19/10/2006 2nd Extension 17/02/2006 Extension 23/02/2001</td>
<td>3,500,000 m³</td>
<td>Maintenance</td>
<td>1 month 8 months 5 years</td>
</tr>
<tr>
<td>12/04/1999</td>
<td>118,000 m³</td>
<td>Maintenance Ross River, Outer Harbour, Berth 11</td>
<td>1 year</td>
</tr>
<tr>
<td>30/05/1997 Extension 31/05/2000</td>
<td>500,000 m³ annually</td>
<td>Maintenance</td>
<td>3 months 3 years</td>
</tr>
<tr>
<td>31/05/1996</td>
<td>500,000 m³</td>
<td>Maintenance</td>
<td>1 year</td>
</tr>
<tr>
<td>24/02/1995</td>
<td>500,000 m³</td>
<td>Maintenance</td>
<td>1 year</td>
</tr>
<tr>
<td>21/10/1992</td>
<td>940,000 m³</td>
<td>Capital &amp; Maintenance</td>
<td>1 year</td>
</tr>
<tr>
<td>30/04/1990</td>
<td>450,000 tonnes</td>
<td>Maintenance</td>
<td>1 year</td>
</tr>
<tr>
<td>31/05/1988</td>
<td>350,000 tonnes &amp; 53,000 tonnes annually</td>
<td>Maintenance</td>
<td>1 year &amp; 3 years</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Historic Volume (m$^3$)</th>
<th>Year</th>
<th>Predicted Volume (m$^3$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>117,454</td>
<td>2019</td>
<td>600,000</td>
</tr>
<tr>
<td>2008</td>
<td>338050</td>
<td>2020</td>
<td>750,000</td>
</tr>
<tr>
<td>2009</td>
<td>612,284</td>
<td>2021</td>
<td>550,000</td>
</tr>
<tr>
<td>2010</td>
<td>55,300</td>
<td>2022</td>
<td>550,000</td>
</tr>
<tr>
<td>2011</td>
<td>809,135</td>
<td>2023</td>
<td>700,000</td>
</tr>
<tr>
<td>2012</td>
<td>424,950</td>
<td>2024</td>
<td>550,000</td>
</tr>
<tr>
<td>2013</td>
<td>369,684</td>
<td>2025</td>
<td>550,000</td>
</tr>
<tr>
<td>2014</td>
<td>516,060</td>
<td>2026</td>
<td>700,000</td>
</tr>
<tr>
<td>2015</td>
<td>700,000</td>
<td>2027</td>
<td>550,000</td>
</tr>
<tr>
<td>2016</td>
<td>353,925</td>
<td>2028</td>
<td>550,000</td>
</tr>
<tr>
<td>2017</td>
<td>487,750</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2018</td>
<td>380,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Historic volume 5,164,592m$^3$</td>
<td>Predicted 10-year volume 6,050,000m$^3$</td>
<td></td>
</tr>
</tbody>
</table>

Noting that between 2007 and 2018 a total of 5,225,000m$^3$ of maintenance material was approved under four separate sea placement approvals (including four approval extensions), with 5,164,592m$^3$ 592m$^3$ of maintenance material being placed at sea. These volumes do not include historic volumes dredged from the Ross Rive. this material historically has been placed on land.

5.2 Minimisation of sediment accumulation and dredging needs

Cleveland Bay is 25km wide between the tips of Cape Cleveland and Cape Pallarenda, and 22m long, between the Tip of Magnetic Island and land just east of the Ross River (furthers point of land from the outer edge of the bay). The Port of Townsville maintains two channels for safe navigation of vessels entering and exiting the Port. These two channels are 13 km in total length (the platypus channel joins the sea channel) and are positioned to maximise the use of deep water, this path is the shortest path to deeper water at the edge of the bay.

Sediments that enter the bay, either move in from the south via long-shore drift or are naturally resuspended by the environmental conditions of the bay. A number of studies have been undertaken in regard to reducing the sediment buildup in the channels, as well as in the Outer and Inner harbours, including for the Port Expansion Project EIS. The PEP harbour design was based on both engineering and environmental requirements, including maintenance dredging.

Minimising sediment from building up within the two channels would could only effectively be achieved by installing a permeant sediment barrier, similar to a rock breakwater wall, that ran from Outer harbour out to beyond port limits; which is not a feasible outcome. Port of Townsville has a narrow approach channel and PEP has a tapered channel to minimise dredge volumes.
POTL has investigated a number of Dynamic Under Keel Clearance Systems (DUKC) similar to that currently used at the Port of Brisbane. The DUKC system is a real-time aid to navigation program that aims to provide up to date channel depths, maximum drafts and tidal windows and can result in a reduction in maintenance dredging.

5.3 Maintenance Dredging and disposal requirements

The Port of Townsville is expecting to dredge approximately 6,050,000m³ over the next 10 years (1st January 2019 to 1st January 2029). These volumes are the maximum estimates expected and are dependent on climatic conditions, infrastructure priorities of each year as well as the dredge availability and scheduling. It is estimated that each campaign’s indicative volume shown in Table 5 below, however, annual volumes may vary (increase or decrease) in any given year in response to all external factors. However, the total volume of 6,050,000m³ is unlikely to change:

Table 5. Maintenance Dredge schedule – sea placement 10-year plan

<table>
<thead>
<tr>
<th>Year</th>
<th>Maintenance Volume</th>
<th>Placement area (DMPA)</th>
<th>Placement in DMPA within Port limits</th>
<th>Placement in DMPA outside of port limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>2019</td>
<td>600,000</td>
<td></td>
<td>300,000</td>
<td>300,000</td>
</tr>
<tr>
<td>2020</td>
<td>750,000</td>
<td>Ross River</td>
<td>300,000</td>
<td>450,000</td>
</tr>
<tr>
<td>2021</td>
<td>550,000</td>
<td></td>
<td>300,000</td>
<td>250,000</td>
</tr>
<tr>
<td>2022</td>
<td>550,000</td>
<td></td>
<td>300,000</td>
<td>250,000</td>
</tr>
<tr>
<td>2023</td>
<td>700,000</td>
<td>Ross River</td>
<td>300,000</td>
<td>400,000</td>
</tr>
<tr>
<td>2024</td>
<td>550,000</td>
<td></td>
<td>300,000</td>
<td>250,000</td>
</tr>
<tr>
<td>2025</td>
<td>550,000</td>
<td></td>
<td>300,000</td>
<td>250,000</td>
</tr>
<tr>
<td>2026</td>
<td>700,000</td>
<td>Ross River</td>
<td>300,000</td>
<td>400,000</td>
</tr>
<tr>
<td>2027</td>
<td>550,000</td>
<td></td>
<td>300,000</td>
<td>250,000</td>
</tr>
<tr>
<td>2028</td>
<td>550,000</td>
<td></td>
<td>300,000</td>
<td>250,000</td>
</tr>
<tr>
<td></td>
<td><strong>Total volume required over 10 years = 6,050,000m³</strong></td>
<td><strong>3,000,000</strong></td>
<td><strong>3,050,000</strong></td>
<td></td>
</tr>
</tbody>
</table>

*See Figure 3 for Port Limits boundary line over the DMPA

The volumes listed above include a number of staged projects that will roll over into maintenance dredging as they come online over the next 10 years. They also include dredging the entrance channel of the Ross River, which is currently dredged every three years at approximately 140,000m³; however, the schedule may change depending on requirements/priorities of the river, and potential reuse of this sand. Noting that in the three separate years the Ross River is to be dredged, there will be two different dredges in operation. The additional ~ 140,000m³ is generally dredged using a cutter suction dredge, whereas the majority of all other material will be dredged using a TSHD.
Due to its location in the tropics, the Port of Townsville also requires a cyclone contingency volume to enable reestablishment and ensure the safe operation of port infrastructure after a cyclone has passed through/near the region. Cyclones can have either a direct or indirect impact on sediment volumes within Cleveland Bay.

Cyclones that have a direct impact on the bay through storm surge, wind, increased wave energy and rain, including Cyclone Yasi in 2011. Tropical Cyclone Yasi crossed the Queensland coastline at Mission Beach as a severe Category 5 cyclone; despite the distance to the eye, Cleveland Bay was still heavily impacted by the cyclone - given the size of the storm. The wind and rain generated by this cyclone increased the sediment volume in the bay with days. TC Yasi added 350,000m$^3$ back into port infrastructure, primarily the channels and around the Outer harbour.

Cyclones that indirectly impact the bay are those that impact an area of the coastline south of Cleveland Bay generating an increase in the longshore drift volumes. The Severe weather events in 2011 increased the sediment load of the longshore drift, with increased volumes reaching the bay two (2) years after. Tropical Cyclone Debbie hit the Burdekin/Whitsunday/Mackay coast in March 2017, the sediment input created by this cyclone has yet to reach the Port of Townsville, this longshore drift is expected to bring upwards of 200,000m$^3$ into the bay in 2019/2020.

As the intensity and frequency of tropical cyclones are predicted to increase over the coming years, the Port of Townsville is allowing for at least one Tropical Cyclone will directly impact port infrastructure over the coming 10 years. The predicted volumes as shown in Tables 4 and 5 do not account for cyclone contingencies, as these are unpredictable, and could occur on any year. Adding any contiguity volumes to these numbers would only artificially inflate the volumes. Therefore, a 350,000m$^3$ cyclone contingency volume will sit outside of the stated maintenance dredging volumes, to only be used in the event of a cyclone impacting upon Port infrastructure, in areas approved at the time, for unconfined sea placement.

All placement of any cyclone contingency volume will be placed in the area of the approved DMPA outside Port Limits (see Figure 3 for DMPA location).

**5.4 Examination of reuse, recycle and disposal options**

The 1996 Protocol to the London Convention requires consideration of alternative methods of dealing with waste, (the convention’s definition includes dredge material). POTL gives due consideration to alternatives to sea placement, to ensure that the placement of dredge material has environmentally sound outcomes. Alternative placement and beneficial re-use options have been investigated and assessed in a number of internal and external studies undertaken over the last 20 years. The most recent being an external investigation undertaken by SKM (2013), for the Great Barrier Reef Marine Park Authority (GBRMPA), although it has also been reviewed for the Port Expansion Project EIS (compiled by AECOM in 2009) and again reviewed in 2015/2016 for the Additional Environmental Impact Statement (AEIS).

As part of our (Section 19) Deed of Agreement with the Commonwealth Department of Environment and Energy, POTL will be further investigating its two long-term strategies looking to minimise the volume of material placed.
at sea, for delivery in July 2019. Namely (i) the investigation of alternative placement options, and (ii) the reduction in maintenance dredge volumes.

Alternative options for maintenance dredge material are primarily dictated by the sediment characteristics and dredging methodologies. The choice of dredge methodology is dictated by the scale of the operation, nature of the materials to be dredged, and other constraints that may reduce accessibility - such as limited water depths and dredging in operational port channels. The economic feasibility of options can also impact on their viability.

Maintenance dredge material at the Port of Townsville is usually dominated by the silt fraction, and therefore, there are fewer options than the coarser material that is found during capital dredging works.

POTL has considered the following options:

- Beneficial reuse - placement on land / reclamation
- Beneficial reuse - offsite recycling
- Beneficial reuse - treatment of sediments
- Beneficial reuse - beach re-nourishment
- Beneficial reuse - habitat restoration
- Beneficial reuse - disposal/capping at landfills

**Beneficial reuse – Placement on Land / Reclamation**

The main alternative strategy to the placement of the dredge material at sea is placement on land. Historically, (since inception in 1864), POTL has reclaimed large areas of land using dredge material, with the majority of the current port built on reclaimed land. In the late 1970s to early 1980s, this resulted in the establishment of the Eastern Reclamation Area (100 ha), which has been available for dredge material placement since that time. Currently, POTL utilises two land-based dredge material placement areas (land-based DMPAs), namely the Eastern Reclamation Area which includes designated dredge ponds, and the Marine Precinct, both of which are located on POTL land.

Existing land placement options are limited with no new suitable available port-owned land. The Eastern Reclamation area is nearing capacity, and preference for land placement of material potentially exceeding NAGD 2009 has been implemented for the last 15 years, as a good environmental practice measure by POTL. Currently, there is approximately 210,000 m³ capacity (allowing for space to dewater) if no additional action is taken. Given legislative changes, particularly the introduction of the *Sustainable Ports Development Act 2015*, capacity needs to be prioritised to ensure all capital dredge material is brought to land.

The Channel Capacity Project (CCU) (as part of the Port Expansion Project) will bring to land all capital dredged materials. The reclamation area at the end of Stage 3 (of the PEP), will comprise of 152ha, filled by capital dredge material, exhausting all capacity for annual maintenance dredging material. It must be noted that both PEP and CCU capital works are not part of this LTMDMP. PEP has been approved via the EIS process, and CCU is seeking...
their own tidal works applications as part of that project. This LTMDMP does, however, consider and include the maintenance material generated after CCU has come online, as this will be within the 10-year period of this plan.

On average, POTL places approx. 10% of its maintenance dredging volume on land each year (including material that does and does not meet the NAGD 2009), however, to meet legislative changes made in 2015 to capital dredge placement, this maintenance dredge volume is likely to decrease (for land placement), as it is necessary to give priority to land placement for capital dredge material. Maintenance dredge material that is currently brought to land that meets the NAGD, will now most likely be placed at sea due to the limitation of land availability.

A range of factors come into consideration for placement on land, including the availability of suitable land, the size of the available land, tailwater management, acid sulphate soils (ASS and PASS), and the management techniques and options, including transport of material to site, dewatering, handling and then the transport of material offsite, or long-term management onsite.

POTL does not currently hold approvals for the establishment of a new land placement area, nor does it own suitable lands. Current land space is limited in close proximity to the port, and any land that is close by is of insufficient capacity to cater for the annual volume of maintenance dredge material involved, other than the Townsville State Development Area, which is in a range of different ownership. Any utilisation of this land, may not be achievable within the scope of this 10-year plan.

Costs associated with handling this material on land are approximately 2-3 times higher than the cost of sea placement if an already established land placement area is used. These costs can rise by approximately 8-times if a new land placement area is to be developed. These costs include the purchasing land, earthworks to construct settling ponds, the running of transport of material to site, and equipment needed to handle the material, once on site. Then there are costs for tailwater management and potential water treatment, costs to dewater and store the material, costs for acid sulphate soils treatment (ASS and PASS), and, costs for relocation of material off site (once it’s been de-watered). Any of these additional costs would increase the cost of production and operations not only for the Port of Townsville but for all companies operating out of the facility. These costs would be passed on to the consumer in order to maintain an effective port facility.

A report written by SKM in 2013, commissioned by the GBRMPA as part of a response to the World Heritage Committee’s request to Australia to undertake a strategic assessment with the primary aim of determining the likely impact of actions on matters of national environmental significance as defined by the Environment Protection and Biodiversity Conservation Act 1999, the effectiveness of existing management arrangements, and the need for improved management strategies (SKM 2013).

SKM determined that for the Port of Townsville, the Reclamation is the primary option that could feasibly be considered for land-based placement of dredge material. Other land-based options are highly constrained due to a lack of available land and due to the nature of sediments to be dredge, which is unsuitable for beach nourishment or construction purposes.
**Beneficial reuse – Offsite Recycling**

POTL aims to re-use dredge materials wherever possible. However, due to the potential for reuse is primarily associated with coarser materials, i.e. sands are predominantly used for reclamation of land for infrastructure projects. The maintenance dredge material consists of muds, and silty sands to fine-grained sands, minor medium to coarse-grained sands and stiff clays. The beneficial re-use possibilities for maintenance material as offsite fill/construction material, or for the use in soil products are limited primarily due to the material’s low strength, high compressibility, salt content, and poor drainage characteristics when dredged and placed on land.

The characteristics of the (maintenance material) sediments (i.e. high fines content) make the material unsuitable for use as fill or other purposes. Most commercially available topsoils comprise of at least 70% to 80% sand by weight for adequate drainage requirements. The maintenance material POTL dredges from the majority of our maintenance areas would require blending with additional large quantities of sand, in order to be used as a soil product, e.g. topsoil. Consequently, for every 1.0m³ of dredge material, around 3-4m³ of clean sand would need to be blended with the dredge material, depending upon the density of the dredge material and sand. This would require between 2,400,000m³ and 3,000,000m³ of combined material to be relocated offsite annually, after a 600,000m³ maintenance dredging campaign. The high salt water content of the dredge material also complicates its beneficial re-use possibilities, it requires dewatering operations and salt extraction treatment in the form of stockpiling for at least one wet season to reduce the salt levels, or would require a significant volume of freshwater. Using freshwater is a significant limitation to this process given the limited supply of water in Townsville. As the port is located in the dry tropics, this option is unviable.

The costs associated for the treatment of this material would be significant, including the need for an extensive irrigation system to salt leach; as well as treating the significantly large volume of potential/acid sulphate soils.

Any beneficial reuse of maintenance dredge material needs to have the material dewatered first. Dewatering has its own problems. The availability of space to receive and dewater maintenance dredge material on/near Port land is limited, making tailwater management difficult onsite. Historically land at the Port of Townsville has been used to dewater third party dredge material, before being removed by the third party, off-site. This process has now ceased given the limited land available.

Townsville City Council has raised concerns regarding the amount of potable water that would be required for extensive irrigation purposes in salt leaching, if this option was chosen, particularly given the history of water restrictions and limited rainfall in Townsville.

POTL has limited ability to treat, or cope with, the volumes of dredge material and dewatering issues involved with the re-use of dredge material for broad range applications (building purposes, bricks, etc.). The reused/recycled dredge material is generally of lower quality to existing onshore supplies for these materials, in comparison to other products already available in the Townsville area. The re-use/recycled dredge material is also economically unviable and would trigger amendments to the Port’s existing Environmental Authorities; it would also trigger royalty charges to legally move the treated material offsite, and resolution of commercial competition with the local quarries be undertaken. This all further adds to its economic disadvantage.

The movement of large volumes of dredge material for beneficial re-use, particularly at distant mine sites, would require extensive transport capabilities either by truck or rail on both ends of the system. For example: to move dredge material from a 600,000m³ dredging campaign off Port lands, would require approx. 40,000 ‘B-
double’ truck movements each way to meet road and safety legislation. This equates to approximately 109 trucks heading into and out of the port each and every day, 365 days a year.

This would not only add considerably to the costs of dredging but would also increase the amount of greenhouse gas emissions from truck exhausts being released into the environment; it would cause an adverse economic impact on road infrastructure; increasing heavy trucking volumes and associated road safety impacts, and amenity impacts, would all adversely impact on the health and safety of motorists travelling on the same routes; and, increase noise pollution to surrounding business and residents with the increase in truck breaking/engine re-reeving as they enter and exit the Port.

Significant environmental considerations at the placement site would also need to be assessed and managed, to ensure there were no unforeseen environmental impacts by placing maintenance dredge material at the selected site.

**Beneficial reuse – Treatment of Sediment**

As the amount of land available to receive dredge materials becomes restricted, POTL has increasingly focused on bringing to land dredge material that is not suitable for ocean placement, for it to be appropriately managed. Methods to destroy, reduce or remove contaminants in maintenance dredge material is not necessarily an issue for the POTL as contaminant concentrations are substantially below relevant guideline values for re-use on land, with the exception of potential/actual acid sulphate soils issues, and salinity.

The proportion of dredge material most useful for re-use is the sand fraction, which can be used in construction and beach re-nourishment projects. The proportion of sand in the soft, unconsolidated sediment proposed for maintenance dredging is small (estimated from bore logs to be less than 10% by weight). Therefore, this poses practical and economically challenging to physically separate fine and coarse-grained sediment. This would also result in a large quantity of fine-grained sediment with poor geotechnical capabilities and reduced self-buffering capacities for acid sulphate soil considerations, which would remain on site to be dealt with separately; meaning this increases the risk profile of material that remains on port lands.

**Beneficial reuse – Beach Re-nourishment**

Beach re-nourishment is another possible beneficial reuse of dredge material. The high fines content of the maintenance dredge areas at the Port renders most of the proposed dredge material unsuitable for beach re-nourishment; The majority of the maintenance dredge material would not be stable under a moderate wave climate typical of the shallow waters of Cleveland Bay. In Townsville, Townsville City Council has State-imposed requirements (on local beach nourishment approvals), as to the allowable grain size of material used for beach re-nourishment - to prevent erosion (particularly for the Strand and Rowes Bay Beaches). In the case of the Strand Beach, this is due to it being a completely man-made construction.

Currently, no component of the maintenance dredge material meets the State’s specific grain size requirements/criterion. There may be a possibility to use the sand dredged from the mouth of the Ross River, which is considered to be of good quality; however, on selling this material introduces complications due to interactions with other local markets (competition), it requires royalties to be paid on its removal from POTL lands, and the locations in need of beach nourishment are currently being restored by the local council, who source their material from a commercial entity.
**Beneficial reuse – Habitat Restoration**

Other possible beneficial reuse of dredge material includes habitat development/restoration and levee maintenance. A common form of habitat development using dredge material is the creation/restoration of tidal wetlands, (SFBRWQCB 2000). However, no local habitat construction/rehabilitation projects or levee maintenance projects could be identified in which the dredge material would be beneficially re-used. Additional state approvals including royalty payments would be required prior to this being a viable option, which further adds to its economic disadvantage compared to other material.

**Beneficial reuse – Disposal / Capping at Landfills**

Rehabilitation and cover at existing landfills is also a possible beneficial reuse of dredge material. Contaminant concentrations in unconsolidated sediment residing in the maintenance dredge areas, are well below acceptable levels for disposal at a landfill and do not require treatment except to neutralise the acid generating capacity of potential acid sulphate soils (PASS), and the salt content of the material in some cases. Minor amounts of dredge material is currently approved to be placed at a local landfill - Vantassel Street Waste Disposal Site operated by Townsville City Council, (State Approval No: ENAQ04313912). However, the Council has indicated that they are not in the position to accept large quantities of maintenance dredge material as it “has no beneficial re-use for landfill application in terms of interim or final capping requirements as a result of its pH and physical characteristics” (TCC 2014).

Key implications for each of the alternatives are shown in Table 6.
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<tbody>
<tr>
<td>Not dredging</td>
<td>Increases risk to navigational safety and health of humans on vessels</td>
<td>Increases greenhouse gases due to reliance on road, rail, and air transport for the movement of products, in order to continue the same level of support to the region.</td>
<td>Results in the depth restrictions for vessels due to infilling of the channels, and ultimate cessation of commercial vessels to the port.</td>
<td>Sediment barrier would sit in some of the Anchorages beyond port limits, reducing their availability for vessels. The barrier would need significant maintenance – removing sediment building up (otherwise the bay would become even more shallow), maintenance after severe weather events, maintenance on navigational lighting required the length of the barrier. The sediment barrier may not actually prevent sediment buildup and would pose a risk during severe weather events being so close to the channel – the structure may fall into the channel and cause an obstruction to navigation and port operations.</td>
<td>Results in significant loss of revenue for the greater Townsville region, not just for the Port of Townsville. Not dredging adversely increases the cost of living in NQ as access to products and fuel decreases. Not dredging has a significant direct and indirect impacts on employment (port employees, port users and customers, and companies that rely on imports/export) from the Port of Townsville.)</td>
<td>Breach of the Queensland’s Transport Infrastructure Act 1994</td>
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<tr>
<td>Installing sediment barrier devices (permanent hardstand structure), reducing dredge volumes.</td>
<td>Increased risk to navigational safety and health of humans on vessels as a permanent, hard structure, would pose a significant hazard, cutting the bay in half as it followed the Platypus and Sea Channels out to the end of Magnetic Island</td>
<td>Significant environmental impacts during construction. Significant ongoing impacts by cutting the bay in half. It would significantly change the sedimentation characteristics of the bay. It would significantly impact upon sensitive receptors (permanent destruction). It would act as a barrier for marine fauna – preventing their movement between feeding/life cycle habitats. The barrier would be reclamation by default, and it would reduce the marine area of the Great Barrier Reef world heritage area.</td>
<td>A significant outlay of capital cost for quarry material, to build the wall. Operational costs for maintenance, especially after cyclones/severe weather events would be significant. The structure would require significant environmental offsets if it could actually be approved by State and Commonwealth governments.</td>
<td></td>
<td>Works may fail to meet the EPBC Act</td>
<td>Other approvals needed would include those under: - The Planning Act 2016 (which includes the Coastal Protection and Management Act, Fisheries Act, Environmental Protection Act.) - The Environmental Offsets Act 2014.</td>
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<tr>
<td>Land placement / reclamation (port land)</td>
<td>Increase safety risks due to a large area of waterlogged dredge ponds, and the ongoing management by port employees. Increases in land transport (truck/rail movements) due to the volume of maintenance material that would come to shore, and associated increases in road/rail accidents due to the increase in land transport. Potential dust, noise, and air emission nuisance issues for the neighbouring residents of South Townsville; and increased risk to navigational safety within the bay due to floating pipelines used to transfer maintenance dredge material to shore.</td>
<td>Creates potential acid sulphate soil, tailwater management issues and greenhouse gas emissions from increases in plant &amp; equipment. Potentially reduces the marine area of the Great Barrier Reef World Heritage Area for any further reclamation, as there is no available land. Does not decrease/change maintenance dredging impacts i.e. water quality, turbidity, disturbance to the seabed, transport and resuspension of contaminants, marine fauna strikes, and underwater noise remain as currently assessed.</td>
<td>Lack of availability of suitable nearby land to treat and store the material. Land is needed for placement of dredge material and be available for long-term management of the area. Maintenance material on land reduces the available capacity for approved capital dredge material land placement areas. Maintenance material has poor engineering qualities, making it not suitable for beneficial reuse without further treatment and stabilisation.</td>
<td>Increases cost of dredging campaign by up to 8 times the current cost. The significant cost of purchasing suitable reclamation areas or new land near POTL to place, treat and store the material. Significant cost of clearing/preparing that land to ensure it is suitable to take the proposed material. Significant cost of treating the maintenance material for PASS/ASS to ensure no further environmental impacts are created.</td>
<td>POTL would need approvals under: - The Planning Act 2016 (which includes the Coastal Protection and Management Act, Fisheries Act, Environmental Protection Act.) - The Environmental Offsets Act 2014. - Potential assessment under the EPBC depending on location</td>
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<td>Beneficial reuse (i.e. on or off-site recycling for construction, fill, products, etc.) With treatment</td>
<td>Limited risk due to low contaminant concentrations. Increase in potential noise due to a mid-scale processing plant for onsite recycling. Risks for land placement include: - Navigation risk - long floating pipelines required to bring material to shore. - Transport risks - increase in land transport, and increased accident risks.</td>
<td>Creates potential acid sulphate soil, salt content, tailwater management issues and greenhouse gas emissions from plant &amp; equipment. Does not decrease/change the maintenance dredging impacts, and remain as currently assessed.</td>
<td>Land is needed for placement of dredge material, for treatment to address poor engineering qualities of the material before it can be used /recycled into a usable by-product. Contaminant treatment not required as concentrations below land-based acceptance levels. ASS / PASS and salinity treatment needed before beneficial reuse could be an option. New onsite processing requires new staff and ongoing maintenance of plant</td>
<td>Increases cost for treatment, and treated material remains uneconomic compared to existing onshore supplies in the region. Onsite processing is cost prohibitive to startup and can be cost prohibitive for ongoing operational/maintenance costs. Cost for royalties that may still be required to be paid on end-product (once maintenance dredge material has been processed and converted into a viable by-product).</td>
<td>POTL would need approvals under: - The Planning Act 2016 (which includes the Coastal Protection and Management Act, Fisheries Act, Environmental Protection Act.) - POTL would also need Land Owners Consent from DNRMR.</td>
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Table 6. Key Implications for each maintenance dredging/placement alternative

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<tr>
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<tr>
<td><strong>Without treatment</strong></td>
<td>Dust, noise and air emissions nuisances for the neighbouring residents</td>
<td>No local project could be identified to take maintenance dredging material, with its poor engineering qualities, ASS/PASS and salinity issues that all require treatment to prevent further impacts to the potential receiving environment/area.</td>
<td>Increase in costs for transportation out of the Townsville region (given no local project could be identified for reuse), cost to pay royalties in removing the material from POTL lands. The maintenance dredge material generated at the Port of Townsville is uneconomic to reuse or recycle for construction, fill or any other product compared to existing onshore supplies.</td>
<td>Falls to meet requirements of Queensland’s Coastal Protection and Management Act. Other approvals needed would include those under: - The Planning Act 2016 (which includes, Fisheries Act, Environmental Protection Act); - Potentially the Environmental Offsets Act 2014</td>
<td></td>
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<tr>
<td><strong>Beach nourishment</strong></td>
<td>Limited risk due to low contaminant concentrations. Increases in land transport (truck/rail movements) to move the material to the designated location. This could then increase road/rail accidents due to the increase in land transport. Increases potential dust, noise, and air emission nuisance issues for neighbouring residents of any area identified for placement.</td>
<td>Creates potential acid sulphate soil, salt content, tailwater management issues and greenhouse gas emissions from plant &amp; equipment. Does not decrease/change maintenance dredging impacts, and they remain as currently assessed.</td>
<td>Majority of maintenance material is not suitable as it does not meet Queensland Government’s conditions on beach nourishment approvals. POTL’s maintenance material has poor engineering qualities that requires treatment before reuse and is not stable enough to remain onshore as beach nourishment.</td>
<td>Increase in costs for transportation to appropriate beaches, increase the cost to pay royalties in removing the material from POTL lands; and it is uneconomic to use this material, given the quality and consistency of material available from other existing onshore supplies within the region. Increase cost or truck/barge movement to move material to the designated site.</td>
<td>Potentially the Environmental Offsets Act 2014</td>
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<tr>
<td><strong>Habitat restoration</strong></td>
<td>Limited risk due to low contaminant concentrations. Increases in land transport (truck/rail movements) due to the volume of maintenance material that would come to shore. This then increases road/rail accidents due to the increase in land transport. Increases potential dust, noise, and air emission nuisance issues for the neighbouring residents of both South Townsville, and the area surrounding any habitat restoration.</td>
<td>Creates potential acid sulphate soil, salt content, tailwater management issues and greenhouse gas emissions from plant &amp; equipment. Does not decrease/change maintenance dredging impacts, and they remain as currently assessed.</td>
<td>No local project could be identified that would benefit from the maintenance material generated from Cleveland Bay. Poor engineering qualities of material require treatment before material could be utilised in habitat restoration projects. The material also requires dewatering prior to being moved to the designated site, along with treatment for ASS/PASS and salinity, depending on where habitat restoration may be required</td>
<td>Increase in costs for transportation to appropriate areas of restoration; increase the cost to pay royalties in removing the material from POTL lands; and it is uneconomic to use this material, given the quality and consistency of material available from other existing onshore supplies within the region. Increase in cost to dewater the material, and increase cost for truck movements to move the material to the designated site.</td>
<td>Land Owners Consent may also be required from DNRM</td>
</tr>
<tr>
<td><strong>Landfill</strong></td>
<td>Limited risk due to low contaminant concentrations. Increases in land transport (truck/rail movements) due to the volume of maintenance material that would come to shore. This then increases road/rail accidents due to the increase in land transport. Increases potential dust, noise, and air emission nuisance issues for the neighbouring residents.</td>
<td>Creates potential acid sulphate soil, salt content, tailwater management issues and greenhouse gas emissions from plant &amp; equipment. Does not decrease/change maintenance dredging impacts, and they remain as currently assessed.</td>
<td>Treatment required to address poor engineering qualities of the material. Treatment would also be required for ASS/PASS, salinity and dewatering prior to placement in landfill. Contaminant treatment not required as concentrations below land-based acceptance levels</td>
<td>Council will not accept the volume of material generated, due to their site volume limitations. Landfill placement also increases cost for treatment, transportation and royalties</td>
<td>Potentially the Environmental Offsets Act 2014</td>
</tr>
<tr>
<td><strong>Sea placement</strong></td>
<td>Limited risk due to low contaminant concentrations. Minor navigational impacts from a TSHD, however, these are considered to be low, as the vessel highly manoeuvrable and</td>
<td>Results in limited short and long-term impacts at sea DMPA to water quality, removal of existing habitats, burial and smothering of organisms on the seafloor.</td>
<td>No local project could be identified to take maintenance dredging material, with its poor engineering qualities, ASS/PASS and salinity issues that all require treatment to prevent further impacts to the potential receiving environment/area.</td>
<td>No costs for treatment and transport beyond the normal running costs. No ongoing management</td>
<td>Potentially the Environmental Offsets Act 2014</td>
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<td>scheduling of the inner harbour allows for dredging around ships berthing.</td>
<td>Potential dredging impacts remain, including dredge plumes are localised to the source point. Placement in the DMPA is away from sensitive receptors in the bay and &gt;6km from Magnetic Island</td>
<td>Significant input into monitoring and testing the associated parameters as required under permit conditions.</td>
<td>Act, Environmental Protection Act; Commonwealth’s Environment Protection (Sea Dumping) Act 1981; and Landowners consent from DNRM for placement areas.</td>
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</table>
5.5 Selected future dredging and disposal strategy

Given the uncertainty of the timing of Capital dredging works (PEP), the Port of Townsville cannot be accurately provided predictions on future dredging requirements beyond scope of this 10 years document. The first stage of this project, CCU, will be completed within the life of this document, however, additional stages of PEP are dependent upon demand and funding.

What we can predict is the volumes required to maintain those areas of the CCU, once they roll over into the maintenance dredging campaigns.

The Port of Townsville is currently undertaking a DMPA location investigations for future disposal options within Cleveland Bay and the Townsville Area. This study is part of the Section 19 Deed of Agreement, monitoring and research plan with the DoEE, and is currently due for completion in 2019. Once this investigation has been completed, and the outcomes approved by DoEE, the study will be included in the LTMDMP, as part of the long-term disposal strategy.

POTL continues to review land placement options and opportunities as new opportunities arise.
6. Risk assessment framework

Port of Townsville Limited is committed to the effective management of risks arising for the environment in which POTL operates. POTL Risk Management Policy and Risk Management guidelines are consistent with the International Risk Management Standards (AS/NZ ISO 31000:2009). Figure 18 shows the Risk assessment process.

*Figure 18. Risk management process*

Under the *Transport Infrastructure Act 1994*, POTL is required to establish, manage and operate efficient port facilities and services. This legislative responsibility extends to the provision of safe navigational access to marine facilities and infrastructure such as harbours, berths and channels under POTL’s jurisdiction.

To comply with the *Transport Infrastructure Act*, POTL must maintain navigable areas within the port’s jurisdiction to target operational design depths within the bounds of our approved maintenance areas (i.e. within our existing footprints). This, at the Port of Townsville, means regular maintenance dredging activities are required to remove natural accumulations of sediments within the existing port facilities.

The Port of Townsville undertakes maintenance dredging within:

- Sea Channel (every 1 to 2 years)
- Platypus Channel (annually)
- Outer Harbour (annually)
• Inner Harbour (annually)
• Berths 1, 2, 3, 4, 8, 9, 10, and 11 (annually)
• Townsville Marine Precinct (only when required, limited sedimentation occurs within the harbour)
• Ross River, including Marine Precinct Swing Basin (every 3 years)
• Ross Creek (rarely - only when deemed necessary)

Risks have been assessed initially on the basis of no management controls (inherent risk), then again following the introduction of management controls (residual risk).

Whilst all dredging equipment has been considered in this risk assessment, the risk scores are based on the most impacting dredge plant. For the Port of Townsville, this is the TSHD for plume generation, or a cutter suction dredge for land placement, as it can be assumed that environmental risks for other types of dredge equipment would be less given the location and scale of such activities. This assumption is supported by the finding of modelling of maintenance dredging at Port of Townsville which has shown that the Trailer Suction Hopper Dredge generates the most turbidity out of the dredging plant used at the Port of Townsville (in both dredging and sea placement).

Modelling has been undertaken for maintenance dredging at the Port of Townsville, that considered the generation of turbidity in the water column as a result of:

• Turbidity generated by the dredge while operating (hopper overflow and propeller wash) and resuspension of dredge material that has been disturbed by the dredging process;
• Deposition (e.g. sedimentation) of dredged sediment particularly on sensitive receptors; and
• Longer term resuspension of placed material within the DMPA modelled over a 12-month period, in:
  o A representative ‘El Nino’ year (see Figures 19 and 20);
  o A representative ‘La Nina’ year (see Figures 21 and 22); and
  o A representative ‘Transitional’ year (see Figures 23 and 24).

The modelling investigation was undertaken for a 670,000m$^3$ maintenance dredge program that included dredging in the Sea Channel (closest proximity to the coral) and 12 months re-suspension. The volume of 670,000m$^3$ is considered to be a worst-case volume, which includes the Dredge returning to Townsville directly after a normal campaign to undertaken emergency works (cyclone sediments).

This modelling incorporated available water quality data from five locations around Cleveland Bay, the modelling indicated:

• Impacts from annual maintenance dredging under different periods are predicted to be negligible, with zones of impact restricted to the immediate dredging and placement areas only. The change in turbidity due to dredging at sensitive receptor locations is predicted to remain well within the range of variability in ambient water quality of Cleveland Bay.
• Sensitive ecological receptors in Cleveland Bay, such as seagrass and coral reef habitats along Magnetic Island, are within the ‘zone of influence’ of maintenance dredging (and associated dredge material placement at the approved DMPA), however, they are not predicted to be within any zones of low, moderate or high impact.

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<th>Plan</th>
<th>Document No.</th>
<th>POT 2128</th>
</tr>
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<td>Revision</td>
<td>0</td>
<td>Date</td>
<td>17/12/2018</td>
</tr>
<tr>
<td>Page</td>
<td>60</td>
<td>of</td>
<td>106</td>
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</table>
The zones of impact for all climate scenarios indicate a similar small localised ‘zone of low impact’ within and directly adjacent to the Platypus Channel near the bend in the channel. There are no zones of moderate or high impact predicted anywhere in the model domain.

Table 7 describes the different zones of impact, which relate to Figures 19 to 24.

**Table 7. Description of Impact Assessment Threshold Values**

<table>
<thead>
<tr>
<th>Zone of Impact</th>
<th>Water quality (Turbidity)</th>
<th>Threshold Value</th>
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<tr>
<td>Zone of Influence</td>
<td>Extent of detectable plumes, with no predicted ecological impacts.</td>
<td>Dredging related turbidity exceeds 0.5 NTU above 50th percentile conditions and 2 NTU above 80th percentile conditions</td>
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<tr>
<td>Zone of Low Impact</td>
<td>Excess turbidity may push total turbidity beyond natural variation, potentially resulting in sub-lethal impacts to ecological receptors with recovery time of approximately 6 months.</td>
<td>Excess turbidity greater than one standard deviation from the natural background mean for nearshore areas, and two standard deviations for offshore areas.</td>
</tr>
<tr>
<td>Zone of Moderate Impact</td>
<td>Excess turbidity likely to push total turbidity beyond natural variation, potentially resulting in sub-lethal impacts to ecological receptors and/or mortality with recovery time up to 24 months</td>
<td>Excess turbidity greater than two standard deviations from the natural background mean for nearshore areas, and three standard deviations for offshore areas</td>
</tr>
<tr>
<td>Zone of High Impact</td>
<td>Excess turbidity most likely to cause total turbidity to go beyond natural variation, (excluding extreme weather events) potentially resulting in mortality of ecological receptors with recovery greater than 24 months.</td>
<td>Excess turbidity greater than three standard deviations from the natural background mean for nearshore areas, and five standard deviations for offshore areas.</td>
</tr>
</tbody>
</table>

Noting: 20th percentile (low turbidity conditions – low wind and waves); 50th percentile (average conditions); and 80th percentile (high turbidity conditions – moderate to high wind and waves).
Figure 19. El Nino Year Zone of Impact for the Dredging Period

Figure 20. El Nino Year, Zone of impact over the full 12 months

LEGEND
- Shipping Channel
- Area
- Zones of Impact
  - Zone of Influence
  - Zone of Low Impact
  - Zone of Moderate Impact
  - Zone of High Impact
Figure 23. Transitional Year Zone of Impact for the Dredging Period

Figure 24. Transitional Year Zone of Impact over the Full 12 Months
A comprehensive risk assessment covering all environmental, technical and operational, economic, and social and cultural risk areas has been developed for the Port of Townsville. This detailed risk assessment is currently under review and consultation with local leading experts to ensure all potential impacts to and from maintenance dredging have been captured.

Table 8 below, is a high-level risk assessment, covering the key risk, areas and areas of interest for Cleveland Bay. Once all comments have been received from consultation with local experts, any knowledge gaps, unidentified impacts, or changes to the residual risks will be included in the LTMDMP.

Table 8. Risk Assessment for the Port of Townsville, to and from maintenance dredging within Cleveland Bay.

<table>
<thead>
<tr>
<th>Issue</th>
<th>Risk Receptor</th>
<th>Potential Impact</th>
<th>Details</th>
<th>Likelihood / Consequence</th>
<th>Residual Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turbidity generated during dredging</td>
<td>Sensitive receptors: Coral, Seagrass and Benthic communities</td>
<td>Temporary smothering of sensitive receptors</td>
<td>Temporary turbidity plumes localised to source point, or within/ directly adjacent to, the channels</td>
<td>Unlikely / insignificant</td>
<td>Low</td>
</tr>
<tr>
<td>Turbidity generated during maintenance material placement in DMPA</td>
<td>Sensitive Receptors: Coral seagrass benthic communities</td>
<td>Temporary smothering of sensitive receptors</td>
<td>Negligible impact, placement area is 6km+ from sensitive receptors of the bay. Temporary impact at DMPA – with a limited change seafloor profile for benthic communities. The 12km² DMPA, would register a change of 4cm for a full campaign.</td>
<td>Rare / insignificant</td>
<td>Low</td>
</tr>
<tr>
<td>Underwater noise during dredging and placement</td>
<td>Megafauna</td>
<td>Masking megafauna communications; impacting on hunting behaviour</td>
<td>TSHD highly mobile vessel; noise production monitored for dredge plant; dredge vessel operates within noise modelling volumes.</td>
<td>Rare / insignificant</td>
<td>Low</td>
</tr>
<tr>
<td>Dredge vessel strike</td>
<td>Dolphins, whales, dugongs</td>
<td>Death/injury of protected megafauna species</td>
<td>Dredge is, mobile, with high bridge tower for visual observations of animals within a 300m radius. Most megafauna can readily avoid the dredge</td>
<td>Rare / moderate</td>
<td>Low</td>
</tr>
<tr>
<td>Dredge draghead entrains a turtle</td>
<td>Turtles (including listed turtle species)</td>
<td>Death/injury to turtles</td>
<td>Dredge dragheads have turtle diversion devices installed. The suction of dragheads only permitted while the draghead is on the seafloor (i.e. not mid water column)</td>
<td>Possible / insignificant</td>
<td>Low</td>
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<tr>
<td>Dredge draghead entrains other marine fauna</td>
<td>Fish, eels or sea snakes</td>
<td>Death / injury to marine fauna</td>
<td>Dredge dragheads have diversion devices installed. The suction of dragheads only permitted while the draghead is on the seafloor (i.e. not mid water column)</td>
<td>Rare / insignificant</td>
<td>Low</td>
</tr>
<tr>
<td>Introduced marine pests to Cleveland bay from dredge vessel</td>
<td>Local and regional marine ecosystems</td>
<td>Introduction of pest species to Cleveland bay</td>
<td>All vessels must comply with State and Commonwealth Biosecurity Legislation (quarantine, ballast water management, inspections</td>
<td>Rare / Insignificant</td>
<td>Low</td>
</tr>
<tr>
<td>Issue</td>
<td>Risk Receptor</td>
<td>Potential Impact</td>
<td>Details</td>
<td>Likelihood / Consequence</td>
<td>Residual Risk</td>
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<tr>
<td><strong>OPERATIONAL AND TECHNICAL</strong></td>
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<tr>
<td>Dredging or placement activity impedes commercial traffic</td>
<td>Commercial fleet</td>
<td>Temporary commercial disruptions</td>
<td>Temporary delays only (&lt;hour) in production and operation for commercial operators. TSHD highly maneuverable, allowing for movement around other vessels</td>
<td>Unlikely / Minor</td>
<td>Low</td>
</tr>
<tr>
<td>Severe weather disrupts dredging resulting in a reduction of depth, restricting all shipping movements</td>
<td>Commercial fleet</td>
<td>Temporary disruption</td>
<td>Temporary, short-term delays (days), disrupting all operations in and out of the Port. TSHD can arrive in days, it has high production rates to clear infrastructure, reducing further downturn for Port operations. RHM to re-declared depths.</td>
<td>Unlikely / Serious</td>
<td>Medium</td>
</tr>
<tr>
<td>Dredging or placement activity impedes recreational traffic</td>
<td>Recreational fleet</td>
<td>Temporary disruption</td>
<td>Temporary delays (&lt;hour) in and out of Ross Creek by TSHD, or Ross River by Cutter Suction. Both mobile dredgers, allowing movement around operations area</td>
<td>Unlikely / insignificant</td>
<td>Low</td>
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<tr>
<td>Legislative increase in land placement</td>
<td>Commercial fleet</td>
<td>Ongoing disruption; navigation hazards; delays in operations</td>
<td>Limited land available for placement. Delays in placement restricts dredging production and declared depths of infrastructure. Adequate volume forecasting in LTMDMP and permits to State and Commonwealth Governments required.</td>
<td>Rare / Major</td>
<td>Low</td>
</tr>
<tr>
<td><strong>ECONOMIC</strong></td>
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<tr>
<td>Legislation increases land placement, increasing the cost of maintenance dredging</td>
<td>Local community; Regional community and Queensland</td>
<td>Temporary loss of port for transport impacts network of supply chains due to increased cost for normal port operations</td>
<td>Medium term (months) negative impacts, including increased costs to consumers. Adequate volume forecasting required in LTMDMP and relevant approvals by State and Commonwealth Governments,</td>
<td>Unlikely / Minor</td>
<td>Low</td>
</tr>
<tr>
<td>Dredging or placement activity impedes commercial traffic</td>
<td>Commercial fleet</td>
<td>Temporary commercial disruption</td>
<td>Temporary delays (&lt;hour) in production and operation for commercial operators. TSHD highly maneuverable, allowing or movement around other vessels</td>
<td>Unlikely / Minor</td>
<td>Low</td>
</tr>
<tr>
<td>Loss of infrastructure depth following a cyclone</td>
<td>Local community;</td>
<td>Restricted access to port for transport, impacts network of supply chains</td>
<td>Temporary, short-term (weeks) negative impacts in production in and out of the Port.</td>
<td>Unlikely / Serious</td>
<td>Medium</td>
</tr>
<tr>
<td>Issue</td>
<td>Risk Receptor</td>
<td>Potential Impact</td>
<td>Details</td>
<td>Likelihood / Consequence</td>
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<tr>
<td>Community disturbance by dredge (light, noise, fumes)</td>
<td>Local community</td>
<td>Loss of amenity</td>
<td>Short term (hours) localised impacts to within the vicinity of the dredge vessel</td>
<td>Unlikely / Insignificant</td>
<td>Low</td>
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<tr>
<td>Dredging or placement activity disrupts water traffic</td>
<td>Recreational and/or commercial vessels</td>
<td>Temporary disruption</td>
<td>Temporary delays only (&lt;hour) in production and operation for vessel operators. TSHD vessel highly mobile in Cleveland Bay; Cutter Suction dredge leaves a clear path for vessels in Ross River</td>
<td>Unlikely / Insignificant</td>
<td>Low</td>
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<tr>
<td>Visual impact from dredging or placement</td>
<td>Local community</td>
<td>Temporary disruption</td>
<td>Temporary turbidity plumes (hours) localised to the source point, or within/ directly adjacent to, the channels; and placement area is &gt;6km from the Magnetic Island.</td>
<td>Unlikely / Insignificant</td>
<td>Low</td>
</tr>
<tr>
<td>Cultural heritage (indigenous and non-indigenous) impacted by dredging</td>
<td>Local traditional owners</td>
<td>Disturbance of cultural artefacts, Impact on cultural important marine species</td>
<td>POTL has a Cultural Heritage Management Plan registered with the Queensland Government. POTL site inductions include Cultural heritage and direction to report any artifacts found. Impacts on culturally important marine species addressed in Environmental Risk Assessment above.</td>
<td>Unlikely / Minor</td>
<td>Low</td>
</tr>
</tbody>
</table>

This risk assessment is based on definitions of risk consequences, likelihood and hazard grade, adapted from:

- *Great Barrier Reef Region Strategic Assessment: Strategic assessment report, GBRMPA, Townsville* (GBRMPA, 2014) for the Environmental, and Social and Cultural Risk Assessments; and
- Port of Townsville Limited’s Risk Assessment Guidelines (POT 442) for the Economic, and Operations and Technical Risk Assessments
7. Identification and treatment of key risks

As identified in the Risk assessment, the sensitive receptors of the bay are the key environmental concerns for maintenance dredging for the Port of Townsville. These concerns include impacts to coral and their spawning periods, the location seagrass meadows and impacts from turbidity, and impacts to marine fauna within the bay.

To mitigate these impacts, adaptive measures are implemented by way of the Scheduling of the TSHD Brisbane, and a detailed dredge Environmental Management Plan approved by POTL prior to the dredge arriving in Townsville:

- The scheduling of the TSHD is undertaken based on a risk assessment completed by each Port which includes environmental windows to avoid. Port of Townsville is committed to limiting any impact maintenance dredging and placement activities have upon Cleveland Bay – which includes avoiding dredging during the coral spewing periods (October / November each year).
- To ensure specific operational controls for maintenance dredging and placement activities are considered/controlled in campaign-specific EMP as drafted by the Port of Brisbane as owner and operator of the TSHD Brisbane (see Section 8).
- Where possible, for perception reasons, the Port of Townsville requests dredging is avoided in school holidays mid-year (peak tourism season)

On 30 July 2015, POTL entered into a Deed of Agreement with DoEE under Section 19 of the Environment Protection (Sea Dumping) Act 1981. This formalised POTL’s research and monitoring activities relating to the consequences to the marine environment of sea disposal activities for maintenance dredge material, derived from the Port of Townsville; and continues investigations as part of a long-term strategic program that investigates, and identifies opportunities and options, for reducing the need for future sea placement of maintenance dredge material.

Section 9 of this LTMDMP lists the agreed monitoring programs the POTL is committed to, as per the S19 Deed of Agreement. This agreement ends in August 2020, after which a re-assessment of these programs and environmental priorities will be undertaken, in consultation with DoEE.

Table 9 below shows the historic ambient and targeted monitoring that has occurred within Cleveland Bay, by the Port of Townsville.
### Table 9. The last 17 years of long and short-term research programs at the POTL

<table>
<thead>
<tr>
<th>Year</th>
<th>Benign Fauna / Introduced marine pests</th>
<th>Bioavailability / toxicity / Eliminate testing</th>
<th>Coral</th>
<th>Hydrocarbons</th>
<th>Hydrodynamic / Sediment characteristics</th>
<th>Marine Mega Fauna</th>
<th>Nutrients / Pesticides / Herbicides</th>
<th>Photosynthetically Active Radiation (PAR)</th>
<th>Spatnas</th>
<th>TBT / Organic Carbon</th>
<th>Trace Metals</th>
<th>Turbidity (NTU)</th>
<th>Underwater flora</th>
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</table>

✓ = monitoring conducted
8. Risk assessment framework

In order to manage the environmental risks associated with dredging and placement activities, the Port of Townsville follows the recommended structure of the Dredging Management Strategy (Figure 25), as well as Port’s Australia’s *Code of Practice for Dredging and Dredge Material Management* (Figure 26).

In following these structures, the Port of Townsville, reviews and approves the contracting dredge owner’s Dredge Environmental Management Plans (EMPs) each year prior to the dredge vessel arriving in Townsville. This includes the TSHD Brisbane, owned by the Port of Brisbane, and Cutter suction dredge, as contracted from time to time by the tender process, the past two campaigns were undertaken by Hall Contracting with the vessel Everglade, (see Section 8.2 for the description of dredge types used at the Port of Townsville).

The Port of Townsville has a range of other small plant that are internally operated, primarily the mechanical dredge, however, there is also the potential for backhoe and suction. Though these currently not be utilised.

The Port of Townsville has a range of operational controls for the mechanical dredge, formalised via internal work practices however a full dredge EMP will be drafted for these in 2019.

*Figure 25. Dredge management and monitoring elements (DMS 2016)*
8.1 Example Dredge Environmental Management Plan

Whilst dredge management plans can vary per operator, structures usually are similar, the TSHD Brisbane’s Dredge Environmental Management Plan has followed the following structure:

1. Description of Port of Brisbane use of TSHD Brisbane and requirement of the EMP as part of their Environmental Management System.
2. Description of the TSHD Brisbane
3. Location and description of the Port of Townsville
4. Description of the approved activity at the Port of Townsville
5. List of Environmental legislation and approvals as applied to dredging at the Port of Townsville
6. Roles and responsibilities of key personnel associated with dredging at Port of Townsville
7. The Environmental Management Plan (structure)
8. Management Plans
   - Waste management
   - General and recycling wastes
   - Sewage treatment
   - Hazardous waste
   - Emissions
   - Turbidity control
   - Protected Marine fauna
   - Cultural Heritage
   - Ballast water management
   - Vessel washdown; and
The Port of Townsville contracts maintenance dredging to the Port of Brisbane using the TSHD Brisbane. The main responsibility for following the EMP and the POTL approval conditions lies with the TSHD Brisbane. Port of Townsville is however responsible for undertaking all pre, during and post hydrographic surveys, environmental monitoring (monitoring of marine fauna is the responsibility of the Dredge Master during dredging), auditing and reporting. The Port of Townsville also has an oversight role for deviation from the EMP, and demonstration of all condition compliance, noting the Port of Brisbane is in charge of the plant.

8.2 Types of equipment used for dredging at the Port of Townsville

The methods for maintenance dredging are determined based on the volume and area to be dredged, equipment availability, and the placement method. The majority of maintenance dredging at the Port of Townsville is undertaken using a Trailer Suction Hopper Dredge (TSHD). A Cutter Suction dredge is utilised in shallower waters and smaller scale dredging works (e.g. spot removal, minor berth pocket dredging and areas inaccessible for TSHDs) may be undertaken using a grab dredge with a split hopper barge. POTL also maintains declared depths and vessel safety between dredging campaigns, and some works are supported by drag beaming. Operation of any dredging methods could be carried out by a number of dredgers dependent on their availability and will be in accordance with a Dredging Environmental Management Plan (DMP) developed by the dredging contractor for the specific dredging campaign, taking into account the requirements of POTL’s DEMP guideline and any permits. Further details of maintenance dredging methods are provided below, with a comparison of production rates listed in Table 9 at the end of this section.

Trailer Suction Hopper Dredge (TSHD)

A TSHD is typically used for POTL’s annual dredging campaign where significant volumes of material can be removed in relatively short periods in deeper waters with no or limited navigational impacts. Since 2001, the TSHD Brisbane has been used for the majority of dredging at the Port of Townsville (Figure 27). The TSHD Brisbane (84 m long and ~3,500 t displacement) is a relatively small TSHD, owned and operated by Port of Brisbane Corporation. The TSHD Brisbane dredges at many Queensland Ports, therefore maintenance dredging works at the Port of Townsville are scheduled dependent on the TSHD Brisbane’s availability and may be influenced by dredging requirements at other Queensland ports.
Hydrographic survey information is loaded onto the TSHD Brisbane’s onboard computer system and the vessel can operate in either automatic mode, where onboard computers control vessel dredge systems, or manually. The onboard computers also assist in accurately positioning the vessel by displaying a differentially corrected GPS position of the vessel track against intended dredge areas.

The vessel dredges sediment by lowering two suction heads (one on either side of the vessel) to the seafloor whilst steaming slowly (1-3 knots) ahead. Large onboard pumps draw water through the heads entraining sediments from the seafloor and depositing a mixture of water and sediments into the vessel’s central hopper (Figure 28). The total volume of the hopper is 2,900 m³, but the effective capacity of the hopper is dependent upon the type of material being dredged, ranging from approx. 1,700 m³ for sands to approx. 2,800 m³ for fine silts. Once the hopper has reached optimum capacity for the type of material being dredged, the vessel steams to the offshore DMPA.
During placement at sea, the material is generally “bottom discharged” by opening large valves in the floor of the hopper.

An environmental valve, or ‘green valve’ (Figure 29), is used in the dredging industry to reduce the surface turbidity during overflow of the hopper. While the green valve does not reduce the amount of sediment released from a dredge, it does reduce the extent of turbid dredge plumes in the water column and limits the mobility of dredged material.

The overflow from the TSHD consists of water, sediments and air. Without a green valve, the air in the overflow carries the sediment fines to the surface. As a consequence, the sediment fines are dispersed over a much larger area increasing turbidity in the water column. With a green valve, the overflow is choked such that a constant fluid level is maintained in the hopper and, as a result, no air is taken down with the overflow water. This results in more sediment taken to the seabed and less sediment suspended in the water column as turbid plumes. The material on the seabed is less likely to become mobilised into areas of sensitive ecological receptors compared to material suspended in the water column.
Mechanical (Grab) Dredge and Split Hopper Barge

A mechanical (grab) dredge and split hopper barge (Figure 30) owned and operated by POTL is typically used for minor dredging work which generally only requires the removal of small volumes of material; is in areas where larger dredging vessels are unable to access; and, to remove material which does not meet NAGD requirements for sea placement and therefore, is required to be placed onshore. This method of dredging is slow and operation is often suspended due to commercial vessels requiring access to the Port’s Berths; once the berth is free operation can then again commence (which could be days or weeks depending on cargo). This material is then pumped to shore, rather than sea placement due to operational requirements.

Mechanical Grab dredging is undertaken by vessels owned and operated by POTL, namely the Max Hooper and the Netterfield. The Max Hooper is a 30 m deck barge, which supports a 60t crane that operates a 3m$^3$ clamshell bucket. The crane and bucket collects the sediment and places it directly into the Netterfield. The Netterfield is a split hopper barge, (36 m long, 200 m$^3$), capable of hinging open along its centre line and placing material directly into the sea; it has also been fitted with a slurry pump, so the material can be pumped out and placed directly onshore.

Grab dredging is a labour intensive and slow method of dredging small volumes, POTL can average anywhere up to approximately 20,000m$^3$ a year, depending on the areas requiring dredging and previous scheduling. This method of dredging occurs opportunistically throughout the year when areas of Port infrastructure are free from commercial/cargo vessels.

Operational controls to minimise environmental and operational impacts, and to meet permit conditions, are on internal work processes. The Port of Townsville also maintains management over tailwater although this is limited due to the slow scale of the mode of dredge.
Figure 30. Mechanical Grab Dredge, and Netterfield Split Hopper.

Cutter Suction Dredge

A cutter suction dredge is generally made up of two parts: the lead Cutter boat, and the Suction pipe boat that locks into the lead boat. The dredge is equipped with a rotating cutter head, which is mounted to the head of the suction pipe (Figure 31). Maintenance material sediments are sucked up as they are cut, by the dredge pumps on board the tail boat and transported by floating pipeline, either to land or to split hopper barge for sea disposal. The suction pumps on, as an example, the Everglade can move sediments through a floating pipeline for a maximum length of 1000 meters. This type of dredge is a manually operated dredge that is fixed to the river bed via Spud Poles during cutting/suction works to stabilise and manoeuvre the dredge machinery.

Figure 31. Cutter Suction Dredge, working view
For previous campaigns, POTL has contracted out the cutter suction dredge *Everglade*, along with her crew (Figure 32) to undertake dredging in the Ross River. Currently dredging of the Ross River occurs on a three years basis, with approximately 140,000m$^3$ removed each campaign (from Ross River entrance channel, and TMP swing basin); an average campaign is typically completed within two months.

*Figure 32. Cutter Suction Dredge Everglade*

A site based Environmental Management Plan which addresses standard operational procedures to minimise environmental impacts and address regulatory and permit conditions, is provided to POTL for approval prior to the vessel arriving in Townsville. Each Cutter Suction dredge vessel contracted by the Port of Townsville, also maintains management over tailwater, and floating pipe management.

**Suction Dredging**

For operational purposes, occasionally different plant and equipment, such as small suction heads and barges, may need to be utilised, usually for small volumes or in areas inaccessible by other dredging equipment. This method relies purely on the water velocity to mobilise the sediment with material going into a barge.

**Backhoe**

A backhoe dredger consists of a long reach excavating unit mounted on a pontoon or secured barge, which is positioned by spuds (legs). After positioning, the pontoon is slightly raised from the water by winches to create additional downward spud pressure and reduce wave effects. The hydraulic backhoe is mounted at the lowest point of the pontoon to facilitate maximum dredging depth. The buckets and booms can be replaced or changed to suit the depth of dredging and type of materials to be dredged and this method can move stiff material. A backhoe dredger allows for a very targeted campaign and can achieve depths of -15.5 m LAT with material going into a barge.
Production rates

The production rates of each dredging option depicts the areas in which they operate for maximum efficiency. Table 10 lists the production rates for the three main types of dredging that occurs at the Port of Townsville.

Table 10. Comparison of Dredge machines production rates at the Port of Townsville

<table>
<thead>
<tr>
<th>Dredge Equipment</th>
<th>Volume per day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trailer Suction Hopper Dredge</td>
<td>~ 11,000 to 14,000m³ per day</td>
</tr>
<tr>
<td>Cutter Suction Dredge</td>
<td>~ 2,500m³ per day</td>
</tr>
<tr>
<td>Mechanical Grab dredge</td>
<td>~ 330m³ per day</td>
</tr>
</tbody>
</table>

Affiliated works with maintenance dredging

Sounding

To ensure all maintenance dredging is undertaken only in approved areas, to approve depths, and within approved volumes, POTL undertakes Hydrographic Surveys (soundings) of the Harbour, Channels, berths, DMPA etc. These soundings are achieved by using both multibeam and single-beam echo sounder systems to produce accurate hydrographic data and sounding charts. The TSHD Brisbane uploads the pre-dredge survey soundings to align their onboard navigational positioning system. Soundings are undertaken after dredging has finished, to confirm depths, areas and volumes meet the approved limits (both State and Commonwealth regulations).

Drag Beaming

Drag beaming is a method used to support other forms of dredging, without the need to dredge. Drag beaming uses a beam to push peaks of sediment into lower areas and flattens out a works area.

The Port of Townsville operates a drag beam (a 16m workboat pushing a 14.5 x 6 m barge via a purpose-designed pushing frame) to assist in maintaining declared depths at berths and operational areas within the harbour areas (Figure 33). The barge machinery consists of a diesel powered hydraulic power pack, lifting derrick and winch gear, which supports and controls the depth of the beam. The barge is also fitted with a bow thruster to assist in turning the work vessel/barge in confined areas. All barge machinery may be remotely controlled via a radio on the work vessel.

The drag beam maintains depth by relocating and flattening sediment displaced by vessel and tide movements. Sediment is moved by lowering a 10m steel beam to the declared height of the area being worked. The work vessel then steers a predetermined course using the GPS plotter as a reference. The beam acts as a grader blade and pushes material from high peaks to lower areas, which is essential in maintaining declared depths close to design depths. Unlike the dredging methods described above, the drag beam method does not entrain sediment into the dredging equipment.
Figure 33. Drag Beaming.
9. Monitoring framework

POTL undertakes a range of ambient, impact and real-time monitoring programs before, during and after maintenance dredging campaigns (Table 11). These are to ensure the health of Cleveland Bay remains high, whilst helping to identify, manage or reduce any detected impacts to sensitive receptors known within the bay, and around Magnetic Island. A number of these programs are conditioned by development approvals to undertake a number of monitoring programs, and not just for maintenance dredging.

In 2015 the Port of Townsville entered into a Section 19 Deed of Agreement for a Research and Monitoring plan with the Commonwealth Department of Environment and Energy (DoEE). This agreement set out 17 research and monitoring programs that were to be delivered over five years. POTL has completed years 1, 2 and 3 of the plan, with the terms of the agreement to be finalised for August 2020 (year 5) – See Table 12.

<table>
<thead>
<tr>
<th>Monitoring Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient monitoring (PORT WIDE)</td>
<td>Port of Townsville undertakes a number of ambient monitoring programs through the bay, and not just for maintenance dredging. These programs include - marine water, marine sediment, air quality (and dust monitoring) biosecurity monitoring, Light/PAR, seagrass, potable water, trade waste, groundwater. These programs set out to understand and monitor not only the marine environment of Cleveland Bay but also how the Port may impact upon the surrounding environment.</td>
</tr>
<tr>
<td>Impact monitoring (MAINTENANCE DREDGE CAMPAIGN-SPECIFIC)</td>
<td>Port of Townsville has undertaken a number of impact monitoring programs. Including those required by the S19 Deed of Agreement with DoEE, which required dredge plume monitoring, including plumes generated by placement activities. Impact monitoring is also undertaken by way of real-time water quality buoy positioned in the bay. The data captured by these buoys helps to identify direct and/or indirect impacts from maintenance dredging and placement activities on the sensitive receptors within the bay.</td>
</tr>
<tr>
<td>Real-time monitoring (MAINTENANCE DREDGE CAMPAIGN-SPECIFIC)</td>
<td>Port of Townsville has a number of real-time water quality buoys operating within Cleveland Bay. These buoys are utilised for both ambient monitoring as well as impact monitoring – collecting NTU, pH, Conductivity and Orp in different sections of the bay. This data is used to monitor water quality during dredging and placement areas. A real-time water quality dashboard is currently being developed for these water quality buoys. Once the dashboard is finalised, a link will be put on the POTL website for public access.</td>
</tr>
</tbody>
</table>

The results of campaign-specific monitoring are reviewed after each campaign, with any impacts identified presented to the TACC, and then captured to in the following years campaign-specific EMP and environmental monitoring program. POTL is committed to undertaking a broader long-term review of all baseline environmental monitoring as part of the 5-year LTMDMP review.
### Table 12. Section 19 Deed of Agreement, Research and Monitoring programs 2015-2020

<table>
<thead>
<tr>
<th>Research and Monitoring Area</th>
<th>Objective</th>
<th>Method</th>
<th>Delivery (year) / Timing of monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monitoring of water quality (Turbidity / PAR) near sensitive receptors</td>
<td>Assess impact of maintenance dredging and dredge material placement activities on turbidity and PAR levels under a range of timing and conditions</td>
<td>Turbidity and PAR monitors with data loggers serviced on a regular basis with water quality grab samples taken to assist with calibration/verification of results</td>
<td>2016 2017 2018 Continually – (year round) data retrieved monthly</td>
</tr>
<tr>
<td>Plume monitoring at DMPA</td>
<td>Assess impact of maintenance dredge material placement activities on turbidity levels</td>
<td>In-situ water quality probe, hung from boat - before, during, and after placement with the TSHD Brisbane</td>
<td>2016 2017 2018 At the time of placement – collecting data before, during, and after the dredge has placed the material in the DMPA.</td>
</tr>
<tr>
<td>Monitoring sedimentation, resuspension and plume monitoring adjacent to dredge areas</td>
<td>Determine the source and marine fate of sediments adjacent to areas disturbed by maintenance dredging</td>
<td>Water quality frames deployed water, logging equipment and lab analysis</td>
<td>2016 2017 2018 Continually – (year round) data retrieved monthly</td>
</tr>
<tr>
<td>Monitoring of seagrass areas in Cleveland Bay</td>
<td>Assessment of seagrass health in Cleveland Bay</td>
<td>(Contracted TropWATER (JCU) to conduct surveys) via helicopter survey, boat-based free-diving survey, and boat-based CCTV camera-sled tows</td>
<td>2016 2017 2018 2019 2020 Between September and November - Annually</td>
</tr>
<tr>
<td>Three Bays Project environment impact assessment in Cleveland, Halifax, and Bowling Green Bays</td>
<td>Assess long-term impact of maintenance dredging and dredge material placement activities on DMPA compared to neighbouring bays</td>
<td>Van Veen grab across sites in the three bays for identification and density/species richness.</td>
<td>2017 Between 5 and 10-year intervals</td>
</tr>
<tr>
<td>Sedimentation – Effects on different proximal stressors on selected species</td>
<td>Assess impact of maintenance dredging and dredge material placement activities on key habitat forming species such as corals, sponges, seagrasses and algae</td>
<td>Research study - dose-response relationships and pressure-response relationships on key habitat forming species</td>
<td>2017 2018</td>
</tr>
<tr>
<td>Hydrodynamics - current &amp; historical bathymetric surveys in Cleveland Bay</td>
<td>Assess long-term impact of maintenance dredging and dredge material placement activities on bathymetry in and around port infrastructure</td>
<td>Desktop study of Bathymetric surveys</td>
<td>2018 2019</td>
</tr>
<tr>
<td>Monitoring of benthic fauna at DMPA in Cleveland Bay</td>
<td>Assess community composition and rate of recolonisation at the DMPA</td>
<td>Benthic grab samples of fauna and flora, in and adjacent to the DMPA, for identification and density.</td>
<td>2016 2019 2020 Before and after placement (specific timing yet to be determined)</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Monitoring sedimentation and resuspension in DMPA</th>
<th>Determine the source, and marine fate, of sediments at DMPA</th>
<th>Research study/modelling of POTL and Cleveland Bay</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monitoring underwater noise levels if using dredge equipment other than TSHD Brisbane</td>
<td>Assess impact of maintenance dredging and dredge material placement on underwater noise levels</td>
<td>A desktop study into appropriate monitoring equipment – unlikely to be required during the lifespan of the S19 DoA as contract with TSHD Brisbane doesn’t expire until 2024.</td>
</tr>
<tr>
<td><strong>Dredging and Dredge Material Placement Factors</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 Operational approach to maintenance dredge material placement and impacts on turbidity</td>
<td>Optimise dredge material placement methodologies to provide greatest efficiency and lowest turbidity in DMPA</td>
<td>Research study – as based upon data collected from the field</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2016 2017 2018</td>
</tr>
<tr>
<td>12 Operational approaches to maintenance dredging and impacts on turbidity and production</td>
<td>Optimise dredging methodologies to provide greatest efficiency and lowest turbidity in maintenance dredge areas</td>
<td>Research study – as based upon data collected from the field</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2016 2017 2018</td>
</tr>
<tr>
<td>13 Operational approaches to management of land-based dredge material</td>
<td>Reduce land requirements for and impacts from maintenance dredge material placement activities of land</td>
<td>Research study – research operational approach to management of land disposal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2020</td>
</tr>
<tr>
<td><strong>Factors Influencing Maintenance Dredging and Dredge Material Placement</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14 Future Maintenance Dredging Requirements - interaction between developments in Port infrastructure, sedimentation and the shipping, safety and operational activities of the Port</td>
<td>Forecast the future maintenance dredge needs of the Port of Townsville in conjunction with the future developments proposed in the Port of Townsville’s “Ports Development Plan” (to be timed with the development of the Port of Townsville Master Plan and Ports Development Plan)</td>
<td>Research study – research/forecast dredging needs – interaction between infrastructure, sedimentation, shipping and safety</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2019</td>
</tr>
<tr>
<td>15 Long-term alternative options to current DMPA in Townsville</td>
<td>Investigate options for long-term sea DMPAs</td>
<td>Research study – research/survey alternative options to the current DMPA in Townsville</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2019</td>
</tr>
<tr>
<td>16 Alternative Options to Sea Placement in Townsville</td>
<td>Minimise potential for impacts to sensitive receptors near DMPA</td>
<td>Research study – research alternative options to sea placement and opportunities for Townsville</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2019</td>
</tr>
<tr>
<td>17 Short term and long term beneficial reuse options and opportunities in Townsville</td>
<td>Reduce volumes of maintenance dredge material placed at sea</td>
<td>Research study – research beneficial reuse options and opportunities for Townsville</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2019</td>
</tr>
</tbody>
</table>
10. Performance Review

As described in section 1.2, POTL’s objectives for this Long-term Maintenance Dredging Management Plan are:

a) Maintaining safe navigation for the continued operation of both Ports;
b) Ensuring the Outstanding Universal Characteristics (OUV’s) of the GBRWHA and sensitive receptors surrounding both the Port Townsville and the Port of Lucinda are maintained;
c) Ensuring a robust, transparent long-term planning approach to the management of sediments within Port infrastructure;
d) Continue the long-term proactive and environmentally responsible management approach of maintenance dredging and material placement at the Port of Townsville;
e) Capture and communicate operational controls for best management; and
f) Support local and regional communities, ensuring the health, wellbeing and connectivity to the global market is maintained.

Performance indicators used to determine whether these objectives are being met and/or to better inform future risk assessments are:

- Routine maintenance dredge volumes are within predicted volumes outlined in table 4 of this document
- Routine maintenance dredge volumes are within modelled parameters, and modelling is updated if changes are noted and incorporated into the risk assessment as required
- POTL requirements for timing of dredge, as identified by the risk assessment, are incorporated into annual scheduling discussions with Queensland Ports and Port of Brisbane.
- No material is placed at sea that has not been assessed against NAGD and approved for placement (noting a new SAP is required every 5 years)
- Demonstrated evidence that all dredging undertaken is done so under a relevant EMP (or Dredge Management Plan)
- POTL to undertake observation during dredge campaigns to provide oversight for compliance with EMP/DMP and/or approvals.
- Incorporate information from ambient and target monitoring and research projects into risk assessments to inform decisions and improve outcomes
- Capture any performance measures that have not been achieved and detail corrective actions undertaken
- Full compliance with State and Commonwealth approvals and reporting requirements including notification processes and volume reporting
- Undertake scheduled internal audits of the LTMDMP as part of the ports Certified Integrated Management System
- Annual reviews to be undertaken against the performance indicators, this review is included consolidation of the effectiveness and relevance of the performance indicators. This includes
initiating an independent review of the LTMDMP if the annual reviews determine the performance indicators are not effective.

- Undertake a full review of the LTMDMP (informal at 12 months; formal at 5 years; and formal for the creation of new LTMDMP at 10 years).
2. Port Locality, Setting and Shipping

2.1 Location and environmental setting.

Port of Lucinda (−18.524017°S, 146.330581°E) sits almost 100 kilometres north of Townsville, approximately 26km north-east of the township of Ingham. Lucinda is located within the Hinchinbrook Shire Council Region, and within the northern corner of Halifax Bay, east of the Herbert River mouth and Hinchinbrook Channel. The port sits below Hinchinbrook Island (Figure 34).

The Port of Lucinda exports sugar grown and milled from the surrounding district (Victoria and Macknade Sugar mills). It is equipped with on-shore sugar handling and storage facilities, as well as a single trestle jetty and conveyor running out to an off-shore berth and ship loader.

The jetty is one of the longest of its type in the world, extending 5.6 kilometres out to sea and dipping 1.2 metres over its length as it follows the curvature of the earth. Sugar takes 22 minutes to travel along the conveyor from the on-shore storage sheds to the ship loader.

The port terminal is operated by Lucinda Bulk Sugar Terminal, a subsidiary of Queensland Sugar Limited (QSL). (POTL website, 2018)
2.2 Port of Lucinda Overview

The Port of Lucinda was gazetted in 1892, born out of the need for an all tide access facility for the growing sugar cane industry’s exports. The bulk terminal at Lucinda was opened in 1958, with the construction of a new L shaped concrete wharf with wooden piles (PCQ 2004). Due to the shallowing of the Hinchinbrook Channel, this inner wharf was no longer a long-term solution; in 1975 the construction of the (current) offshore jetty began, finishing in 1979. This 5.6km long jetty houses a conveyor system to move sugar out to the offshore berth. The berthing depth was designed at 14m deep, and due to the self-scouring nature of this area of the bay, the berth does not require maintenance dredging.

The Port of Lucinda has state designated Port Limits (see Figure 35), which differ from the exclusion zone from the Commonwealth Marine Park (see Figure 37, in section 3.2).
Figure 35. Port Limits of the Port of Lucinda
2.3 Current and future uses

In the 2017/2018 Financial year, the Port of Lucinda totalled a throughput (export) of 579766 tonnes of sugar, via 15 ships.

As the Port of Lucinda has not been deemed a priority port, master planning is not required. The port is reliant on the production of sugar from the surrounding cane farms and two sugar mills. There is no expected change of usage of this facility, as the conveyor, trestles and jetty are arranged for exports only.

2.4 Navigational infrastructure and capacity

The Port of Lucinda operates via a 5.6km long jetty, with a 400m wharf located on its end. The jetty houses a conveyer belt that moves sugar from the three terminal sheds to ships berthed at the end. This jetty negates the need for any large vessel from entering the onshore facilities. Only the pilot vessels need to berth at the public (inner) wharf situated off the main Port area.
3. Port of Lucinda Environmental Values

The Port of Lucinda (-18.524017°S, 146.330581°E) is situated on the coastline east of the township of Ingham, in tropical North-East Queensland, approximately 1,473 kilometres north of Brisbane, Queensland’s capital city. The port is located in the Northeast corner of Halifax Bay, near the mouth of the Herbert River and at the southern entrance to the Hinchinbrook Channel (Figure 36). The Palm Island Group sit at their closest point 16.4km from the main port lands. Pelorus Island is the Port’s closest neighbouring island and the top most island in the Palm Island Group.

Halifax Bay is a naturally long, broad and turbid bay, it is bound to the south by Cape Pallarenda, and Hinchinbrook Island to the north, which are approximately 90km apart. The Bay is mostly east facing, with limited shelter (except the Palm Islands in the north) makes the bay a on occasion a turbid water body, enhance by the sediment load received from the multiple creek systems which dot the coastline of the Bay (one river, two mangrove deltas, 10 named creeks, and multiple unnamed drainage lines).

*Figure 36. Regional Location Map including Halifax Bay, North Queensland*
Located within the wet tropical region of Northern Queensland, Lucinda is characterised by a tropical, seasonal wet and dry climate. High humidity and frequent storms and occasional cyclones, typically occur during the wet season (November to April). The dry season (May to October) produces mild and moderate temperatures. The temperature ranges from a mean maximum of 30°C in January to a mean minimum of 18°C in July. Relative humidity is highest in the mornings and average annual rainfall in Lucinda is approximately 1,056.2 mm, with the majority typically recorded during the wet season (January to March).

3.1 Environmental

3.1.1 Climate and coastal processes

Climate change projections indicate that the region’s future climate is likely to be characterised by:

- increased average annual temperature and increased number of days with maxima over 35°C;
- decreased average annual rainfall, increased annual potential evaporation, and more drought-like conditions;
- increased average wind speeds;
- increased number of severe tropical cyclones; and
- elevated sea level and increased frequency and height of storm surge.

Careful planning of the potential effects of natural events such as cyclones and floods including predicted climate change risks are a key consideration in port planning, design and operations.

Halifax Bay is a moderate wave energy environment as it is only sheltered from the predominant south-east waves by the Palm Island group. The open expanse of the Bay’s outer edges makes the bay shallow only along the coastal beaches (1 to 5m below chart datum), deepening quickly out to 9m, and then out to 12 – 15m halfway between the coast and Palm Island. The coastline continues to be shaped by the prevailing waves at a slow rate, punctuated only by the energy from severe weather events that easily move across the bay onto the shoreline.

The Port of Lucinda and surrounding coastal areas remain relatively untouched. This is mainly due to the location of the main township to Ingham being located some 26km inland. Limited land available for residential areas also reduces coast modification – Taylors Beach to the south and Cardwell to the North are the two main coastal development areas of Halifax Bay. Long-shore drift that moves sediments north along the coastline, adds to the sediment loading at the point of Lucinda. The 5.6 km jetty ends offshore in deep water, meaning there is a limited need to manipulate the natural environment in order to operate a functioning port.

The Hinchinbrook channel and island are both protected areas, which also limited development along the coast.

3.1.2 Marine ecosystem values of Halifax Bay

Halifax Bay supports numerous rich and diverse coastal habitats with varying ecological sensitivities, typically abundant in north-east Australia’s coastal wet tropics area, including:

- Soft bottom communities;
- Intertidal and subtidal seagrass beds, are present in about 10% of the Bay and provide food for the threatened dugong and turtles and are also a nursery for prawns;
• Seagrass communities;
• Extensive mangrove and saltmarsh communities, all of which:
  o provide a nursery and shelter for fish, mud crabs and prawns;
  o trap tide-borne sediments and help control coastal erosion; and
  o provide vital protection from strong winds, tidal surges and heavy rainfall associated with cyclones, which occasionally affect this part of Queensland’s coastline;
• Forested, brackish and freshwater swamps;
• Corals; and
• Megafauna (included protected species).

Reef communities
Reef communities comprised of hard corals exist around all of the Palm Islands, as well as on the south-west side of Rattle Snake Island (known as Rattlesnake Island Reef), in the south of Halifax Bay. A large number of hard corals have been recorded in these communities, with 340 species recorded around the Orpheus Island dive sites. The distribution and abundance of coral species vary in the fringing reefs of the different islands and is related to the physical characteristics of the substrate and energy environments.

Coral cover, species diversity and aesthetic quality are generally considered higher in the fringing reefs on the north-western sides of each of the islands; which provided protected areas from the prevailing waves on the eastern sides. However, further out from Pelorus Island sits Bramble Reef (amongst other reefs) these site within the main Great Barrier Reef shelf.

Current conditions of the GBR has been impacted by two consecutive years of coral bleaching, however, the GBRMPA released survey results from the Eye on the Reef program in September 2018. These results indicated there were minor levels of coral disease and coral damage throughout the marine park. and isolated cases of minor coral breaching beginning to appear from Port Douglas in the south to the Capricorn-Brunker group in the south, (gbrmpa.com.au, 2018).

Seagrass Communities
A number of studies have been undertaken both within Halifax Bay and around the Port of Lucinda on the seagrass communities. In 1998 Lee Long et al, indicated spatial and temporal variations in seagrass density and species composition for the Hinchinbrook Region, PCQ 2004 also described dense seagrass communities in the lower intertidal and shallow areas of the port region, including the nearby Hinchinbrook Channel; at the time, the closest seagrass meadows to the off-shore berth were located on part of the larger sandbank near Lucinda Point.

Mangrove Communities
Mangrove communities represent diverse communities growing in the intertidal zone of tropical to temperate coastal rivers, estuaries and bays (Lovelock 2003). Sixteen species of mangroves have been identified in the Port area, with the most dominant species being *Cerips tagal* (PCQ 2004). They are most extensive in the Hinchinbrook Channel, the mouth of the Herbert River, and in the Halifax Bay Wetlands National Park.
The occurrence of particular mangrove species is dependent on environmental factors such as salinity (Sam and Ridd 1998), nutrient availability (Walker and O’Donnell 1981), oxygen levels in the sediment and wave energy (Brinkman et al. 1997).

Saltmarsh Communities

Halifax Bay is also home saltmarsh species. Saltmarshes are ecologically important habitats, as they link the marine environment to terrestrial, and provided habitat for both marine and terrestrial organisms (Goudkamp and Chin, 2006).

Saltmarsh communities tend to occupy the areas of low energy, intermittent, tidal inundation areas, on sheltered soft substrates, and often occurring behind mangrove communities (Creighton, Gillies and McLeod, 2015). Different saltmarsh community types produce different benefits to the ecosystem, including sediment trapping, nutrient cycling, dissipation of wave energy, fish and prawn nursery, carbon sequestration, and feeding areas for birds (Creighton et al, 2015).

Distribution throughout the bay depends on the site microhabitat and seasonal influences from both land and sea direction. Saltmarshes play an important role in the ecosystem by providing organic matter, a rich supply of nutrients, and support a great diversity of both marine and terrestrial life (adapted from RIVER Group, 2004).

Marine Megafauna

Being home to the Wet Tropics World Heritage Area, Hinchinbrook Island National Park, the Great Barrier Reef Marine Park and two declared Fish Habitat Areas, Halifax Bay is home to a diverse range of aquatic fauna, including whales, dolphins, turtles, and dugongs. The PQC 2004 lists the area home to a number of listed species, including: - Irrawaddy River Dolphin, Estuarine Crocodiles, Green and Loggerhead turtles, Indo-Pacific Humpback dolphins, and dugongs. A comprehensive study undertaken by Queensland Parks and Wildlife services in 2002 found populations of both the Green turtle and loggerhead turtle within the Port area.

Fish and Fisheries

The mangroves, seagrasses, reef and soft bottom benthic communities present in Halifax Bay provide habitat for a variety of fish species. Fishing for target species is a common practice in Halifax Bay, where legal fishing can occur, which includes the Hinchinbrook Channel, for traditional owners, commercial and recreational fishers. Target recreational fishing species include barramundi, threadfin salmon, queenfish, grunter, flathead and mud crabs.

Fish habitat areas have been established in Halifax Bay and Hinchinbrook Island for many years. The Halifax declared Fish Habitat Areas was originally declared in 1983, with two redeclarations occurring in 1989, and again in 2003 to reestablish the cadastral boundaries. The Hinchinbrook Declared Fish Habitat Area was declared in 1971, followed by two redeclarations in 1983, and again in 1999 both to clarify and link to cadastral boundaries.

Declared Fish Habitat Areas provide protection and breeding grounds for target indigenous, recreational, and commercially important species (including barramundi, blue salmon, estuary cod, flathead, grey mackerel,
grunter, prawns etc.). While these species are highly mobile, it is recognised that the loss of important habitats such as for feeding, or breeding associated with habitats, including seagrasses, and reef and benthic habitat, may affect long-term stock levels and abundance.

3.2 Protected Areas within Halifax Bay

The Port of Lucinda’s sea jurisdiction is within the Great Barrier Reef World Heritage Area (GBRWHA), which is also a national heritage place. The port and its marine infrastructure are all within an exclusion area from the Commonwealth GBRMP and the State Great Barrier Reef Coast Marine Park (Figure 37). However, there are areas that lie outside the exclusion zone but still remain within Port limits (see Figure 38).

Figure 37. Great Barrier Reef Marine Park boundaries/zones around the Port of Lucinda exclusion zone
Some of the key conservation areas, as well as other features of the region, include:

- the GBRWHA, a world and national heritage place;
- the GBRMP and the State Great Barrier Reef Coast Marine Park (including a number of different zones of protection);
- A declared Fish Habitat Area Management A area within the Hinchinbrook Channel;
- A Declared Fish Habitat Area Management B area within Halifax Bay;
- The neighbouring Hinchinbrook Island National Park;
- The Palm Island Group National Parks;
4. **Consultation and key issues**

The Port of Townsville website is currently undergoing update in order to host all the associated documents that accompany the Long-Term Maintenance Dredging Management Plan. Two submissions received included comments regarding the Port of Lucinda. One recognised the inclusion, the second provided formatting and information inclusion comments. These edits are scheduled for inclusion in January 2019 as per the Gap and Issues action plan on the POTL website.
5. Port Sediment Characteristics

5.1 Port Sediment
A small number of targeted sediment characteristic studies have been undertaken within the lower half of Halifax Bay, over the past five decades. To date, studies around the northern section of the Bay have not been identified (including around Port infrastructure). As the port does not require maintenance dredging, the need for a sediment sampling and analysis plan has not been necessary. Should any maintenance dredging be required, a full SAP will be undertaken, and relevant applications to both State and Commonwealth Governments would be required. No approved placement (land or sea) exists for Lucinda.

5.2 Minimisation of sediment accumulation and dredging needs
The Port of Lucinda jetty and berth structure are currently self-cleaning systems. The structure was constructed in an area that allows vessels to berth at the wharf without the need of maintenance dredging, and therefore there is currently no further need in minimising sediments and there are no dredging needs.

5.3 Maintenance Dredging and disposal requirements
The Port of Lucinda does not undertake any maintenance dredging and as such has no material disposal requirements. There are no approved placement areas approved in Lucinda. If dredging was ever required significant investigation and application to relevant government regulators would be required.

5.4 Examination of reuse, recycle and disposal options
Currently, the examination of the reuse of maintenance dredging material is not required as no maintenance dredging or placement activities are planned or approved for the Port of Lucinda. Should such works be required for approval, all methods to reuse, recycle and dispose of will be provided in a review of this LTMDMP prior to any application to the State and Commonwealth Governments.

5.5 Selected future dredging and disposal strategy
This currently is not applicable to the Port of Lucinda no dredging approval is considered necessary at this point in time. Should maintenance dredging ever be considered for the Port of Lucinda, this LTMDMP will be updated to accompany applications to both State and Commonwealth governments.

There are no future dredging or disposal strategies currently proposed for the Port of Lucinda.
6 Risk Assessment

As dredging is not required at the Port of Lucinda, a risk assessment for maintenance dredging and placement activities is currently not required. Should at any point maintenance dredging is required for the Port of Lucinda, a risk assessment will be created to accompany a development approval for such works, (including placement activities).
### Identification and treatment of key risks

#### Table 13. Monitoring programs at the Port of Lucinda

<table>
<thead>
<tr>
<th>Monitoring Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ambient monitoring</strong></td>
<td>POTL undertakes a number of monitoring programs at the Port of Lucinda. Due to the lack of maintenance dredging, there is a low-risk profile (average of 15 vessels per year). These monitoring programs are undertaken based on risk as per best practice for port operations. Programs include biosecurity, groundwater and stormwater, and targeted programs when required.</td>
</tr>
<tr>
<td>PORT WIDE</td>
<td></td>
</tr>
<tr>
<td><strong>Impact monitoring</strong></td>
<td>Maintenance dredging is not approved or undertaken for the Port of Lucinda. Impact monitoring is not currently required, however, should any maintenance dredging be approved by State and Commonwealth governments, impact monitoring will be implemented.</td>
</tr>
<tr>
<td>MAINTENANCE DREDGE CAMPAIGN-SPECIFIC</td>
<td></td>
</tr>
<tr>
<td><strong>Real-time monitoring</strong></td>
<td>Currently, no real-time monitoring is undertaken at the Port of Lucinda, as maintenance dredging is approved or undertaken. As above, should any maintenance dredging be approved by State and Commonwealth governments, real-time monitoring would be implemented if required.</td>
</tr>
<tr>
<td>MAINTENANCE DREDGE CAMPAIGN-SPECIFIC</td>
<td></td>
</tr>
</tbody>
</table>
Environmental Management

POTL follows the recommended structure of the Dredging Management Strategy (Figure 33) to manage the environmental risks associated with dredging and placement activities at the Port of Lucinda. Should the requirement for maintenance dredging be needed at the Port of Lucinda, the following structure will be implemented in order to comply with any conditions attached to an approval (from State and/or Commonwealth Governments).

The Port of Lucinda falls under Port of Townsville Limited’s banner for environmental management. Twice-yearly formal environmental observations are undertaken at the Port of Lucinda; the Port itself has an EMP, and monitoring as part of routine management, is undertaken.

If maintenance dredging is ever approved for the Port of Lucinda, this section will be updated.

Figure 39. Maintenance Dredging Strategy’s Monitoring elements
9 Monitoring Framework

Currently, the POTL undertakes some ambient monitoring at the Port of Lucinda. The expectation of this document is to undertake a review of existing monitoring programs, with the aim of creating a Monitoring Management Plan in the coming year/s. As maintenance dredging and placement activities do not occur at the Port of Lucinda, a detailed monitoring program for maintenance dredging has not been required up until this point.

As mentioned in previous sections of this document, should any maintenance dredging and placement activities be proposed for the Port of Lucinda, a stand-alone LTMDMP will be created to accompany any approval sought from the State and Commonwealth Governments.
10 Performance Review

As described in section 1.2 of the main document POTL’s objectives for this Long-term Maintenance Dredging Management Plan are:

a) Maintaining safe navigation for the continued operation of both Ports;
b) Ensuring the Outstanding Universal Characteristics (OUV’s) of the GBRWHA and sensitive receptors surrounding both the Port Townsville and the Port of Lucinda are maintained;
c) Ensuring a robust, transparent long-term planning approach to the management of sediments within Port infrastructure;
d) Continue the long-term proactive and environmentally responsible management approach of maintenance dredging and material placement at the Port of Townsville;
e) Capture and communicate operational controls for best management; and
f) Support local and regional communities, ensuring the health, wellbeing and connectivity to the global market is maintained.

Performance indicators used to determine whether these objectives are being met and/or to better inform future risk assessments for the Port of Lucinda are:

- Annual hydrographic surveys to determine any changes in the self-scouring nature of the berth;
- Annual reviews to be undertaken against the performance indicators, this review is included consolidation of the effectiveness and relevance of the performance indicators. This includes initiating an independent review of the LTMDMP if the annual reviews determine the performance indicators are not effective.
- Undertake a full review of the LTMDMP (informal at 12 months; formal at 5 years; and formal for the creation of new LTMDMP at 10 years).

Should any maintenance dredging be approved for the Port of Lucinda, POTL will implement the indicators as used for the Port of Townsville, these are:

- Routine maintenance dredge volumes are within predicted volumes outlined in table 4 of this document
- Routine maintenance dredge volumes are within modelled parameters, and modelling is updated if changes are noted and incorporated into the risk assessment as required
- POTL requirements for timing of dredge, as identified by the risk assessment, are incorporated into annual scheduling discussions with Queensland Ports and Port of Brisbane.
- No material is placed at sea that has not been assessed against NAGD and approved for placement (noting a new SAP is required every 5 years)
- Demonstrated evidence that all dredging undertaken is done so under a relevant EMP (or Dredge Management Plan)
- POTL to undertake observation during dredge campaigns to provide oversight for compliance with EMP/DMP and/or approvals.
• Incorporate information from ambient and target monitoring and research projects into risk assessments to inform decisions and improve outcomes
• Capture any performance measures that have not been achieved and detail corrective actions undertaken
• Full compliance with State and Commonwealth approvals and reporting requirements including notification processes and volume reporting
• Undertake scheduled internal audits of the LTMDMP as part of the ports Certified Integrated Management System
• Annual reviews to be undertaken against the performance indicators, this review is included consolidation of the effectiveness and relevance of the performance indicators. This includes initiating an independent review of the LTMDMP if the annual reviews determine the performance indicators are not effective.
• Undertake a full review of the LTMDMP (informal at 12 months; formal at 5 years; and formal for the creation of new LTMDMP at 10 years).
Reference Material and Supporting Documentation

Port of Townsville and Port of Lucinda


Belperio AG 1978. Recent paralic and continental shelf sediments adjacent to Townsville. Field Trip Guides: Third Australian Geological Convention, Townsville.


BMT WBM 2014. Assessment of Maintenance Dredging for 10 Year Permit. Prepared for Port of Townsville Limited


Creighton C, Gillies CL and McLeod IM (eds), 2015. Australia’s saltmarshes: a synopsis to underpin the repair and conservation of Australia’s environmental, social and economically important bays and estuaries. TropWATER Publication, James Cook University, Townsville (Report No. 15/61)


Davies JN, McKenna SA, Jarvis JC, Carter AB and Rasheed MA 2014. Port of Townsville Annual Monitoring and Baseline Survey October 2013. Report No 14/02. James Cook University, Centre for Tropical Water and Aquatic Ecosystem Research, Cairns

DES, Guideline for disposing of material in tidal water Department of Environment and Science (QLD)

DES, Guideline for the allocation of quarry material Department of Environment and Science (QLD)

DES, Guideline: dredging and allocation of quarry material Department of Environment and Science (QLD)

DoEE, Reef 2050 Long-Term Sustainability Plan Department of Environment and Energy (Cth)

DoEE An integrated monitoring framework for the Great Barrier Reef World Heritage Area Department of Environment and Energy (Cth)


DTMR, 2016, Maintenance Dredging Strategy for Great Barrier Reef World Heritage Area Department of Transport and Main Roads (QLD)
Commonwealth LTMMP Checklist (Long Term Monitoring and Management Plans for Dredging)


Persson A 1997. The influence of river regulation on downstream channel morphology and sediment delivery to the coast: the lower Ross River, North Queensland. James Cook University, School of Tropical Environment Studies and Geography, Townsville.


Ports Australia 2016. *Ports Australia Environmental Code of Practice for Dredging and Dredged Material Management*

POT 1898 v2, POTL 2018 Environmental and Social Values Assessment surrounding the Port of Townsville (yet to be published)

POTL 2016. Port expansion AEIS, Revised Cumulative Impacts Assessment; Section 25


POTL. Port of Townsville Limited Annual Report, 2018 2017/2018


State LTMDMP Guidelines (Long-term Maintenance Dredging Management Plan)


