

Maintenance Dredging Strategy

for Great Barrier Reef
World Heritage Area Ports



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Foreword

As a coastal state, Queensland is dependent on maritime trade, with ports being important gateways to international markets and shipping vital to our economic activity.

Ports are critical to Queensland's supply chain and economy, facilitating trade and the development of regional, state and national economies. More than \$40 billion worth of exports is transported through our ports every year, providing jobs and income for many Queenslanders.

The majority of Queensland's commodity exports are shipped through four major ports and six other trading ports located in the Great Barrier Reef World Heritage Area (GBRWHA), which was established in 1975 in recognition of the fact that the Great Barrier Reef is the largest and one of the richest and most complex coral reef ecosystems on Earth.

The Great Barrier Reef is deeply connected with our national identity, and is one of the most inspiring of all our natural icons. For millennia, Traditional Owners have fostered the cultural and natural heritage for which the Great Barrier Reef is recognised.

Since its world heritage listing, the GBRWHA has been managed as a multi-use area that supports a range of different industries, while at the same time maintaining its Outstanding Universal Value.

The Reef's tourism industry alone supports almost 70,000 full-time jobs and contributes \$5.2 billion a year to the Australian economy. It also provides thousands of jobs in recreation, fishing, scientific research and management activities.

The Queensland Government understands that sustainable Port development and maintenance is key to minimising environmental impacts on the Great Barrier Reef, and that such protection has value beyond conservation - it supports and stimulates economic activity nationally and in regional Queensland.

This Maintenance Dredging Strategy (the Strategy) will provide a transparent and consultative framework for sustainable, leading practice management of maintenance dredging in GBRWHA ports to ensure their safe and effective operation, and to contribute to securing the Reef's health and resilience.

The Strategy meets Queensland Government election commitments and implements a key port-related action under the Reef 2050 Long-Term Sustainability Plan (Reef 2050 Plan), the most comprehensive plan ever developed to protect the Reef.

We have also made important progress by passing the *Sustainable Ports Development Act 2015* which restricts greenfield port development and bans sea-based disposal of port-related capital dredge material in the GBRWHA.

We thank the Reef 2050 Advisory Committee and Independent Expert Panel, our ports and the Queensland Ports Association, regulators, non-government organisations, community groups, other peak industry bodies, scientists and other stakeholders who all contributed to the Strategy's development.

Balancing economic growth while ensuring that our valuable environmental assets continue to be protected is complex. This Strategy provides the basis for a long-term framework to ensure maintenance dredging of our ports does not threaten the Reef's Outstanding Universal Value.



The Hon Mark Bailey MP

Minister for Main Roads,
Road Safety and Ports and
Minister for Energy, Biofuels
and Water Supply



The Hon Dr Steven Miles MP

Minister for Environment and
Heritage Protection and Minister
for National Parks and the Great
Barrier Reef

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Executive summary

The aim of the Maintenance Dredging Strategy for Great Barrier Reef World Heritage Area Ports (the Strategy) is to provide a framework for sustainable, leading practice management of maintenance dredging at ports in the Great Barrier Reef World Heritage Area (GBRWHA). The objective of the framework is to build on the current strong regulatory requirements and ensure the ongoing protection of the Reef's values and the continued operating efficiency of ports within the GBRWHA.

Maintenance dredging involves the removal of sediments that have built up in existing channels, berths, approaches, and associated swing basins. It is a vital component of operations in most Queensland ports.

Maintenance dredging is different to capital dredging, which involves the excavation of previously undisturbed areas of sea bed to expand or create new shipping channels, berths or swing basins.

The Strategy has been developed through a consultative process, with feedback being sought from industry groups, Queensland and Australian Government regulators, and various environmental groups and experts.

Role of ports

As an island nation, Australia is dependent on maritime trade to advance its productivity, living standards and quality of life. Australia relies on an uninterrupted and competitive flow of imports and exports and ports have a central role in this trade. Their activities are vital to Australia's industry and commerce, generating direct employment and income in local communities, as well as creating flow-on effects to regional economies.

However, port activities also have the potential to generate environmental impacts. In Queensland, managing environmental impacts of ports is made particularly challenging given the operation of ports in the Great Barrier Reef (GBR) region. There are 10 major trading ports and two minor ones along the GBR coast. The waters surrounding most of these ports are within the GBRWHA, but not within the GBR Marine Park. The GBRWHA is special to all Australians and has been recognised globally for its Outstanding Universal Value (OUV).

Protecting the Great Barrier Reef

The GBR was inscribed on the World Heritage List in 1981 in recognition of its OUV. The World Heritage Committee has considered the state of conservation of the Great Barrier Reef World Heritage Area since 2011.

It has recognised that Australia's management of the GBRWHA is in many respects international best practice, but made recommendations to further manage and protect the reef.

The Reef 2050 Long-Term Sustainability Plan (Reef 2050 Plan) is the Australian and Queensland Governments' overarching framework for protecting and managing the GBR from 2015 to 2050. The Reef 2050 Plan contains concrete targets, actions, objectives and outcomes to ensure the protection of the Reef's OUV, and allow ecologically sustainable use.

All levels of government, as well as the ports industry, recognise the importance of ensuring port activities are ecologically sustainable. The Reef 2050 Plan has many actions relating to the management of port activities to ensure an economically, socially, and environmentally sustainable future.

Building on responsible environmental management practices

The Strategy outlines the regulatory framework for maintenance dredging which is both complex and comprehensive involving local, state, national and international requirements relating to dredging and dredge material placement.

Queensland ports have a demonstrable long and successful history of responsible environmental management. Ports have invested considerable time and funds in ensuring that they implement leading practices associated with port operation and dredging, and all ports have advanced environmental management and monitoring programs in place.

The development of this Strategy is aimed at improving transparency and consistency, and better managing and lessening the impacts of maintenance dredging. Through the Strategy, it is intended that there will be further improvements in the way maintenance dredging is planned, coordinated and regulated to ensure minimal impact on the Reef and other marine environments. It also aims to improve the transparency of the process by requiring improved levels of consultation, monitoring and reporting.

The Strategy is based on the findings of the Technical Supporting Document, which is informed by an appraisal of available engineering and environmental information, providing a sound scientific and technical evidence basis. It draws on a review of published research and technical reports, and experiences associated with maintenance dredging elsewhere in Australia and internationally.

Analysis undertaken for the Strategy focuses on the GBRWHA ports, but takes into account maintenance dredging at other Queensland ports that are not within the GBRWHA to assist in considering operational requirements in relation to the Trailer Suction Hopper Dredger (TSHD) Brisbane.

Relevant stakeholders have been, and continue to be consulted, to ensure the Strategy is being developed in a collaborative manner to help deliver a strategy that presents the required outcomes in a fair and unbiased manner.

What the Strategy does

The Strategy presents a standardised long-term maintenance dredging management framework as per the figure below. From this framework, this Strategy sets out key guiding principles and actions that will be adopted to ensure that maintenance dredging which maintains efficient navigation within GBRWHA ports continues to occur in an environmentally sustainable manner.

Its primary objective is to provide certainty to the ports industry and to the wider community that the economic and social contribution of ports is maintained, while ensuring the continued protection of Queensland's valuable environmental assets, and in particular our World Heritage listed GBR.

This Strategy aims to support and complement existing laws and guidelines by making clear the framework and practices that should apply to maintenance dredging in Queensland. It is not intended to create additional regulatory requirements or layers to what is already a complex and comprehensive regulatory system.

Establishment of key guiding principles

Based on the findings contained in the Technical Supporting Document, a number of key guiding principles and actions are identified to improve different aspects of maintenance dredging (Table 1 on page 10).

These include a number of guidelines in regards to setting future limits, environmental windows, risk assessments, monitoring, opportunities for beneficial reuse of dredge material, coordination of dredging activities, long-term management and continual improvement.

These key guiding principles and actions prescribe greater coordination, efficiency and effectiveness of maintenance dredging activities, and how the ports industry, regulators and the community can work together to strengthen how maintenance dredging is undertaken in a manner that protects the GBR's values, health and resilience.

Going forward

It is anticipated that further advances in our understanding of natural sedimentation processes, the impacts of maintenance dredging, as well as technological and scientific developments for dredging activities, will in time lead to further improvements in maintenance dredging practices. Continual improvement in undertaking maintenance dredging is an ongoing obligation of government, regulators and the ports industry. Department of Transport and Main Roads will continue to work with relevant stakeholders to this end. It is intended that this Strategy will be reviewed every five years.



Table 1.

Summary of key guiding principles and actions

Principle 1

Long-term Maintenance Dredging Management Plans



GBRWHA ports will develop Long-term Maintenance Dredging Management Plans (LMDMPs) consistent with the framework outlined in this document that:

- contribute to maintaining and enhancing the OUV of the GBR
- are based on the best available science
- utilise the principles of ecologically sustainable development
- ensure continued efficient operation of the port
- are developed in consultation with key stakeholders.

GBRWHA ports will publish their LMDMPs.

Action 1

GBRWHA Ports will work with TMR, regulators and relevant stakeholders to develop guidelines for LMDMPs in accordance with the Long-term Maintenance Dredging Management Framework outlined in this Strategy.

Development of the LMDMP guidelines is intended to be completed by June 2017. Development of LMDMPs will commence concurrently, with priority to be given to GBRWHA ports that dredge annually or frequently.

Principle 2

Developing the knowledge base for maintenance dredging activities



LMDMPs for GBRWHA ports will be based on an understanding, using the best science available, of sediment transport processes and environmental values relevant to maintenance dredging activities.

Principle 3

Avoiding or minimising the need for maintenance dredging



GBRWHA ports will include future maintenance dredging requirements in port infrastructure planning to ensure relevant environmental values and potential impacts are properly understood, and to assist in minimising the need for maintenance dredging.

Principle 4

Volume limits



Maintenance dredging will be limited to that required to maintain the approved dimensions of port infrastructure to ensure efficient shipping access and the optimisation of port operations (i.e. will not be used to increase channel or berth footprints or depth).

Principle 5

An increase in channel or berth dredging areas and depths will only occur as a result of approved capital dredging following assessment of implications of future maintenance dredging needs and disposal options (as per existing approval processes).

Principle 6

Beneficial reuse



GBRWHA ports will:

- ensure that LMDMPs include an assessment of beneficial reuse options for dredge material management to determine if viable opportunities exist
- seek to beneficially reuse material where viable options are available, in accordance with existing regulatory requirements and the comparative analysis outlined in this document
- continue to assess the latest scientific, technological and other factors which may render previously unsuitable practices suitable or viable for beneficial reuse
- work with relevant Queensland and Australian government agencies and scientific organisations to conduct an examination and, where appropriate, a pilot program to evaluate different treatment and reuse options for managing dredged material consistent with the requirements of WQA15.

Action 2

Ports will lead implementation of Reef 2050 Action WQA17, working with relevant government agencies and the scientific community to understand the port sediment characteristics and risks at the four major ports and how they interact and contribute to broader catchment contributions with the GBRWHA. The project will be completed by the end of December 2017.

Principle 7

At sea placement of dredge material



Applications to place material at sea will continue to abide by existing National Assessment Guidelines for Dredging 2009 (or any subsequent versions) and regulatory processes, including an assessment of:

- all feasible alternative disposal options
- sediment quality at both loading and placement sites in accordance with relevant regulation and guidelines to prevent toxic material being placed at sea
- how the sites may be impacted, with consideration of the marine environment and other uses of the area
- monitoring and management measures to control or mitigate impacts.

Principle 8

Comparative analysis



GBRWHA ports will undertake a consultative comparative risk based analysis process encompassing environmental, economic, technical, operational and societal issues to determine the most suitable solution(s) for management of maintenance dredging material using a repeatable and structured methodology.

Information and results of the comparative analysis process will be published in the LMDMP.

Principle 9

Dredging equipment and operational approaches



As part of the risk-assessment for maintenance dredging, GBRWHA ports must provide rationale for the type of dredger chosen for each annual maintenance dredging program, with regard to the equipment's ability to undertake the necessary works, implement best practice environmental management measures, its technical and operational capabilities, and its cost-effectiveness.

Principle 10

Any new or alternative vessels or methods considered or proposed should result in environmental performance that is equal to, or better than, current equipment or methods used.

Action 3

Ports will work together to ensure that an annual state-wide maintenance dredging program for the TSHD Brisbane is developed to optimise environmental outcomes and operational efficiencies by:

- ensuring identified environmental windows, as well as any restrictions imposed on maintenance dredging permits are applied
- minimising the net risk of impacts at each port by adopting site-specific operating procedures, and
- avoiding unnecessary dredger travel and relocation.

The programs will be made publicly available and the first program is to be completed for the 2017 dredging season.

Principle 11

Environmental windows



Prior to any maintenance dredging GBRWHA ports will identify and apply environmental windows supported by an evidence-based risk assessment. Particular consideration must be given to periods of coral spawning, seagrass recruitment, turtle breeding and periods immediately following severe weather events.

Principle 12

Cumulative impacts, offsets and providing net benefits



LMDMPs will take into account any Reef 2050 Plan policy developments in relation to cumulative impacts, offsetting impacts and providing net benefits.

Principle 13

Monitoring



Appropriate monitoring programs for maintenance dredging activities at GBRWHA ports will be:

- determined by a risk assessment process
- informed by ongoing port and regional monitoring programs
- activity and port-specific
- focused on environmental values and activities of higher risk or that are indicative of broader ecosystem health.

Principle 14

Adaptive management



GBRWHA ports will apply adaptive management strategies and continual improvement processes to ensure that leading practice management is maintained. This will involve monitoring the effectiveness of strategies put in place and assessing potential benefits from altering or applying new management measures.

Principle 15

Reporting



Maintenance dredging, monitoring and reporting programs by GBRWHA ports will be available for inclusion in the Integrated Monitoring and Reporting Program for the Reef 2050 Plan (Action GA15).

Principle 16

GBRWHA ports will provide mechanisms for stakeholders to access data and information from monitoring programs.

Action 4

GBRWHA ports will publish a publicly-available report on all maintenance dredging activities annually, including timelines, volumes, evaluation of dredge material disposal options and spoil placement locations, and outcomes of monitoring.

Principle 17

Review



Action 5

TMR will review this Strategy in five years to assess its effectiveness in achieving the objectives of ensuring the ongoing protection of the GBR OUV and the continued operating efficiency of GBRWHA ports.

1

Introduction

1.1 Aim and objective of the Maintenance Dredging Strategy

The aim of the Queensland Maintenance Dredging Strategy is to provide a framework for sustainable, leading practice management of maintenance dredging at ports in the Great Barrier Reef World Heritage Area (GBRWHA). The objective of the framework is to ensure the ongoing protection of the Reef's Outstanding Universal Value (OUV) and the continued operating efficiency of ports within the GBRWHA.

The Strategy was initiated as a result of an action (WQA16) within the *Reef 2050 Long-Term Sustainability Plan* (Reef 2050 Plan). Consequently, the Strategy focuses on the GBRWHA, and maintenance dredging at the ten major trading and two minor ports within the GBRWHA. This approach is also consistent with the scope of the *Sustainable Ports Development Act 2015* (SPD Act).

The scope of the Strategy does not extend to maintenance dredging at ports outside the GBRWHA, or non-port dredging (such as at boat ramps and marinas). Dredging at non-port areas is subject to the same regulatory approval process as dredging at ports, although the volume and frequency of maintenance dredging at non-port areas is generally less than that undertaken at ports. It is reasonable that the broad principles described in this Strategy may also be applied to maintenance dredging at Queensland Ports outside the GBRWHA and non-port areas, however this is not included in the scope of this document.

1.2 What is 'maintenance dredging'

Maintenance dredging involves the removal of sediments that have built up in existing channels, berths, approaches, and associated swing basins. It is a vital component of port operations in Queensland.

Channels, berths and swing basins naturally shallow over time due to siltation and sediment transport processes. Maintenance dredging is required to maintain designated channel and berth depths to ensure the continued efficient passage of vessels utilising the port. Most ports cannot sustainably function without maintenance dredging, and maintenance dredging has occurred in Queensland since ports were first established.

Dredging to maintain navigation depths is critical to the effective operation of ports to facilitate export of Queensland's agricultural, pastoral and mineral commodities, and import of a range of goods on which communities rely including household goods, manufactured products, vehicles, machinery and fuel.

Maintenance dredging is different to capital dredging. Capital dredging involves the excavation of a site for the first time to create or expand navigation channels, port berths or swing basins.

1.3 Development of the Maintenance Dredging Strategy

This Strategy has been developed through a consultative process involving key industry members represented by the Queensland Ports Association (QPA), state and Australian Government regulators, and various environmental groups and experts including members of the Reef 2050 Independent Expert Panel. Members of the Reef Advisory Committee, including local governments, Indigenous owners and industry representatives were also provided an opportunity to contribute to the development of the Strategy.

Early consultation was conducted to obtain agreement regarding the structure and focus of the Strategy in late 2015. A draft was circulated for a four-week consultation period from 21 March to 18 April 2016. Detailed submissions were received through this process, which have been analysed, and the Strategy amended accordingly. Further consultation with key stakeholders has confirmed the content and key principles of the final document to ensure an evidence-based and balanced approach.

It is informed by an appraisal of available engineering and environmental information which provides a sound scientific and technical evidence basis for the Strategy. The results of this appraisal are contained in the *Maintenance Dredging Strategy - Technical Supporting Document* (July 2016) (Technical Supporting Document).

The Technical Supporting Document draws on a review of published research and technical reports, information provided by the port industry and regulators, the findings of relevant GBR Strategic Assessments and Outlook Reports, and experiences associated with maintenance dredging elsewhere in Australia and internationally.



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The Great Barrier Reef and managing pressures on its Outstanding Universal Value

The Great Barrier Reef was inscribed on the World Heritage List in 1981 in recognition of its OUV. It is the world's most extensive coral reef ecosystem comprising thousands of reefs and islands, and is the home to an extensive range of marine flora and fauna species. It is recognised as one of the most precious ecosystems on Earth and an Australian icon. It has great significance to its Traditional Owners, and is strongly valued by the national and international community.

In obtaining inscription on the World Heritage List, the Australian Government assumed an obligation to ensure the values of the GBR for current and future generations.

Every five years the Great Barrier Reef Marine Park Authority (GBRMPA) prepares an Outlook Report, underpinned by the best available scientific information that provides an independent assessment of the health, condition, use, management effectiveness and long-term outlook for the Reef.

The 2014 Outlook Report found that although the Reef system as a whole retains the qualities contributing to its OUV, and the northern third of the ecosystem was in good condition, the inshore central and southern areas had continued to deteriorate due to the cumulative effects of impacts. The highest risk factors for system wide impacts were identified as:

- **climate change**
- **land-based run-off.**

The risk factors for local and regional wide impacts were identified as:

- **coastal land-use change**
- **direct use.**

Direct use includes activities such as legal and illegal fishing, collecting and poaching, incidental catch of species of conservation concern, marine debris, recreational and tourism related activities, and the disposal of dredge material.

While the Outlook Report 2014 found that port activities may have a significant localised effect, they pose a relatively lower threat to the health of the Reef than more systemic factors such as climate change, land-based runoff, fishing, and tourism.

However, all levels of government recognise the importance of ensuring port activities are sustainable. The sensitivity of the GBR was further highlighted in 2016 with what has been reported as the most serious coral bleaching event on record on the GBR. The bleaching is believed to have been caused by heat stress related to a combination of warming of the Earth's oceans and a major El Nino event. Although the GBR has demonstrated its underlying resilience to such events, it is incumbent on all levels of government and the GBRWHA ports to ensure that port activities are responsibly managed.

2.1 The Reef 2050 Plan

The Australian and Queensland Governments released the *Reef 2050 Long-Term Sustainability Plan* (Reef 2050 Plan) in March 2015 in response to a request from the World Heritage Committee. The development of the plan was informed by the GBR Strategic Assessment and Outlook Report, and builds on the strong foundation of legislated protection and cooperative management of the GBR to provide a blueprint for continuing efforts to preserve it and its OUV.

The Reef 2050 Plan involves all levels of government, the community, Traditional Owners, industry and the scientific community, and has concrete targets and actions to improve, enhance and maintain the GBR's health and deliver ecologically sustainable development. As a long-term strategy, it includes an extensive list of actions, many of which are inter-related. These actions have been prioritised and grouped as immediate, medium and future priority actions.

Everyone with a stake in the GBR has clear responsibilities in the Reef 2050 Plan, and the Queensland Government is responsible for a significant number of immediate priority actions.



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A key policy response by the Queensland Government to address actions within the Reef 2050 Plan was the introduction of the *Sustainable Ports Development Act 2015* (SPD Act) to better manage the potential impacts of port development on the GBRWHA. The SPD Act restricts new port development in and adjoining the GBRWHA to within current port limits and outside Commonwealth and state marine parks. It also prohibits major capital dredging for the development of new or expansion of existing port facilities in the GBRWHA outside the priority ports of Gladstone, Abbot Point, Townsville and Hay Point/Mackay, and prohibits the sea-based disposal of port-related capital dredge material within the GBRWHA. In addition, the SPD Act mandates master planning for priority ports and their surrounding land and marine areas. As part of each priority port master planning process, the state government will develop an environmental management framework, which will take into account future development at the priority port and any associated changes to maintenance dredging requirements.

The development of this Maintenance Dredging Strategy is also an immediate priority action in the Reef 2050 Plan. Action WQA16 states that the development of a state-wide Maintenance Dredging Strategy should:

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

The maintenance dredging strategy action is closely linked with a number of other actions in the Reef 2050 Plan. In particular, actions associated with improving water quality have many inter-relationships and interdependencies.

In addition, actions associated with broader ecosystem health that will reduce impacts and improve the condition of the OUV, are relevant considerations in the context of managing an activity within the broader GBR context. Reef 2050 actions that have the greatest direct linkages to maintenance dredging, the lead agency and timeframe, are listed in Table 2.

The links between the Maintenance Dredging Strategy and the Reef 2050 themes demonstrate the importance of the management of maintenance dredging as an activity within the broader GBR ecosystem, and its contribution towards maintaining the GBR OUV.

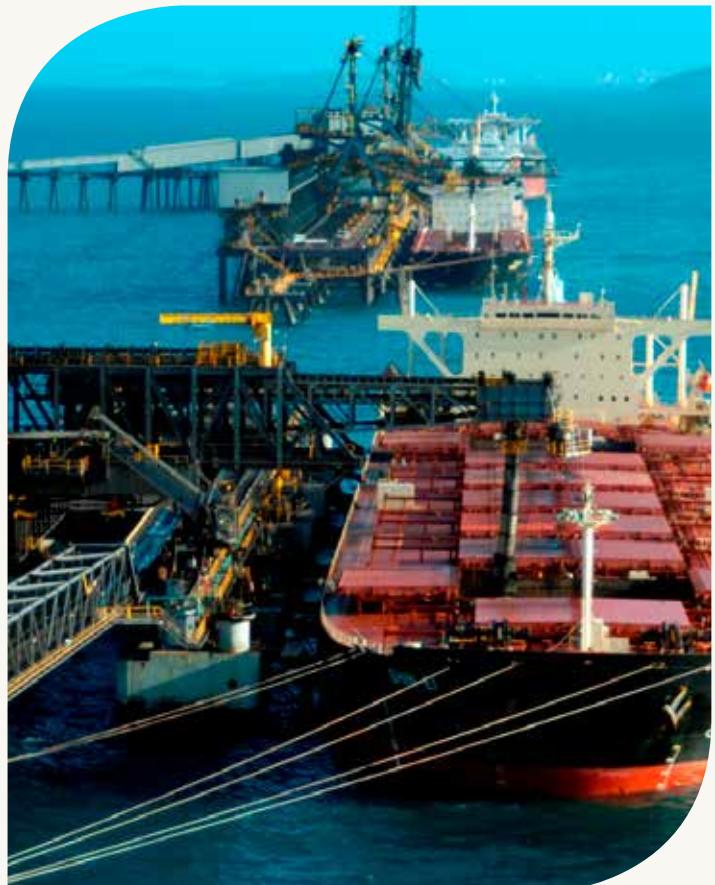




Table 2.

Reef 2050 Plan actions to reduce the impact of ports and dredging



Action Number	Action	Status
WQA14	Restrict capital dredging for the development of new or expansion of existing port facilities to within the regulated port limits of Gladstone, Hay Point/Mackay, Abbot Point and Townsville.	
WQA18	In 2015 legislate to ban sea-based disposal of capital dredge material in the GBR Marine Park and in the balance of the GBRWHA from port-related capital dredging.	Complete The Queensland Government enacted the Sustainable Ports Development Act 2015 (SPD Act) addresses these actions.
WQA19	Mandate the beneficial reuse of port-related capital dredge spoil, such as land reclamation in port development areas, or disposal on land where it is environmentally safe to do so.	The Australian Government has placed a permanent ban on disposal of material in the GBR Marine Park from capital dredging projects, under the Great Barrier Reef Marine Park Regulations 1983.
EHA21	Protect greenfield sites by restricting significant new port development within and adjoining the World Heritage Area to within existing port limits fixed in regulation under the <i>Transport Infrastructure Act 1994</i> (Qld).	
EHA25	Ensure Great Barrier Reef ports planning incorporates evidence-based measures to support protection, restoration and management of coastal ecosystems that contribute to Reef health and resilience.	
WQA15	Develop and implement a dredging management strategy that includes: <ul style="list-style-type: none"> an examination and, where appropriate, a potential pilot program to evaluate different treatment and reuse options for managing dredge material measures to address dredging-related impacts on Reef water quality and ecosystem health a ‘code of practice’ for port-related dredging activities. 	Identified as an immediate priority action to commence by December 2016. TMR identified as lead reporting agency, with Ports Australia responsible for developing the ‘code of practice’.
WQA16	Develop a state-wide coordinated maintenance dredging strategy which: <ul style="list-style-type: none"> identifies each port’s historical dredging volumes and likely future requirements and limits identifies appropriate environmental windows to avoid coral spawning, seagrass recruitment, turtle breeding and weather events examines opportunities for the beneficial reuse of dredge material or on-land disposal from maintenance activities establishes requirements for risk-based monitoring programs. 	This action is the subject of this Strategy. TMR identified as lead reporting agency.
WQA17	Understand the port sediment characteristics and risks at the four major ports and how they interact and contribute to broader catchment contributions within the GBRWHA.	Identified as an immediate priority action to commence by December 2016. Queensland Ports Association (QPA) has been identified as lead reporting agency.
WQA21	The Queensland Government will not support trans-shipping operations that adversely affect the GBR Marine Park.	Ongoing TMR is lead reporting agency.
WQA20	The Queensland Government will require all proponents of new dredging works to demonstrate their project is commercially viable prior to commencement.	Identified as an immediate priority action to commence by December 2016.
WQA22	Support on-land disposal or land reclamation for capital dredge material at Abbot Point.	Department of State Development (DSD) identified as lead reporting agency.
EBA4	Adopt the best practice principles identified in the Gladstone Independent Review reports and integrate into port planning and development.	
WQA23	Expand ‘nested’ integrated water quality monitoring and report card programs at major ports and activity centres (e.g. Gladstone), in priority catchments (e.g. Mackay Whitsundays) and Reef-wide, to guide local adaptive management frameworks and actions.	Identified as an immediate priority action to commence by December 2016. Department of Environment and Heritage Protection has been identified as lead reporting agency.
GA15	Develop, implement, and operate an Integrated Monitoring and Reporting program to facilitate adaptive management for the Reef.	Great Barrier Reef Marine Park Authority is managing development and implementation, as well as leading the marine component of the Reef 2050 Integrated Monitoring and Reporting Program. The Queensland Government is leading the coastal component. The Authority is leading development of joint policy documents in partnership with the Queensland and Australian governments.
EBA11	Continue to refine and improve guidance and procedural requirements for avoiding, mitigating and offsetting impacts to the Reef from industry activities using standardised policies, procedures and guidelines.	
EHA8	Develop a net benefit policy to restore ecosystem health, improve the condition of values and manage financial contributions to that recovery.	
EHA19	Develop guidelines for assessing cumulative impacts (including climate change pressures) on Matters of National Environmental Significance including ecosystem and heritage values in the Great Barrier Reef World Heritage Area.	

3

Queensland ports and maintenance dredging



Queensland has 20 recognised ports: 15 trading ports, two community ports and three smaller non-trading ports (see Figure 1).

Of the 20 recognised ports, 12 are within or adjoin the GBRWHA. The GBRWHA ports are managed and operated by four government owned port authorities:

- Far North Queensland Ports Corporation Limited (trading as Ports North) is responsible for the ports of Cairns, Cape Flattery, Cooktown, Mourilyan and Quintell Beach
- Port of Townsville Limited is responsible for the ports of Townsville and Lucinda
- North Queensland Bulk Ports Corporation Limited (NQBP) is responsible for the ports of Abbot Point, Hay Point, and Mackay
- Gladstone Ports Corporation Limited is responsible for the ports of Gladstone and Rockhampton (Port Alma).

Queensland's ports contribute significantly to the Queensland economy, handling approximately \$47.8 billion of exports during 2015-16. They have a central role in the transport of exports. Imports shipped through the ports also supply essential inputs for local producers, as well as a wide range of vital consumer goods for the state.

The facilitation of this trade provides income and jobs for many Australians. The government owned port corporations alone employ approximately one thousand full time staff. Operation of a port generates employment and income for the local community, and has significant flow-on effects to other local industries.

Exports from the long established major commodity ports based adjacent to the GBR Marine Park collectively account for most of the throughput from Queensland's ports, making up 81% of total Queensland tonnage throughput for 2015-16.

The development and use of each of Queensland's ports has been determined by a unique set of geographic features such as access to deep water and natural harbours, proximity to sites of production and connecting landside infrastructure, proximity to import markets, and adequate land and sea linkages.

Most of Queensland's ports are located near, or within, populated areas. This partly reflects the central role that ports have played in the establishment and growth of many local communities.

Ports also play an important social role, as Queensland's smaller ports have important strategic functions such as exporting locally produced commodities, importing goods for remote and regional communities, providing facilities for national defence operations, and encouraging tourism through cruise shipping and recreational marine facilities. Ports also help to administer the state's emergency oil spill response and national security needs.

Queensland communities and businesses rely on the range of infrastructure and related logistical networks associated with ports to maintain and grow the Queensland economy. The efficiency of the port sector also affects cost structures, industry competitiveness and living standards. Efficient ports are critical to the successful integration of the transport logistics chain, which ultimately results in competitive costs of transport and goods for local, regional, state and national economies.

The physical dimensions of the berth, basins and channels are determined by the type, size, draft and frequency of vessels accessing the port, meteorological/oceanographic conditions and a number of physical characteristics (such as the nature of the seabed). The primary objective is to provide the most efficient and safest channel for the vessels expected to visit the port.

The channel, basin and berth horizontal dimensions and vertical declared depths are determined and signed off by the port's harbour master. Natural sedimentary processes tend to reduce both the horizontal and vertical dimensions of channels, basins and berths. The harbour master will apply vessel depth and/or operating restrictions to ensure that navigational and berthing safety is maintained until channel, basin and berth dimensions are restored through maintenance dredging.

Constraints imposed on the operation of ports affect the entire supply chain and increase the cost of transport and ultimately the cost of supplying goods and services to the community along with the cost of exporting products. As a result of these factors, the efficiency of Queensland's ports is an important issue for the state and regional communities. The capacity of ports to operate efficiently directly impacts the state's ability for economic growth.



Queensland Ports Map

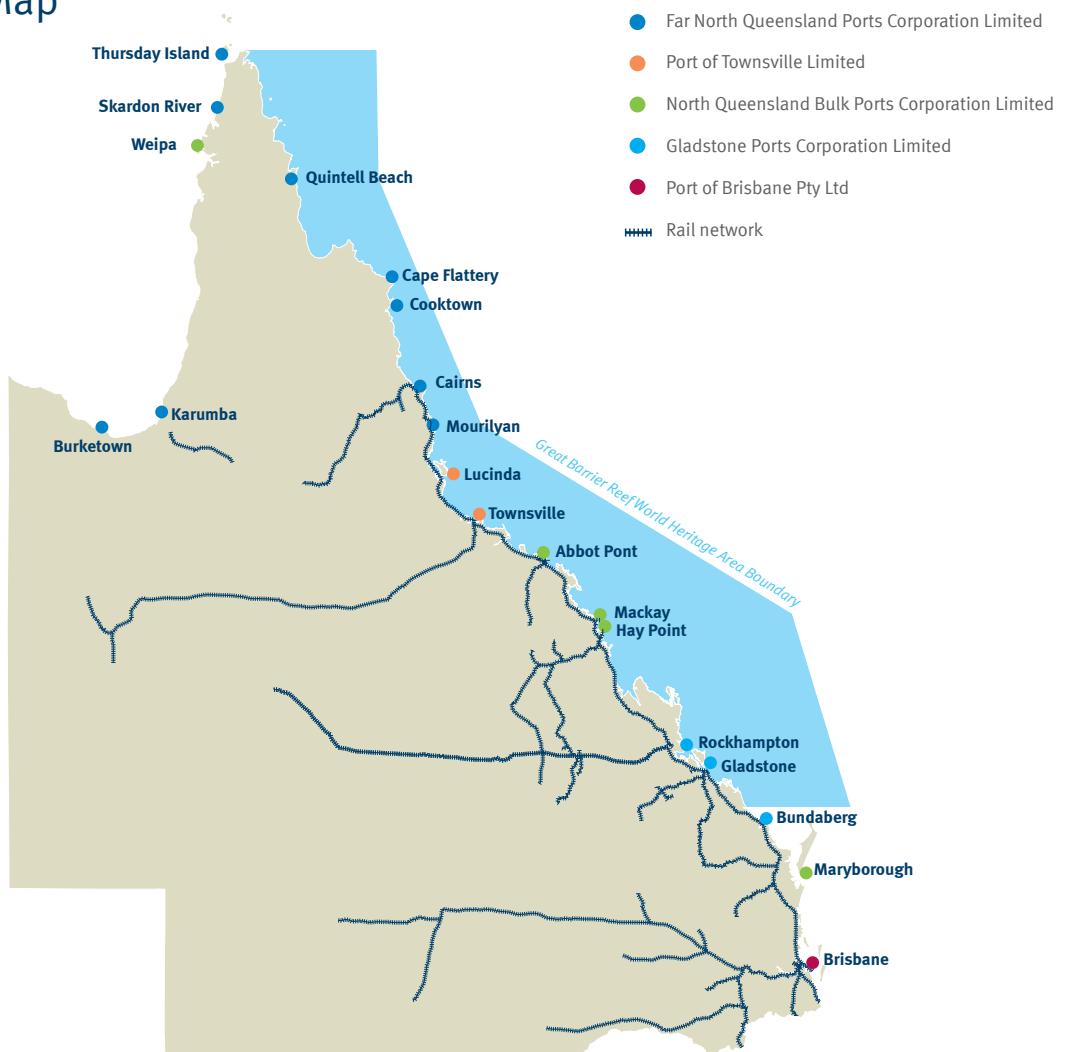


Figure 1: Queensland Ports

Maintenance dredging occurs in previously developed channels and port operational areas that have been developed for decades. It enables efficient shipping access to ports and is therefore critical to the Queensland economy. The varied locations and environments of the ports result in each port being subject to different sedimentation processes and rates. As a result, maintenance dredging needs can vary significantly between the ports and even within an individual port

on a yearly or seasonal basis. Effective maintenance and operation of waterside infrastructure such as shipping channels, wharf areas, berth pockets, and Dredged Material Placement Areas (DMPAs) leads to increased port efficiency. Delayed maintenance dredging or constrained channel access will result in inefficient supply chains and will have adverse economic consequences for the state.

4

Current regulatory framework for maintenance dredging

The activity of dredging, the removal of material from the seabed, and the disposal of this material at sea or on land, has the potential to impact negatively on marine and terrestrial environments. As a result, dredging is subject to international agreements and a broad range of Commonwealth and state legislative requirements. This regulatory framework attempts to balance the needs of ports and economic objectives with the protection of the environment and the interests of other stakeholders.

There are legislative requirements that apply specifically to the activity of dredging, and different regulatory instruments applying to the activity of placing dredge material at sea. In addition, the permitting process for each activity is subject to different jurisdictional requirements by the various regulators involved, depending on the location of each activity.

4.1 International agreements

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

4.2 Australian Government responsibilities

Key Commonwealth Acts and guidelines related to the regulation of dredging and dredge material disposal at sea include:

- **Environment Protection (Sea Dumping) Act 1981**

The Environment Protection (Sea Dumping) Act 1981 (Sea Dumping Act) implements Australia's obligations under the London Protocol to prevent marine pollution by dumping of wastes and other matter. Under the Sea Dumping Act, the Commonwealth aims to minimise pollution threats by:

- prohibiting ocean disposal of waste considered too harmful to be released in the marine environment and
- regulating permitted waste disposal to ensure environmental impacts are minimised.

The Sea Dumping Act applies to all vessels, aircraft and platforms in Australian waters and to all Australian vessels and aircrafts in any part of the sea.

Permits are required for all sea dumping operations, with disposal of dredged material being one of the most commonly issued permits.

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

- **Environment Protection and Biodiversity Conservation Act 1999**

The Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) is the Australian Government's central piece of environmental legislation which provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places (matters of national environmental significance).

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

Under the EPBC Act, an action that is likely to have a significant impact on a matter of National Environmental Significance must be referred to the Australian Government Minister for the Environment for assessment and approval.



Generally, maintenance dredging has been considered as part of the capital approval for infrastructure projects. There remains a requirement for approval under the EPBC Act, for dredging and dumping activities that occur within waters within the limits of a state or the Northern Territory that are likely to have a significant impact on a matter of national environmental significance.

- **Great Barrier Reef Marine Park Act 1975**

The *Great Barrier Reef Marine Park Act 1975* (GBRMP Act) is the key piece of legislation providing for the long-term protection and conservation of the environment, biodiversity and heritage values of the Great Barrier Reef Region.

Applications for dredging and disposal of dredge material within the Great Barrier Reef Marine Park must undergo a comprehensive environmental assessment.

The *Great Barrier Reef Marine Park Regulations 1983*, commencing from 2 June 2015 banned the disposal of dredge material in the Great Barrier Reef Marine Park from capital dredging projects.

- **National Assessment Guidelines for Dredging 2009**

In addition to the above Commonwealth legislation, the Australian Government has the *National Assessment Guidelines for Dredging 2009* (NAGD), which should be read in conjunction with these Acts and Regulations, and Australia's international obligations outlined in the London Protocol.

The NAGD seek to provide clear, consistent standards and criteria for assessment of dredged material, and to facilitate better decision-making by regulators, by improving the quality of information on which assessments are based.

The NAGD are actively used by all ports and regulators, and form the basis of the approvals process. It must be addressed as part of an application under the Sea Dumping Act. These require ports to demonstrate that the material to be dredged and placed at sea has been the subject of a detailed site specific assessment to ensure only material considered acceptable (e.g. non-toxic) is placed at sea. Importantly, opportunities for alternatives to at sea placement (e.g. beneficial reuse or land based placement) must be evaluated, which includes assessment of environmental, social and economic impacts, consistent with the requirements of the London Protocol. Where appropriate opportunities exist to reuse, recycle or treat material without undue risks to human health or the environment or disproportionate costs, these alternatives must be used. These guidelines are internationally considered to be of a world-leading standard.

The NAGD set out the framework for the environmental impact assessment and permitting of the ocean disposal of dredged material. The framework includes:

- evaluating alternatives to ocean disposal
- assessing loading and disposal sites
- assessing potential impacts on the marine environment and other users
- determining management and monitoring requirements.

The Guidelines are intended to provide greater certainty about the assessment and permitting process as well as provide some guidance on opportunities for longer-term strategic planning. These Guidelines should be read in conjunction with the Sea Dumping Act and its Regulations, the EPBC Act, the GBRMP Act and Australia's international obligations outlined in the London Protocol.

4.3 State Government responsibilities

The Queensland Government also regulates maintenance dredging under a series of state laws. The legislation that applies is determined by the location of the dredging activity and the type and scale of dredging being undertaken.

The primary legislation that may apply includes:

- **Transport Infrastructure Act 1994**

Queensland ports are required to undertake maintenance dredging to fulfil their requirement to provide and operate effective and efficient port facilities and services under the *Transport Infrastructure Act 1994* (TI Act).

- **Marine Parks Act 2004**

The Great Barrier Reef Coast Marine Park (GBR Coast MP) is a state marine park that runs the full length of the GBRMP from just north of Baffle Creek (north of Bundaberg) to Cape York. It provides protection for Queensland tidal lands and tidal waters.

The *Marine Parks Act 2004* supports the creation of a comprehensive and balanced zoning system within the GBR Coast MP, providing protection of the Great Barrier Reef's unique biodiversity, while continuing to provide opportunities for the use of and access to the marine park.

• Sustainable Ports Development Act 2015

The *Sustainable Ports Development Act 2015* (SPD Act) requires master planning of the priority ports of Gladstone, Abbot Point, Townsville and Hay Point/Mackay. Priority port master planning will take into consideration the long-term infrastructure development of each priority port, including future channel and berth development and any associated changes to maintenance dredging needs.

• Coastal Protection and Management Act 1995

The *Coastal Protection and Management Act 1995* (CPM Act) provides for the protection, conservation, rehabilitation and management of Queensland's coastal zone, including its resources and biological diversity.

• Sustainable Planning Act 2009

As per the CPM Act, coastal development generally requires assessment under the *Sustainable Planning Act 2009* (SPA) to ensure it is managed to protect and conserve environmental, social and economic coastal resources and enhance the resilience of coastal communities to coastal hazards.

• Environmental Protection Act 1994

The *Environmental Protection Act 1994* (EP Act) is the key piece of environmental legislation in Queensland. It provides for the protection of Queensland's environment through an integrated management program that is consistent with ecologically sustainable development.

• Fisheries Act 1994

This act sets out Queensland's responsibilities for the economically viable, socially acceptable and ecologically sustainable development of Queensland's fisheries resources. It regulates development within declared fish habitat areas.

4.4 Regulatory framework

Figure 2 provides an overview of key legislation applying to maintenance dredging activities at Queensland ports depending on the location of each activity. Note that it does not include legislation described above that may typically apply outside of port areas, and additional requirements may apply for non-sea based disposal.

This illustrates the need to comply with international, Commonwealth and state regulatory obligations and guidelines in undertaking dredging activities.

With this legislative regime, the Queensland and Australian Governments seek to ensure maintenance dredging activities are assessed and regulated in a manner:

- consistent across jurisdictions
- using the NAGD
- balancing operational, economic, social and environmental issues
- that supports long-term approval and certainty.

Of all the legislative acts applicable to maintenance dredging and sea disposal, approval for at sea disposal is generally considered as the key approval authorisation required. Figure 3 highlights the complexity, of the legislative regime for approving at sea disposal.

4.5 Current permitting processes

Ports undertake a risk-based approach in managing impacts of their maintenance dredging activities in compliance with the existing permit process required by each of the regulators involved. While each regulator has particular guidelines in undertaking risk assessment for dredging activities, their assessment processes typically involve consideration of the following:

- description of the proposed activity, including location, volumes of material to be removed, processes employed, duration and timing
- types of environmental risks and emissions, including water, land, air, waste and noise-related risks and emissions
- the potential impacts of the dredging activity on environmental, social, cultural and heritage values
- description of the environmental values both on and offsite that may be impacted by the dredging activity
- mitigation factors to prevent or minimise impacts on sensitive receptors, or the environmental values, including options for monitoring, managing and mitigating the potential impacts of the proposed conduct.

In addition, consistent with the requirements of the NAGD and other national and state guidelines, disposal activities need to demonstrate that all alternatives to ocean disposal have been evaluated (including all on-land placement and reuse alternatives).

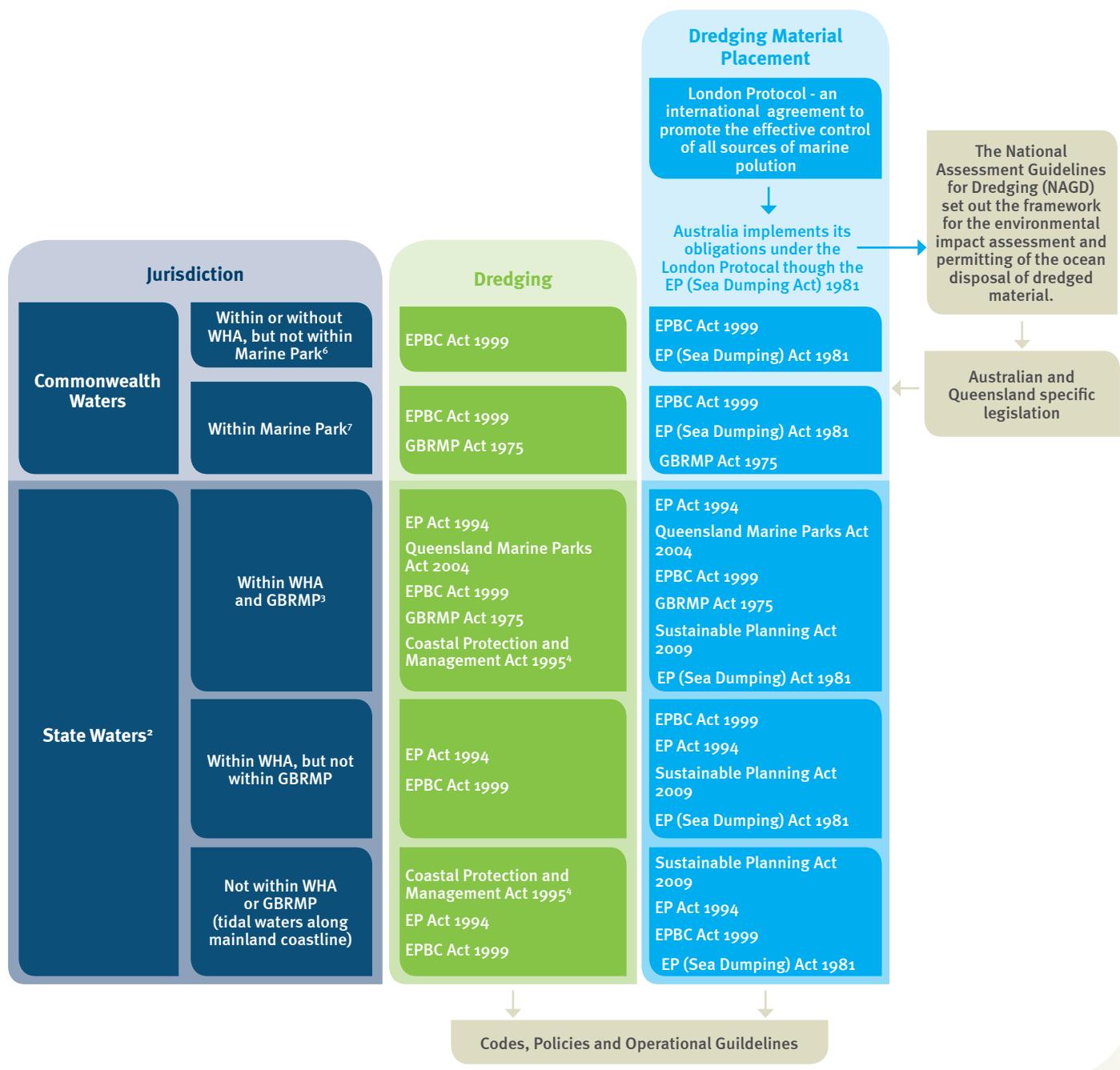
The evaluation should consider the environmental, social and economic impacts of each disposal option. Consultation with potentially affected stakeholders or potential users of the dredged material is required.

Beneficial reuse or on-land placement should be completed in preference to sea disposal where appropriate opportunities exist to reuse, recycle or treat material without undue risks to human health or the environment, or disproportionate costs.

Following regulators' assessment of the risks and impacts of a proposed activity, permits are usually granted with conditions. Permits typically specify details of the approved activity, location and volume of the material to be dredged and location of the disposal site(s), loading and disposal methods and measures to mitigate impacts, environmental windows, environmental monitoring, and reporting.

If a permit is granted, it is the responsibility of the permit holder to ensure any conditions required under the permit are incorporated into project planning and subsequent ongoing implementation of dredging activities.

Activity/Relevant Legislative Regime¹

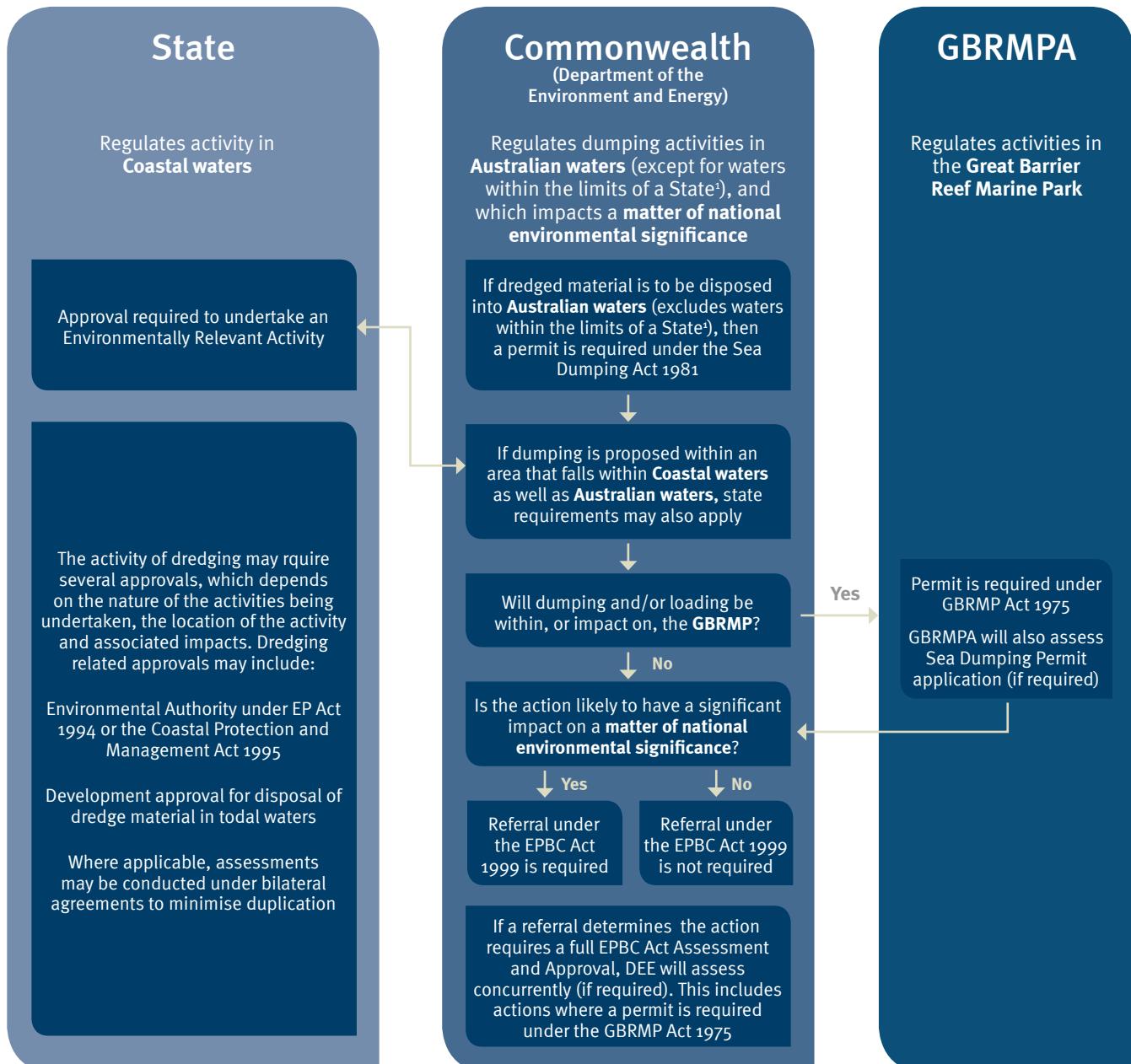


Notes:

1. A dredging campaign may involve at least one, or all of the relevant activities in each jurisdiction, requiring approvals from at least one, or up to all regulators.
2. The Queensland Department of Environment and Heritage Protection is the relevant regulator for activities in state waters, however the Queensland Parks and Wildlife Services (QPWS) may also have jurisdiction.
3. QPWS grants permits for dredging and material disposal as part of a joint permit process with the Great Barrier Reef Marine Park Authority (GBRMPA) for the Great Barrier Reef Marine Park within state waters.
4. An allocation of quarry material (AQM) under the Coastal Protection and Management Act 1995 will only be required for operations that result in quarry material being removed from state coastal land to locations above mean high water springs. The movement of quarry material from one location to another under tidal water (such as campaigns that include at sea disposal) does not require an AQM.
5. The Queensland Department of State Development will lead the development of port master planning schemes for priority ports. The SPD Act does not specifically contain requirements regarding maintenance dredging and placement of maintenance dredge material, however it is intended that Priority ports will consider current maintenance dredging permit/approval/licence requirements as inputs to priority port master planning processes.
6. The Australian Department of the Environment and Energy is the relevant regulator for Australian waters, not within the Great Barrier Reef Marine Park.
7. The Great Barrier Reef Marine Park Authority is the relevant regulator for waters in the Great Barrier Reef Marine Park.

Figure 2: Regulatory Framework/Key Legislation Applying to Maintenance Dredging Activities

Legislative Framework



Notes:

- Defined in the NAGD as those waters that lie within the constitutional limits of the state as determined by Letters Patent issued to the Governors of each of the States at Federation.

Figure 3 Legislative framework and permitting requirements for at sea disposal



5

A management framework for maintenance dredging in the GBRWHA



conditions and the volume of dredging required (which impacts on the amount of material to dispose and the length of dredging programs) may occur over time and need to be taken into account. Understanding potential impacts from maintenance dredging is the foundation on which management is based. Each port will have different risks and site-specific features, and accordingly each dredging and management program is individually designed.

A risk-based assessment of maintenance dredging activities provides a deliberate and transparent analytical framework that incorporates site-specific physical, chemical, and biological characteristics in an evaluation of risk of potential environmental harm.

Each port in Queensland requires a tailored environmental risk management approach. Some ports chose to base their management approach on ISO14001 accredited Environmental Management System. This risk management approach is an essential part of the planning and implementing of maintenance dredging and ensures potential impacts on the environment are minimised and regulatory compliance is achieved.

Queensland ports' risk management programs typically include identification and consideration of the environmental values present at a port and surrounding areas, assessment of the risks of detrimental impacts associated with maintenance dredging and associated regulatory aspects (e.g. permit conditions). Importantly, ports' risk based management takes into account the results of previous and ongoing monitoring programs, such as:

- port-specific monitoring of sensitive ecosystems that may be influenced by dredging (e.g. long-term seagrass monitoring)
- results of continuous monitoring during dredging and at sea disposal (e.g. observations for marine species of conservation importance such as turtles)
- periodic monitoring of projects (e.g. turbidity plumes and water quality impacts).

These monitoring programs provide a basis to assess risks associated with future maintenance dredging and the need for adaptive management during dredging.

The nature of the adaptive management process, based on learning from outcomes, is suited to a long-term approach.

5.1 Applying Reef 2050 Plan principles of decision-making

As the protection of the OUV of the GBR receives increasing focus, the management of 'direct use' activities such as maintenance dredging and the disposal of dredge material comes under increasing scrutiny.

Action WQA16 in the Reef 2050 Plan, requiring the development of a state-wide coordinated maintenance dredging strategy, aims to strengthen management of this activity.

The Reef 2050 Plan sets out four principles that decision makers should consider in making decisions about management of activities impacting the Reef:

- maintaining and enhancing the OUV in every action
- decisions should be based on the best available science
- there should be a net benefit to the ecosystem
- adopting a partnership approach to management.

The principles require consultation with the community, and transparent and accountable governance. They also require a systematic adaptive management approach, requiring a strong knowledge base for management decisions and learning from past experience.

The decision-making principles outlined in the Reef 2050 Plan seek to ensure that the risk and likelihood of all relevant adverse impacts are considered, uncertainties are taken into account, and processes are implemented to manage them commensurate with the level of risk. This Strategy aims to apply this risk-based approach to managing maintenance dredging activities' impacts on the GBR.

5.2 A risk-based approach to managing the impact of maintenance dredging

Each port occupies a different environmental setting, has different environmental values that could be affected and experiences a different, and at times variable sediment transport regime. Environmental risks associated with maintenance dredging are unique to each port and individual assessments of risks are thus necessary.

Within each port, maintenance dredging typically involves the same dredge operating periodically (sometimes yearly and sometimes at longer intervals) within the same (or very similar) locations within shipping channels and berths. However, changes in environmental

5.3 Long-term maintenance dredging management

The consistent application of assessment, planning and monitoring tools over time greatly assists in establishing a whole-of-system understanding and confidence in the management systems in place.

In the case of maintenance dredging, the development and implementation of Long-term Maintenance Dredging Plans (LMDMPs) that address operational needs, environmental risks, monitoring and adaptive actions can improve both the certainty of environmental outcomes and stakeholder confidence.

Based on the Reef 2050 Plan principles of decision-making, a standardised long-term maintenance dredging management framework has been developed. This framework is depicted in Figure 4 and is explained in more detail in Sections 6 to 9.

This framework seeks to:

- maintain and enhance the OUV of the GBR in every action, by underpinning all actions undertaken in managing impacts of maintenance dredging with an overall strategic objective to protect the GBR's values while maintaining the continued operating efficiency of GBRWHA ports
- base decisions on the best available science, by ensuring that an appropriate knowledge base is developed to gain an understanding of the factors that lead to the need for maintenance dredging, and the potential impact of maintenance dredging activities on the GBR's environmental values
- apply the principles of ecologically sustainable development in reviewing, selecting and implementing options, and strive to continually seek opportunities to foster ecosystem health and resilience through adaptive management strategies
- ensure a partnership approach is adopted by seeking that consultation with appropriate stakeholders is undertaken at relevant stages.

This Strategy considers that the development of LMDMPs by GBRWHA ports in accordance with this framework will result in leading practice management of maintenance dredging.



Figure 4 Elements of long-term maintenance dredging management framework

The benefits of a long-term approach to maintenance dredging management include:

- **Allows analysis of monitoring data and conduct of research**
The undertaking of monitoring programs and analysis of data, and the completion of research projects which add to the body of knowledge regarding sedimentation processes, the impacts of maintenance dredging is a long-term prospect. A LMDMP provides the opportunity to undertake this research and analysis in a coordinated and consistent manner and to apply it to current practices.
- **Application of adaptive management processes**
Long-term management allows time for new practices to be trialled and evaluated along with incremental improvements to existing management practices.

- **Opportunities to take into account likely future events**
Likely future events or emerging risks can be considered and documented in decision-making to improve resilience of the management framework. This could include the impact of planned new or expanded port developments.
- **Improved certainty for ports, business and stakeholders**
Frequent approval and continual changes in regulatory requirements creates uncertainty in terms of scheduling maintenance dredging, execution and timing of monitoring and engagement with stakeholders, often leading to pressured timelines and decision-making. A long-term management approach may provide confidence in outcome delivery and may enable longer term approval and regulatory certainty.
- **The ability to undertake stakeholder consultation and utilise expertise through the Technical Advisory and Consultation Committees (TACCs)**
TACCs should include regulators, community members and stakeholders whose activities may be influenced by dredging, and provides a means to identify any new risks that need to be taken into account.

Principle 1

Long-term Maintenance Dredging Management Plans



GBRWHA ports will develop Long-term Maintenance Dredging Management Plans (LMDMPs) consistent with the framework outlined in this document that:

- contribute to maintaining and enhancing the OUV of the GBR
- are based on the best available science
- utilise the principles of ecologically sustainable development
- ensure continued efficient operation of the port
- are developed in consultation with key stakeholders.

GBRWHA ports will publish their LMDMPs.

Action 1

- GBRWHA Ports will work with TMR, regulators and relevant stakeholders to develop guidelines for LMDMPs in accordance with the long-term maintenance dredging management framework outlined in this Strategy.
- Development of the LMDMP guidelines is intended to be completed by June 2017. Development of LMDMPs will commence concurrently, with priority to be given to GBRWHA ports that dredge annually or frequently.

- **A reduction in application processes**

Applying for an annual maintenance dredging permit involves considerable time and costs (both for ports and regulators). Long-term management may facilitate a longer approval period with milestone reviews and triggers for action and change. It may also facilitate better coordinated approval conditions from the different regulators when there is improved certainty about strategies put in place to avoid or mitigate impacts in undertaking maintenance dredging activities.

- **Improved coordination/contribution to ecosystem policy initiatives**
LMDMPs provide greater scope to coordinate maintenance dredging activity with other Reef 2050 Plan monitoring/research needs.

Given the benefits of long-term management planning for maintenance dredging, this Strategy advocates that GBRWHA ports develop Long-term Maintenance Dredging Management Plans (LMDMPs) consistent with the long-term maintenance dredging management framework.

To provide ports and regulators with guidance on implementing the framework, it is intended that ports work with TMR, regulators and relevant stakeholders to develop guidelines to ensure a leading practice, consistent, transparent and accountable process is applied. It is intended that the LMDMPs will be used as a basis for regulatory approval. The guidelines will provide direction on undertaking risk assessments, identifying environmental values, applying environmental windows, the assessment of beneficial reuse options, and monitoring programs. It is intended that the guidelines will consider when it may be appropriate for the LMDMPs, or certain components of the plans, to be independently reviewed by suitably qualified experts.



6

Developing knowledge base

Sediment Forecasting

- Using existing information and coastal process studies, understand the:
 - source of sediment accumulating in port areas (riverine, tidal, wind and wave, continual, periodic, extreme events)
 - sediment environment at ports, including any specific locations of sediment accumulation within the channels and berths
 - sediment processes and dynamics
 - historic sedimentation volumes within the Port.

Sedimentation effects on port operations

- Based on sediment forecast quantify if there a need to manage sediment within the Port, including what impacts on ship movements and economic trade will the sedimentation profile have in the short, medium and long term.

Environmental and Social Values assessment

- Using existing information and specific studies understand the values within and surrounding the Port. Including:
 - attributes of OUV
 - biological and ecosystem values
 - cultural and indigenous heritage
 - social assets, access and activities
 - commercial users
 - ambient monitoring results.

6.1 Sediment forecasting

6.1.1 Sediment sources

In order to understand the drivers behind sedimentation at GBRWHA ports, which leads to the need for maintenance dredging, it is important to determine the source of sediment accumulating in port areas. The Technical Supporting Document provides detail on the coastal processes affecting sedimentation at GBRWHA ports.

Sediment movement and accumulation is a natural feature of the inshore areas of the GBR. However, since European settlement in the area, the level of suspended and resuspended sediments in the marine environment has dramatically increased (GBR Outlook Report 2014).

The importance of understanding sedimentary processes at GBRWHA ports is recognised in the Reef 2050 Plan through the inclusion of action WQA17 (understand the port sediment characteristics and risks at the four major ports and how they interact and contribute to broader catchment contributions within the World Heritage Area). QPA, GBRMPA, Queensland and Australian Governments have commenced implementation of this action.

As knowledge regarding the nature and impact of sediment transport and resuspension develops, this will be taken into account in the adaptive management strategies employed as part of the long-term management of maintenance dredging.

6.1.2 Sediment environment at ports

GBRWHA ports are located in a variety of coastal environments, including estuaries, bays and open water. For the majority of ports, sediment transport and sedimentation during normal conditions is primarily a result of waves and currents resuspending coastal seabed sediments. The waves and currents act to mobilise sediment from the seabed, and the local currents then drive the transport of the sediment.

The configuration and orientation of the dredged areas also influences the siltation. Compared to the adjacent natural seabed, the forces from waves and currents in the artificially deepened berths, channels and aprons are lower which results in siltation and the areas acting as sediment sinks. Typically, the deeper and wider the dredged area, the greater its ‘trapping efficiency’ of sediment. In some instances, infrastructure may also utilise naturally deep areas. These areas may still act as sinks and require maintenance dredging.



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The **first phase** of the long-term maintenance dredging management framework involves gathering relevant information on which to develop and subsequently assess sediment management needs and options. Relevant information includes: detail on sediment regimes; determining the impacts of sediment on port operations; evaluating whether there is a need to manage sediment; and assessing the social and environmental values within and surrounding the port.

Table 3 Summary of Relative Importance of Processes Supplying Sediment to the Ports in the GBRWHA.

Port	Wave Climate	Tidal Currents	Wind Induced Currents	River Inputs	Cyclones and Storms	Key Sediment Supply Mechanisms
Port of Gladstone						
(In Port)	2	3	1	1	2	Waves and currents
(Outer Channel)	3	2	2	1	2	
Port Alma	1	3	1	2	2	Local currents
Port of Hay Point	3	3	2	1	2	Waves and currents
Port of Mackay	3	3	2	1	2	Waves and currents
Port of Abbot Point	2	1	2	1	2	Waves, currents and cyclones
Port of Townsville	3	2	3	1	2	Waves and currents
Port of Cairns	3	2	3	1	2	Waves and currents
Port of Cooktown	1	1	1	1	3	Cyclones

High Importance

3

Medium Importance

2

Low Importance

1

Note: Historic maintenance dredging volumes for these ports are presented in Table 4.

Severe weather and storms play an important role in the input of new sediment to the inner shelf of coastal areas, in particular, large waves and strong currents generated by tropical cyclones play a pivotal role in the supply of sediment to nearshore areas through the erosion and transport of sediment from deeper areas.

At the majority of GBRWHA ports, catchment runoff plays a low to negligible role in driving sedimentation processes. GBRWHA ports are either located too far from major river systems, or are located adjacent to rivers with relatively negligible sediment discharge for catchment runoff to have a significant impact.

It is, therefore, a combination of both local processes and individual port configurations that essentially dictate the sedimentation rates at each port. Table 3 summarises the relative importance of each of the key processes driving sedimentation at ports in the GBRWHA. Any reduction in catchment sediment runoff will, in most areas of the inner shelf, remain overwhelmed by the natural wave and current resuspension as the primary driver for elevated levels of turbidity.

6.1.3 Sediment processes and dynamics

The previous sections provide a broad description of the relative importance of various processes in deposition of sediment in ports. However, it is important for GBRWHA ports to undertake localised assessments of the sediment transport regimes within their regions so that they have a comprehensive understanding of sediment transport and accumulation at their ports. This may involve:

- analysing relevant data at the port, including information on water quality, sedimentation, hydrodynamics and bathymetric data in order to quantify local sedimentation regimes.
- developing a description of the sediment dynamics and coastal processes including key sources and sinks.
- developing a conceptual model of sediment dynamics in the region of the GBRWHA port.

The information gathered on sediment transport regimes and the behaviour of sediment at ports can be used to identify probable maintenance dredging needs and requirements in the short and medium term. However due to the influence of major weather events on sedimentation, it is difficult to predict annual volumes.

6.1.4 Historic volumes

It is important to understand the historical maintenance dredging activities at each GBRWHA port as it can be used to provide an indication of both current and future needs.

A summary of historic maintenance dredging volumes at each GBRWHA port is presented in Table 4.

There is variability in the dredged areas that require maintenance dredging within each port, with different rates of siltation occurring at different areas of a port at different times. As a result of this spatial variability in siltation rates, it is common for maintenance dredging campaigns to target different areas in different years. As a result, volumes will vary accordingly.

Table 4 Historic in-situ maintenance dredging volumes (m^3) at the ports located within the GRBWHA

Year/Frequency	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Frequent Maintenance Dredging (annual)											
Natural processes result in high sediment transport rates in the vicinity of these ports, which, combined with the port configuration, result in regular siltation and therefore maintenance dredging is required annually to maintain design depths.											
Gladstone	174,150	148,426	225,242	160,972	17,995	282,000	0 ¹	309,000	150,000	01	555,107
Townsville	492,740	312,785	156,560	117,454	339,306	675,464	133,100	814,435 ²	502,940	386,610	521,770
Cairns	531,962	387,346	378,554	228,105	201,864	312,807	314,657 ³	439,443 ³	246,727 ⁴	421,491 ³	574,447 ³
Regular Maintenance Dredging (dredging every two to five years)											
These areas experience relatively high rates of natural sediment transport but the dredged areas are not as effective sediment traps as the ports that require annual maintenance dredging. Additionally, the areas can be influenced by extreme events that may lead to the need for maintenance dredging frequency being increased.											
Hay Point	98,900	0	0	0	192,294	0	216,070	0	0 ⁴	0 ⁴	0 ⁴
Mackay	122,760	0	520	106,000	3,406	0	0	0	0	98,381	0
Infrequent Maintenance Dredging											
The local natural processes result in low sediment transport rates in the vicinity of the port, which combined with the naturally deep water where the port is located, results in infrequent maintenance dredging. Over the last thirty years maintenance dredging has been undertaken once, as part of a capital dredging campaign. Over this period a number of tropical cyclones have affected the area but these have not resulted in the requirement for maintenance dredging.											
Abbot Point	0	0	0	0	<20,000 ⁵	0	0	0	0	0	0
Episodic Maintenance Dredging											
The siltation associated with maintenance dredging at these ports results from episodic extreme events such as large floods and tropical cyclones. It is not possible to predict the frequency of these events, they could occur in consecutive years or only every few decades.											
Port Alma	0	0	0	0	0	23,000	0	40,000	0	0	0
Cooktown ⁶	0	0	0	0	0	0	0	0	0	0	0
No Maintenance Dredging											
The configuration of these ports have meant that maintenance dredging is not required regardless of the natural siltation rates. At the Port of Lucinda and the Port of Cape Flattery this is because the berths are located in deep water, while at the Port of Quintell Beach it is because the port only consists of a barge ramp that does not require an access channel.											
Cape Flattery, Quintell Beach, Lucinda, Mourilyan	0	0	0	0	0	0	0	0	0	0	0

1. The years with no maintenance dredging in the Port of Gladstone are due to the timing of the dredging program, instead of dredging occurring towards the end of the year it occurred at the start of the following year.

2. The maintenance dredging volumes for the Port of Townsville in 2011 appear very high as the maintenance campaign was interrupted by TC Yasi, which subsequently silted up the channels and berths requiring additional maintenance dredging.

3. At the Port of Cairns since 2010 it has not been possible to achieve the maintenance dredging target depths due to technical specification reasons.

4. Further maintenance dredging at the Port of Hay Point is currently the subject of a sustainable sediment management project looking to find the best ways to manage sediment at the port (similar activities are underway in other ports).

5. At the Abbot Point Port capital dredging of 201,315m³ to create a new berth as well as maintenance dredging of the existing berth occurred in 2008, this was the first time any maintenance had occurred since 1986. An exact maintenance dredging volume is not available but the volume was estimated to be less than 20,000m³ (GHD, 2012a).

6. Cooktown has required maintenance dredging of 44,141m³ in 2015 and 26,000m³ in 1996 due to tropical cyclones.

There has also been significant variability in the maintenance dredging volumes at individual ports over time which can be due to changes in siltation rates, especially from extreme episodic events, such as tropical cyclones and floods.

These events can result in high levels of siltation over a short period and may necessitate the need for emergency dredging to restore port access. Due to the unpredictable nature of these extreme events, in terms of their intensity, frequency and spatial influence, it is not possible to reliably estimate future maintenance dredging volumes and their variability.

A number of ports have not historically required maintenance dredging. This is due to either low or zero siltation rates, berths being located in sufficiently deep water or alternative management measures (such as bed levelling) to maintain declared depths.

6.2 Sediment effects on port operations

Once ports have developed an understanding of sediment dynamics it is important to also understand sedimentation effects on port operations. In order to understand the effects of sediment on port operations it is necessary to understand:

- the growth and capacity in export volumes
- ship movements, ship sizes and required draft depths
- maritime infrastructure footprints, depths and design
- supply chain logistics and ship loading/unloading durations
- related trade values and economics.

This will require consultation with relevant stakeholders, including port users and customers.

Using this information the implications of sedimentation and shallowing of navigational areas on port operations, the dynamics of shipping movements and economic returns can be evaluated. The rates and specific locations of sedimentation combined with the impacts on port operations will inform when and to what extent sediment management measures are required.

6.3 Environmental and social values assessment

To manage the risks associated with maintenance dredging, each port needs to have a comprehensive, scientifically-based knowledge of the environment in which they operate. Environmental and social values need to be considered in the risk assessment process undertaken for each maintenance dredging program.

Environmental values are defined as particular values or uses of the environment that are important for a healthy ecosystem or for public benefit, welfare, safety or health and that require protection from the effect of pollution, waste discharges and deposits.

The social and environmental values assessment should consider:

- Broad environment values – soils, air, water, biodiversity.
- Identification of matters of national, state and local environmental significance.

- Evaluation of environmental values present at a port to determine their respective contributions to the OUV of the GBRWHA.
- Existing social fabric – including social structure, employment, amenity, cultural and heritage values, services and usage of the port and surrounding regions.

The Technical Supporting Document provides a site-specific description of the distribution and temporal trends for identified environmental values at each of the GBRWHA ports with a history of, or likely future need for, maintenance dredging. These habitats and communities are discussed in more detail in Appendix D of the Technical Supporting Document.

Given the complexity of issues that need to be considered in assessing environmental and social values, this phase will require consultation with relevant stakeholders to determine values relevant to each port area. In particular, regional report card partnerships have established a collective vision for their local waterways and report on environmental, social, economic and cultural health, which should be considered during this phase of the maintenance dredging planning process.

These values form an important overlay that can be used to determine intersects, impacts and opportunities when considering sediment management options. GBRWHA ports have significant historical and ambient monitoring results which should form part of this consideration.

Under the SPD Act, the priority port master planning process will include the development of an environmental management framework for each priority port. The environmental management framework will identify environmental values in the priority port master planned area, identify any potential impacts of future development on these environmental values, and state objectives and measures for managing the potential impacts. Future maintenance dredging requirements associated with future development at the priority port will also be considered as part of this process.

Principle 2

Developing the knowledge base for maintenance dredging activities

LMDMPs for GBRWHA ports will be based on an understanding, using the best science available, of sediment transport processes and environmental values relevant to maintenance dredging activities.



7

Reviewing management options

Avoid or reduce sedimentation

- Examine feasible opportunities to avoid or reduce sedimentation in Port areas. Considerations:
 - port infrastructure planning
 - realities of volume limits
 - the source and quantity of sediments
 - port location (river, estuary, openwater)
 - channel redesign and alternatives to dredging
 - additional port infrastructure.

Determining maintenance dredging requirements

- Following the application of avoidance and reduction measures, and using best available information on sedimentation and effects of port operations, the need and scale of future maintenance dredging requirements can be estimated. These needs will vary annually based on climatic influences and port operational needs.

Dredge Material Management

- Beneficial Reuse
 - Based on sediment properties examine local/regional opportunities for beneficial reuse of accumulated sediments.
- Onshore Placement
 - If reuse of all or part of the material is not feasible examine possible onshore placement options.
- At sea Placement
 - If reuse or onshore placement of all or part of the material is not feasible examine possible at sea placement options.

7.1 Avoiding or reducing the need for maintenance dredging

7.1.1 GBR-wide context

The SPD Act, which commenced in November 2015, enables the state government to balance the protection of the Great Barrier Reef with the development of the state's major ports operating in and adjacent to the GBRWHA. Under the SPD Act, major capital dredging for the development of new or expansion of existing port facilities in the GBRWHA has been restricted to the priority ports of Gladstone, Abbot Point, Townsville and Hay Point/Mackay. The legislation also prohibits the sea-based disposal of port-related capital dredge material within the GBRWHA. (Note: In relation to the Port of Cairns the legislation allows limited port-related capital dredging in its inner harbour in line with specific restrictions.)

By reducing and limiting capital dredging in specific areas of the GBRWHA, the SPD Act has minimised future maintenance dredging needs in the broader GBR environment.

7.1.2 Port infrastructure planning

A crucial measure undertaken by ports to minimise maintenance dredging volumes at present occurs as part of channel design in association with the capital dredging. Hydrodynamic modelling to assess various design options and impacts to siltation processes are undertaken as part of the approval process for any significant capital works such as channel realignment or berth creation. At both a master planning and development stage, it is necessary to consider likely maintenance dredging requirements.

In further considering the role of future port infrastructure planning in reducing sediment, it will be essential for GBRWHA ports to assess the availability, practicability and feasibility of other operational strategies to avoid or minimise maintenance dredging (discussed in section 7.1.3). This assessment should also:

- Be considered against key features of the port, including the sources and quantity of sediments (derived during Phase 1) and the location of a port (e.g. the options for managing sediment at river ports might be very different to an openwater port).
- Put the sediment and hydrodynamic environment in context and examine possible solutions to 'keep sediments out' or 'keep sediments moving' out of the port infrastructure areas.



The **second phase** of the long-term maintenance dredging management framework involves using the information gathered in phase one to determine sediment management opportunities consistent with the processes outlined in the NAGD.

- Develop each potential solution and prepare a process description, constraints analysis and determine the associated comparative costs.
- Contextualise each option in consideration of existing and forecasted maintenance sediment volumes at the port.

Principle 3

Avoiding or minimising the need for maintenance dredging

GBRWHA ports will include future maintenance dredging requirements in port infrastructure planning to ensure relevant environmental values and potential impacts are properly understood, and to assist in minimising the need for maintenance dredging.



The impacts of these types of projects on maintenance dredging requirements is typically addressed as part of the project approvals process and future predictions should therefore be understood prior to approval of the project.

However, historic volumes indicated in Table 4 highlight the variability and complexity of both the climatic and oceanographic drivers, indicating that the local environment and the factors that influence siltation differs between the ports. Due to the variability of processes that drive sedimentation, the maintenance dredging volumes over the last 10 years may be used as a broad indicator of the likely range and frequency of future maintenance dredging requirements at the ports. However, they are not the most reliable method of predicting future maintenance dredging requirements as the variability makes predicting future maintenance dredging volumes difficult and uncertain.

Based on the natural variability in sedimentation rates and the resulting variability in maintenance dredging requirements, adopting an annual maintenance dredging volume limit is not considered to be best practise or an appropriate management approach.

Future maintenance dredging volumes necessary to maintain berth and channel depths are expected to be generally similar to historical volumes, while noting that annual variability will continue to occur as a result of natural variation in the sediment transport and siltation forces. In some years, volumes may increase whilst, in others, volumes may decrease.

Due to the natural processes driving the need for maintenance dredging discussed in Section 6.1.4, which are not expected to alter significantly into the future, there are limited options at present available in GBRWHA ports to try to reduce future maintenance dredging requirements. However, in future there may be opportunities to investigate further alternatives as science and technology develops.

In addition, future maintenance dredge volume estimates for each port should take all reasonable factors into account and also must retain flexibility so that adjustments to volumes can be considered in the event of extreme situations, such as the occurrence of cyclones as well as long-term climatic variations (e.g. La Niña effects).

7.1.3 Volume limits

While ports undertake strategies to minimise the need for maintenance dredging at the development stage for port infrastructure, maintenance dredging mainly occurs at existing port infrastructure where there is little opportunity to modify channel or berth design. As these areas have already been created, at most ports within the GBRWHA there are limited opportunities to further reduce future maintenance dredging requirements through the configuration of existing dredged areas.

There have been suggestions that imposing volume limits on the amount of material dredged or placed at sea could address concerns regarding impact on environmental values. Consideration of imposing volume limits require an understanding of future maintenance dredging requirements at GBRWHA ports.

New shipping areas, such as new berths or channels, can increase the areas and volumes of maintenance dredging needed. There are a number of proposed capital dredging projects or port expansions in priority ports which have the potential to change future maintenance dredging at these ports. These are detailed in the Technical Supporting Document, Table 17.

The Technical Supporting Document (TSD) provides an example in Cairns (TSD Section 4.5) that adopting annual maintenance dredging limits could result in shipping inefficiencies, safety risks and potential increases in suspended sediment due to propeller wash as a result of channel, apron and berth depths reducing.

These factors indicate that implementing prescriptive volume limits would not be effective in protecting environmental values in ports in the GBRWHA. However there is an expectation that GBRWHA ports will try to minimise the actual volume of dredging required and reduce the frequency of dredging activities to only those that are critical to the ongoing and efficient operation of the port.

Principle 4 Volume limits

Maintenance dredging will be limited to that required to maintain the approved dimensions of port infrastructure to ensure efficient shipping access and the optimisation of port operations (i.e. will not be used to increase channel or berth footprints or depth).

Principle 5

An increase in channel or berth dredging areas and depths will only occur as a result of approved capital dredging following assessment of implications of future maintenance dredging needs and disposal options (as per existing approval processes).



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7.1.4 Operational strategies to avoid or minimise maintenance dredging

Maintenance dredging is expensive and there are strong economic drivers for ports to minimise maintenance dredging volumes. Various technologies are used internationally to avoid or minimise anticipated requirements for future maintenance dredging. In GBRWHA ports, these measures include:

- **Hydrographic survey:** ensures that maintenance dredging is focused only on the areas that require removal of accumulated sediments to maintain designated depths. This also ensures that dredging is only undertaken when channels or berths are at capacity in terms of sediment accumulation so as to avoid the need for repeated or follow-up dredging.
- **Bed levelling¹:** maintains designated depths by moving isolated high spots into adjacent existing deep areas. This reduces the frequency of dredging to maintain declared depths.
- **Local interception strategies:** existing deep areas or artificial insurance trenches adjacent to berths and channels can be used as artificial sediment stores. Bed levelling can then be used to move sediment from the berths and channels into the adjacent deep areas.
- **Dynamic under keel clearance (DUKC):** implementation of a dynamic under keel clearance system can help to promote safe navigation and has the potential of allowing for reduced design bed levels in channels.
- **Silt trenches:** May reduce the frequency of maintenance dredging by encouraging material to settle out in the trenches rather than berth pockets and departure paths.
- **Catchment management:** measures to reduce land based sediment inputs can reduce sediment inputs to shipping channel and berths at some ports.

Despite these opportunities, there are limited options which could be adopted in the ports in the GBRWHA to reduce future maintenance dredging requirements given it is natural processes that drive the need for maintenance dredging.

However, the ports regularly review emerging technologies in terms of their benefits and risks with a view to constantly aiming to reduce future maintenance dredging requirements.

It is considered that GBRWHA ports should ensure regular review of emerging and innovative technologies designed to reduce maintenance dredging, and to incorporate these into their management practices where possible. This is further discussed in Section 7.3.

1. In this context, bed-levelling is discussed as a strategy that ports use to attempt to reduce and minimise the need for dredging, through bed levelling within the dredge footprint to redistribute sediment within dredged areas rather than removing the material from that area completely.

7.2 Determining maintenance dredging requirements

Once avoidance and reduction measures have been investigated using the best available information on sedimentation and effects on port operations, the need and scale of future maintenance dredging requirements can be estimated. The natural sediment dynamics and the deeper nature of shipping channels and berths compared with surrounding areas means that most GBRWHA ports have residual sedimentation that can only be alleviated via maintenance dredging.

Combining information gathered from previous phases, GBRWHA ports will need to determine the areas and volumes that need to be dredged and the required time period that maintenance dredging needs to occur to ensure the ongoing operation of the port. Options to manage maintenance dredging needs will then be investigated.

7.3 Managing maintenance dredge material

Maintenance dredge material management will require examination of opportunities to use or dispose of the dredged material. In accordance with well-established practices undertaken as part of the NAGD, there is an order of precedence for options with the preference to either beneficially reuse the material, or dispose of the material on land rather than return the material to the marine environment.

7.3.1 Beneficial reuse

Beneficial use of dredged material is an integral part of the dredge material management evaluation process. It involves using dredged material for a purpose that provides social, economic or environmental benefits (or a combination of these). With beneficial reuse, the dredge material is managed as a valuable resource rather than a product destined for disposal.

In the GBRWHA, if reuse of all or part of the material is not feasible then there is a preference for onshore placement options of dredge material to be examined rather than sea disposal.

Options to relocate or reuse dredged material are assessed through mechanisms defined in the NAGD that requires all alternatives to ocean disposal to be evaluated, including the environmental, social and economic impacts of each reuse/disposal option. As outlined in Section 8.1, these options are also typically assessed in consultation with a range of key stakeholders to ensure that appropriate input and guidance on key constraints and opportunities are identified. At GBRWHA ports, this input is often provided by a port-based Technical Advisory and Consultative Committee (TACC).

Potentially available beneficial reuse or on-shore placement options may include:

- land reclamation
- engineering and product uses - beach nourishment, fill material for infrastructure projects, park creation, commercial product development (e.g. bricks, cement, topsoil)
- agricultural uses - use to enhance soils in agriculture, forestry, and aquaculture, and related uses such as mine rehabilitation
- environmental enhancement – reinstatement of environmental areas, habitat development, restoration of tidal flats, mud flats, wetlands, nesting habitats
- rehabilitation of industrial sites or developments in proximity to dredging location.

These options may involve treatment of dredged material, such as dewatering, mechanical separation, contaminant immobilisation and other treatment technologies to reduce levels of contaminants or make the sediment suitable for use.

A number of case studies were investigated in the Technical Supporting Document providing example applications of these beneficial reuse options. Some of these case studies may or may not be suitable applications for the Queensland environment. Some case studies are discussed in Figure 5.

It should be noted that on-shore placement options either on-land and in the aquatic zone (i.e. underwater or in intertidal areas) while of beneficial reuse, may also cause environmental harm. Land reclamation and onshore placement facilities may have environmental impacts associated with the disposal of dredge material during construction works, such as the permanent loss of sub tidal habitat (e.g. seagrass meadows), discharge of turbid and ultra-saline water from ponds, turbidity plumes, spills from filling operations, Potential Acid Sulphate Soils, and the alteration of coastal dynamics. Ultimately, reclamation also involves the loss of an area of tidal lands and waters, which may be a major limiting factor from an environmental perspective.

Enhancement options, such as the creation or restoration of bird roosting areas, intertidal areas, or wetlands may be positive in the long-term but may involve the loss of some existing form of wetland. Saline run-off to waterways have the potential for impacts on habitats, and drainage into groundwater may affect a range of dependent habitats (and human uses). These factors need careful assessment to determine whether a benefit is actually achieved. The existence of potentially suitable options does not necessarily imply they are viable options, as detailed site specific assessment of technical, economic or environmental factors may limit their feasibility at a particular port.

A review of opportunities for beneficial reuse and on-land disposal of maintenance dredged material in GBRWHA ports has determined that constraints exist. These constraints are primarily related to:

- the predominance of silts and clays within the maintenance dredging areas (which have poor engineering qualities for reuse)
- the volume of material involved is too small and infrequent, and supply is too inconsistent
- coastal environmental impacts
- the unavailability of large areas of nearby land for dewatering of the sediments
- additional permitting processes (separate to sea disposal)
- the economic impacts of the prolonged operation time for pumping to land and additional processing required.

Some of the ports that require regular maintenance dredging have limited areas with predominantly sandy sediment, which may provide greater opportunities for beneficial reuse than the typical silts and clays. These particular sediments may provide potential opportunities for placement within existing sites that have been approved or established for land reclamation activities (e.g. existing bunded areas) and environmental enhancement. However, intermixing of sediment, limited available capacity in existing bunded areas designed for other purposes, and the lack of nearby degraded ecosystems providing opportunities for restoration or rehabilitation within the GBRWHA are likely to limit such opportunities.

In addition, the volumes of maintenance dredging in Queensland are generally too small and programs are infrequent to support viable commercial reuse or reclamation. The supply of reusable material is too inconsistent.

While a number of technical, social and environmental constraints exist for beneficial reuse and land disposal options for dredge material in GBRWHA ports, it is important that beneficial opportunities at each port are continually assessed to ensure that new technologies and beneficial reuse opportunities are identified and considered. This continual review process should be incorporated into a LMDMP.

In addition, the Reef 2050 Plan's Action WQA15 calls for an examination and, where appropriate, a potential pilot program to evaluate different treatments in reuse options for managing dredge material. TMR has the lead reporting responsibility on this action.

It is critical that GBRWHA ports ensure beneficial reuse options are assessed prior to any consideration of alternative onshore and offshore management options.

7.3.1.1 Understanding Port Sediment and its interaction with the broader GBR catchment

It's important to understand that port sediment characteristics and how they interact and contribute to the broader GBRWHA catchment so that risks and impacts can be assessed. The Technical Supporting Document states that effective management of maintenance dredging requires a better understanding of natural coastal sediment processes.

Maintenance dredging volumes make up a negligible percentage of the overall sediment budget in the GBR Inner Lagoon. Consequently, removing maintenance dredging material from the coastal system will not substantially alter the sediment budget of the GBR Lagoon. However, international practice indicates that removing sediment to land may not always be the preferred option. In many instances maintaining the material within the coastal system can be an appropriate management option, like the Port of Newcastle DMPA example in Figure 5.

Development of port and regional sediment distribution maps, and sediment budgets, would assist with understanding of sediment movement pathways and deposition areas for different sediment types. This could potentially facilitate options to beneficially reuse maintenance dredge material within the marine environment.

To improve the understanding of sediment budgets and movement pathways, there are a number of research programs already underway, including a number of National Environmental Science Program (NESP) - Tropical Water Quality Hub research projects. There are also port-led projects, such as the Hay Point Sustainable Sediment Management for Navigational Maintenance Project.

There are many other potential research programs that require further investigation, including:

- Sustainable relocation – as maintenance dredging involves natural materials that form part of the active sediment system, these materials are an integral part of existing ecosystems. Findings from the Technical Supporting Document point that a potential option for maintenance dredged material that requires further understanding is the maintenance of the material in the active natural system. This is in keeping with best practice worldwide (e.g. the World Association of Waterborne Transport Infrastructure's (PIANC's) Working with Nature approach).
- An improved understanding of sediment transport and characteristics at each port may provide better certainty about reusable sediment supply, thus potentially enabling customised beneficial reuse activities. Ports fulfilling the requirements of Reef 2050 action WQA17 (to understand the port sediment characteristics and risks at the four major priority ports and how they interact and contribute to broader catchment contributions within the GBRWHA) will assist in obtaining this improved understanding including the relative impacts of the movement or retaining dredge material within the natural system.

Principle 6 **Beneficial reuse**



GBRWHA ports will:

- ensure that LMDMPs include an assessment of beneficial reuse options for dredge material management to determine if viable opportunities exist
- seek to beneficially reuse material where viable options are available, in accordance with existing regulatory requirements and the comparative analysis outlined in this document
- continue to assess the latest scientific, technological and other factors which may render previously unsuitable practices suitable or viable for beneficial reuse
- work with relevant Queensland and Australian government agencies and scientific organisations to conduct an examination and, where appropriate, a pilot program to evaluate different treatment and reuse options for managing dredged material consistent with the requirements of WQA15.

Action 2

Ports will lead implementation of Reef 2050 Action WQA17, working with relevant government agencies and the scientific community to understand the port sediment characteristics and risks at the four major ports and how they interact and contribute to broader catchment contributions with the GBRWHA. The project will be completed by the end of December 2017.

Land creation

Pasir Panjang Terminal Land Reclamation Singapore

To satisfy the demand for container port facilities the Government of Singapore decided to expand the Pasir Panjang Terminal. This required the creation of 200 hectares of land reclamation over naturally deep waters to create areas for landside infrastructure and 14 new berths. The Maritime and Port Authority of Singapore had the objective of sustainable port development that reduced reliance on sand as engineering fill material, which had also become more difficult and expensive to obtain. The vast majority of material used was specifically dredged for this project, and was not maintenance or capital dredge material.

Port of Brisbane Future Port Expansion Queensland

This project involves reclaiming and extending Fisherman Islands to provide additional quay line length of 1800 metres with approximately 230 hectares of land for port purposes. Work on the project has been in progress since 2002 with ongoing dredging of the approach channels and berths providing fill material for land reclamation and subsequent expansion of the port. In 2007 a 4.8 kilometre sea wall was constructed to provide for in excess of 15 million cubic metres of dredge material. The nature of the material is predominantly soft clays and sand and requires geotechnical treatment to gain load bearing capabilities.

Environmental enhancement

Mobile Bay United States

Mobile Bay, Alabama is the second largest estuary in the United States (US) and the primary depositional basin for the sixth largest river system in the US. The bay also houses the twelfth largest port in the US. Maintenance dredging requirements at the port averages approximately 4 million cubic metres per year.

In November 1986, regulation completely changed dredging and material placement practices in the bay by banning the in-bay disposal of maintenance dredged material. It was observed that over the years following that this change in practice contributed to shoreline recession and the loss of habitat in the region.

Twenty five years after the banning of in-bay disposal, beneficial reuse options were considered in detail and it was determined that keeping the material in the bays active sediment system would act to limit the erosion and habitat loss experienced in the region. A method was developed whereby a thin layer of dredged material was placed on either side of the shipping channel and in doing so this retained sediment in the local system. Monitoring showed that the thin layer placement approach restored natural sediment processes in the Bay as well as creating positive benefits to the local ecosystem.

Agricultural use

Mud to Parks' Project Chicago, United States

The Peoria Lakes are located within the Illinois River and receive sedimentation from an upstream drainage area containing some of Illinois' richest agricultural land. This sedimentation had reduced the volume of the lakes by 77 percent and was adversely affecting navigation and recreational boating activity. Although the sediment dredged from Peoria Lakes comprised rich agricultural soils, the demand for local deposition as topsoil was limited due to the abundance of fertile farm land in the surrounding areas of central Illinois.

However, a beneficial reuse application for the material was identified in Chicago following the closure of the Chicago South Works plant by US Steel, which left a 573 acre site at the mouth of Calumet River covered largely with slag. The site was approved for redevelopment and the muddy sediment dredged from the Peoria Lakes was barged up the river to Lake Michigan and to the South Works site as part of a project named 'Mud to Parks'.

This project is a freshwater example, with limited relevance in Queensland.

Unconfined sea disposal as sustainable relocation of dredged material

Port of Newcastle Dredge Material Placement Area (DMPA) Newcastle

The Port of Newcastle's DMPA has been used for over a century for offshore dredge material placement and has been the subject of numerous studies to develop and verify a conceptual model for far field dispersion of dredge material, and to monitor environmental characteristics of the seabed. Investigations have been completed both within the DMPA boundary and surrounding areas and have included extensive sediment sampling and physical and chemical testing, sampling of benthic communities, remote operated vehicle (ROV) video surveys, hydrographic surveys and sidescan sonar imagery.

These studies have determined that the mud fraction within the dredged sediments disperses from the DMPA in a south-easterly direction before settling in water depths of 60 to 100 metres. The studies have not indicated adverse environmental impacts from ongoing placement activities. ROV investigations determined that the placement of dredged rock from capital dredging activities had, in fact, resulted in environmental enhancement by providing habitat for sponges, moss animals and filamentous algae. Juvenile snapper were also observed in the vicinity of the rocks and boulders.

The Port of Newcastle's DMPA is an example of sustainable relocation where material is placed with the knowledge it will be shifted by natural processes which is acceptable because the fate and consequences of the material movement are well understood.

Figure 5 Case Studies of Beneficial Reuse Options for Dredge Material

7.3.2 Onshore placement of dredge material

If reuse of all or part of the material is not feasible, options to place dredge material onshore should be evaluated by GBRWHA ports.

Onshore disposal of dredge material may be a viable option in some circumstances and involves placement of material in a dedicated storage area. Disposing of large volumes of dredged material on land presents a range of site selection and environmental considerations. Possible options and considerations for disposal include:

- Engineering – onshore disposal requires a large area of unused or disused relatively flat land or depression (natural or constructed) that can be modified to contain dredged material, which in the first instance will be mixed with salt water. Factors such as the site being within a viable distance from the point of dredging, and availability of suitable areas for dredge placement need to be considered.
- Environmental – the clearing and construction of disposal areas may result in environmental impacts that need to be assessed, avoided and mitigated. The placement and de-watering of the material will also pose environmental risks, including the discharge of saline and turbid water into nearby waterways or back into the coastal system. Threats posed by contaminants, acid sulphate soils, dust and other risks need to be managed.
- Long-term management – the onshore disposal areas must be maintained, managed and monitored. Bund walls, water discharge systems and human safety and access restrictions must be maintained while the material is dried and consolidated (this can take many years). Eventually the material will solidify and the area can either be decommissioned or refurbished and extended to accommodate further material.

7.3.3 At sea placement of dredge material

If reuse or onshore disposal of all or part of the material is not feasible, options to place dredge material at sea will need to be considered.

However, the placement of dredged material in offshore waters involves environmental impacts beyond those associated with the actual dredging activity. Consequently, impacts on habitats, and on the physical, chemical and biological characteristics on the placement site need to be assessed carefully.

The placement of dredge material at sea needs to be consistent with the requirements of the London Protocol and the NAGD. The objective of these mechanisms is to protect and preserve the marine environment from all sources of pollution and to establish effective measures to prevent, reduce and where practicable eliminate pollution caused by at sea placement of dredge material.

In addition to evaluating alternatives to ocean disposal, the NAGD provides guidance in assessing dredge loading and placement sites, assessing potential impacts on the marine environment and other users, and determining management and monitoring requirements for at sea placement of dredge material.

The characterisation of both the loading and placement sites are required by the NAGD to inform the assessment of how they may be impacted. It requires that an assessment of sediments at and near the loading and placement site as well as nearby sensitive elements of the marine environment and a consideration of other uses of the area to be undertaken. Assessment of sediment quality will assist in determining the suitability of the dredged sediment for ocean disposal.

If it has been determined that sediment is suitable for ocean disposal, an assessment of the potential impacts on the receiving environment is then required to be undertaken. This assessment will inform the suitability of sites for disposal and will assist in the development of future mitigation and management measures.

As with on-shore disposal, after the likelihood and consequence of potential impacts of the activity have been predicted, management measures need to be evaluated to determine if the impacts can be controlled or mitigated. Other mitigation measures for at sea disposal are further discussed in the following sections of this Strategy.

While the vast majority of maintenance dredging in GBRWHA ports involves the removal and disposal of uncontaminated sediments, the following guiding principle is put forward in this Strategy to ensure that at sea placement of dredge material maintains the reef's integrity and protect its OUV.

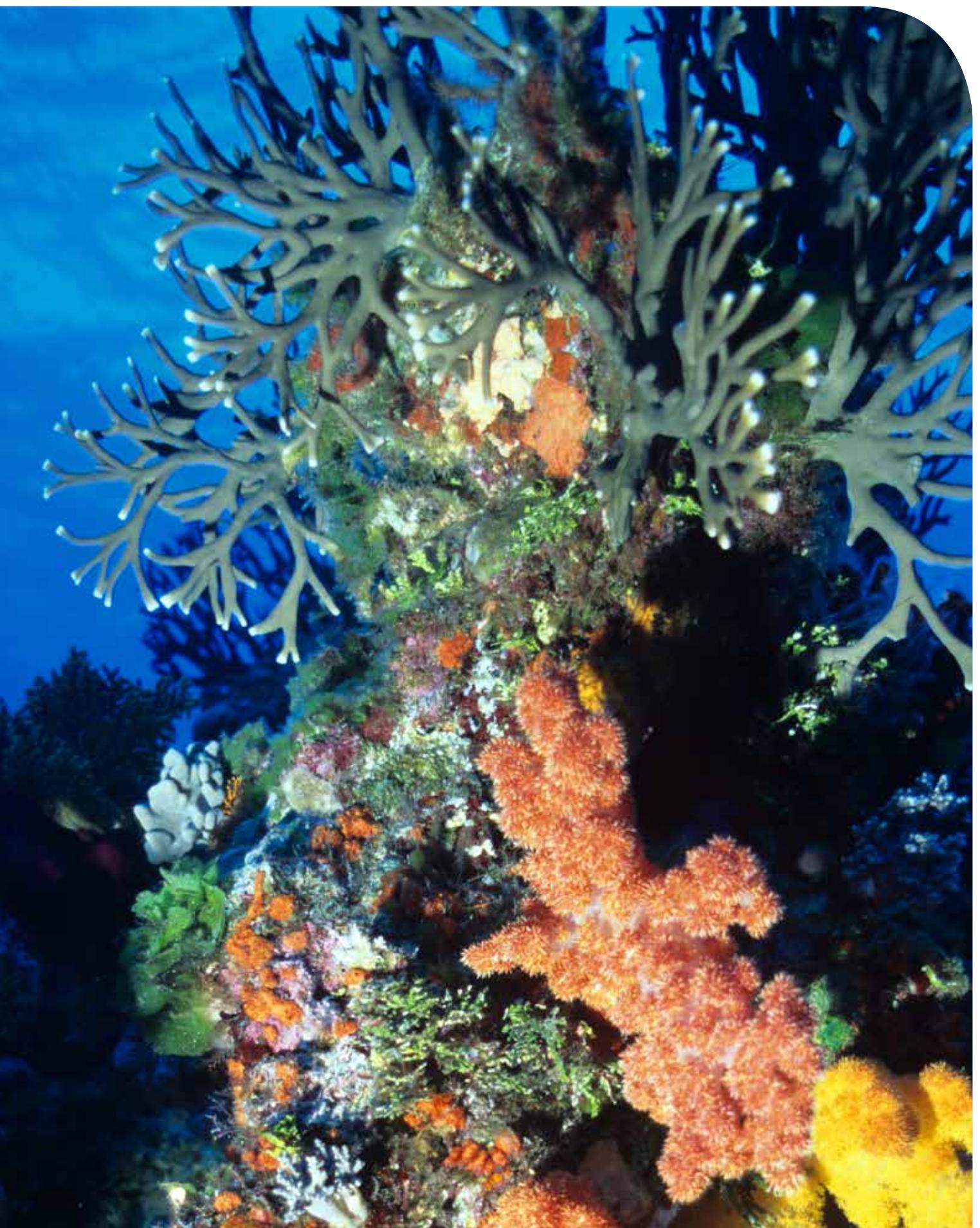
Principle 7

At sea placement of dredge material



Applications to place material at sea will continue to abide by existing National Assessment Guidelines for Dredging 2009 (or any subsequent versions) and regulatory processes, including an assessment of:

- **all feasible alternative disposal options**
- **sediment quality at both loading and placement sites in accordance with relevant regulation and guidelines to prevent toxic material being placed at sea**
- **how the sites may be impacted, with consideration of the marine environment and other uses of the area**
- **monitoring and management measures to control or mitigate impacts.**



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8



Selecting management options

Undertake a comparative analysis of options

- Using a repeatable and structured risk based methodology, compare all possible avoid, reduce, reuse, onshore and at sea options. Consider potential impacts to identified values and effectiveness in maintaining port operations.
- Based on results of comparative analysis select most suitable solution(s).

Long-term Maintenance Dredging Management Plan

- Where the solutions involve maintenance dredging, a port will need to develop and implement a LMDMP that includes provisions for:
 - risk based approach to managing impact
 - sediment budgets and sediment management
 - assessment of beneficial reuse, land and sea disposal options
 - dredging management and selection of equipment
 - assessment of environmental windows
 - port operational considerations
 - environmental impact mitigation
 - social and cultural protection
 - health and safety requirements
 - timing and costs
 - management practices

Regulatory Approvals

- Where required, regulatory approvals should be sought for the proposed sediment management solutions, including any dredging and disposal activities.

8.1 Comparative analysis of management options

Once options for available measures to mitigate the impacts of maintenance dredging have been identified, these options need to be evaluated using a consultative, risk based methodology to determine which alternative will result in the best outcome.

In determining the best management approach, GBRWHA ports need to embark on a structured, transparent and well thought-out multi-criteria decision-making process. Typically, this involves:

- establishing clear objectives that are specific, measurable, agreed, realistic and time-dependent and considering environmental, economic, technical, operational and societal issues
- developing a process which identifies how to compare the effectiveness of different options in meeting the objectives
- prioritising concerns and issues, and deciding on an appropriate compromise where there may be differing objectives
- determining a management option(s).

Given the wide range of possible alternatives for managing maintenance dredging activities, GBRWHA ports need to make this decision-making process transparent, structured and explicit.

Due to the variability of the environmental processes, technical and operational requirements, regional, economic and societal issues facing each GBRWHA port, it is important that ports involve relevant stakeholders in this process to determine important considerations and desirable outcomes. Stakeholders use existing TACCs (which often include port users, regulators, local community non-government organisations and other interested parties) in this process to determine important considerations and desirable outcomes.

To assist GBRWHA ports with establishing this framework in a consistent manner, it is proposed to develop guidelines for LMDMPs (Action 1).



The **third phase** of the long-term maintenance dredging management framework involves using the information gathered in phases one and two to compare and select an appropriate set of long-term management solutions, prepare a long-term management plan and seek regulatory approvals (where required).

Principle 8

Comparative analysis



GBRWHA ports will undertake a consultative comparative risk based analysis process encompassing environmental, economic, technical, operational and societal issues to determine the most suitable solution(s) for management of maintenance dredging material using a repeatable and structured methodology.

Information and results of the comparative analysis process will be published in the LMDMP.

8.2 Developing Long-term Maintenance Dredging Management Plans

Once a management option(s) has been established, this Strategy expects for GBRWHA ports to develop long-term management measures for that option.

The consistent application of assessment, planning and monitoring tools over time greatly assists in establishing a whole-of-system understanding and confidence in the management systems in place. In the case of maintenance dredging, the development and implementation of port-based long-term management that address operational needs, environmental risks, monitoring and management will improve both the certainty of environmental outcomes and stakeholder confidence. Consultation with relevant stakeholders is a key element of developing the LMDMPs and it is recommended that GBRWHA ports consider using existing forums such as Technical Advisory Consultative Committees (TACCs).

As well as measures to avoid and mitigate environmental and social impacts within the GBRWHA context, LMDMPs should also include consideration of the following management measures.

8.2.1 Dredging equipment selection and operational approaches

Selecting the most appropriate method of dredging may to some extent minimise the environmental impacts of dredging and dredge material placement. Methods chosen may affect the physical effects of spoil, sediment contamination, and water quality.

Dredging practices and equipment have evolved considerably in recent years to increase dredging efficiency and to minimise environmental impacts. The Technical Supporting Document provides a discussion on different types of dredgers predominantly used in Queensland.

There are a number of factors that determine the selection of equipment used for a dredging activity. These include physical, environmental and economic factors, such as:

- **Local environment, site conditions and sediment characteristics** – weather, current and tide, and physical characteristics and level of contamination of the sediment to be dredged may make the use of some types of dredgers more or less advantageous. The characteristics of the dredging sites have a significant bearing on the type of dredger which can be used.
- **The requirements of the works to be undertaken** – the quantity of the material to be dredged, the required depth/dimensions of work that needs to be undertaken, and the method of disposal may limit the use of some types of dredgers.
- **Logistics** – accessibility and availability, transport options, distances (including impact on carbon emissions) and costs are considerations in selecting dredging equipment. Given that dredgers are highly specialised equipment, there are limited dredgers currently available locally and internationally.

The varied locations and environments of the GBRWHA ports results in each port being subject to different sedimentation processes and rates. As a result, maintenance dredging needs can vary significantly between the ports and even within an individual port on a yearly or seasonal basis.

Queensland ports have typically used a Trailing Suction Hopper Dredger (TSHD) to undertake the majority of maintenance dredging as they are the most suitable type of dredger for this operation. They have high production rates, can operate in offshore and heavily trafficked areas and are well suited to dredging soft unconsolidated sediment, typically associated with GBRWHA ports' maintenance material.

There are a number of TSHDs available within Australia and internationally, however, the majority of maintenance dredging in Queensland has been undertaken using the TSHD Brisbane since it was commissioned in 2000 purposely for maintenance dredging in Queensland ports.

Owned and operated by the Port of Brisbane Pty Ltd (PBPL), the TSHD Brisbane was specifically designed and built for Queensland conditions with the vessel applying high standards of environmental management. The environmental management mechanisms are equivalent to the features installed in the latest TSHD models used around the world and ensure environmental impact is minimised during the dredging works. It is equipped with the latest state-of-the-art automation control and navigation systems. Environmental mitigation features of this dredger include:

- **central weir discharge system (green valve or anti-turbidity function)** – controls discharge from the dredger to limit the turbidity of overflow waters entering the receiving environment
- **below keel discharge point** – discharge of sediment from the hopper occurs at keel level in order to prevent unnecessary turbidity and dispersal of fine sediment
- **turtle deflection devices** – flexible chain deflector attached to the drag heads to prevent entrainment of sea turtles during dredging operations
- **low wash hull design** – hull design minimises size of wash waves, reducing agitation of the water surface, in turn minimising the interference with the sediments suspended in the water column during discharge
- **electronic positioning system** – global positioning system provides data to operators, ports and regulators of vessel operations
- **environmental management** – addresses standard operational procedures to minimise environmental impacts, address regulatory and permit conditions.

The TSHD Brisbane operates under a Dredge Management Plan that provides a framework to ensure that maintenance dredging achieves leading practice environmental management. The plan provides strategies for effective management of potential environmental impacts associated with operation of the dredger and demonstrates that the dredger is operated in a planned and environmentally responsible manner. Individual ports review and approve the plan prepared by PBPL prior to maintenance dredging occurring.

The TSHD Brisbane dredges individual ports for periods ranging from two to six weeks depending upon the volume of siltation needing to be removed. As dredging volumes vary year to year, so does the required duration and dredging program operated by the TSHD Brisbane. The availability and deployment of the TSHD Brisbane to an annual maintenance dredging campaign at Queensland ports provides a level of surety for Queensland ports that would not be guaranteed if they were to rely on overseas dredgers.

Although the TSHD Brisbane is responsible for undertaking the vast majority of maintenance dredging works at Queensland ports, for minor dredging work where small volumes need to be removed or in locations with limited accessibility/manoeuvrability, small grab, backhoe or cutter suction dredgers are often used to complement the maintenance works performed by the TSHD Brisbane. In ports subject to high levels of siltation (e.g. Cairns and Townsville), such small dredges may operate all year round ensuring inner harbour channels and berth depths are kept to desired dimensions.

In addition, there may be occasions where it may be necessary to bring in dredgers from interstate or overseas despite access to these dredgers being more difficult (e.g. in the case of equipment failure or break down, unavailability of the TSHD Brisbane or coordination with larger capital dredging programs).

However, given that other dredging equipment are, and could be used in maintenance dredging activities in GBRWHA ports, it is considered that the type of dredger chosen for maintenance dredging activities should be justified for each maintenance dredging program.

Principle 9

Dredging equipment and operational approaches



As part of the risk-assessment for maintenance dredging, GBRWHA ports must provide rationale for the type of dredger chosen for each annual maintenance dredging program, with regard to the equipment's ability to undertake the necessary works, implement best practice environmental management measures, its technical and operational capabilities, and its cost-effectiveness.

Principle 10

Any new or alternative vessels or methods considered or proposed should result in environmental performance that is equal to, or better than, current equipment or methods used.

Coordination of an annual dredging program for the TSHD Brisbane

The TSHD Brisbane is likely to continue to be the equipment most commonly used by the GBRWHA ports in maintenance dredging programs given its proximity, environmental mitigation features, capability and capacity to undertake the required program.

However, there may be opportunities to improve the scheduling of the TSHD Brisbane to optimise its operational efficiency and environmental outcomes.

PBPL has long-term contracts in place with all the ports which currently utilise the TSHD Brisbane for their maintenance dredging requirements. Not all GBRWHA ports need to be dredged each year, as detailed in Table 4. The TSHD Brisbane also provides services for the ports of Karumba, Weipa, Bundaberg, Brisbane and Melbourne.

The state-wide program begins at the end of the wet season (when most channel siltation occurs) so as to minimise the need for follow-up dredging and typically continues through until November.

Logistically, the most efficient manner for the dredger to address the existing maintenance dredging requirements is to travel to the ports on the western side of Cape York and have sequential stops at the other ports on the way up or way back, minimising travel time and reducing mobilisation costs. However, PBPL takes into account any need to adapt the dredger program as required in developing the TSHD Brisbane's annual state-wide maintenance dredging program.

After individual Ports have completed their risk assessment process and obtained approval for a maintenance dredging process, generally they will approach the PBPL to be included in the TSHD Brisbane's program.

PBPL collates requests from ports to develop a state-wide program which is based on:

- the anticipated volume / depth requirements for each port
- the urgency of dredging required by individual ports
- permit conditions including any environmental considerations (e.g. environmental window restrictions)
- options to minimise dredging duration in each port
- operational efficiency, i.e. the need for a program that avoids the need for backtracking which results in increased costs, emissions and environmental risks.

The order in which ports are dredged varies from year to year depending upon the relative importance of each of the above factors.

It is also useful to note that, depending on the occurrence of cyclones and floods during the wet season, the maintenance dredging requirements can vary at any of the ports.

Periods when no dredging is allowed under the dredging permits can result in the dredger program having to be adapted and, in some cases, can result in increased travel and costs for the dredger.

Optimising the coordination of the TSHD Brisbane's annual dredging program maximises the availability of the dredger, reduces unnecessary vessel travel, minimising emissions, and reducing the risks of vessel incidents.

This Strategy supports the need to program the annual state-wide maintenance dredging program for the TSHD Brisbane so as to minimise environmental risk for GBRWHA ports and optimise dredger use.

Action 3

Dredging equipment and operational approaches

Ports will work together to ensure that an annual state-wide maintenance dredging program for the TSHD Brisbane is developed to optimise environmental outcomes and operational efficiencies by:

- ensuring identified environmental windows, as well as any restrictions imposed on maintenance dredging permits are applied
- minimising the net risk of impacts at each port by adopting site-specific operating procedures, and
- avoiding unnecessary dredger travel and relocation.

The programs will be made publicly available and the first program is to be completed for the 2017 dredging season.

8.2.2 Identification of environmental windows

Environmental windows (when impact on an environmental value can be minimised by not carrying out an activity for a period of time) are an accepted management tool currently applied to maintenance dredging activity in the GBRWHA. Best practice planning for maintenance dredging activities involves timing of undertaking the activity to avoid periods of high risk or greater stress and critical or sensitive phases of the life cycle of marine species.

The identification of appropriate environmental windows to avoid coral spawning, seagrass recruitment, turtle breeding and weather events is a key component of a coordinated maintenance dredging strategy as required by Action WQA16 in the Reef 2050 Plan.

The need for environmental windows should be based on an understanding of the condition and resilience of the environment values that may be influenced and a scientifically based assessment of the risks posed to those values by maintenance dredging at a certain time. This assessment should be on a case by case basis, taking into account the particular attributes of each port and the relevant maintenance dredging program.

GBRWHA ports have identified environmental values relevant to maintenance dredging in their port, including seagrass meadows, coral and rocky reefs, marine turtles, dugongs, cetaceans (dolphins and whales), and benthic infauna/epifauna.

The Technical Supporting Document identifies that based on historic field observations, maintenance dredging and disposal has generally not been a stressor of primary importance for those environmental values. Therefore adoption of environmental windows prohibiting dredging activities may not be necessary for every dredging program. In some instance, they may not contribute to mitigating environmental harm to sensitive receptors.

However, environmental windows during periods of greater species sensitivity need to be considered along with other mitigation and management practices on an ongoing basis. In particular, the Technical Supporting Document identified the following periods for which environmental windows may need to be considered by ports in their management and scheduling of maintenance dredging:

- warmer months of spring and summer, which is the growing season for seagrass meadows
- the coral spawning season, the timing of which varies between reefs and with the lunar cycle, but falls between October and December each year
- the period immediately following severe weather events (such as tropical cyclones) which are sensitive times for seagrass meadows and coral reefs
- the marine turtle nesting season, which generally occurs between October and February.

Regulators may impose environmental windows through conditions on environmental authorities and development approvals, or management plans required to be prepared and approved under those conditions, by limiting the timing and location of authorised works to protect environmental values such as coral reefs, turtle nesting sites and seagrass beds. Such requirements should be risk based and will depend on the proximity of the sensitive receptor to the activity and the length and timing of the campaign.

It is the responsibility of the GBRWHA ports to identify environmental values that may be impacted by their maintenance dredging activities and any new scientific evidence that needs to be considered, and suggest proposed mitigation measures such as timing of the activity to avoid detrimental impact. Such requirements should be risk and evidence based and depend on the proximity of the sensitive receptor to the activity and the length and timing of the campaign. In assessing the need for environmental windows, ports need to consider:

- the location, duration and timing of maintenance dredging
- the environmental values that may be influenced and their condition
- the risk of impacts recognising the results of any new scientific research or recent monitoring
- stakeholder perceptions and concerns
- potential implications for scheduling of dredging at other ports (as discussed in section 8.2.1).

Principle 11 Environmental windows



Prior to any maintenance dredging GBRWHA ports will identify and apply environmental windows supported by an evidence-based risk assessment. Particular consideration must be given to periods of coral spawning, seagrass recruitment, turtle breeding and periods immediately following severe weather events.

8.2.3 Cumulative impacts, offsets and providing net benefits

Offsets are measures taken to compensate for any adverse residual significant impact that result following the application of avoidance, mitigation and restoration activities.

Environmental offsets are generally negotiated as part of project approvals for capital projects and, in most cases, need to be committed or implemented before the dredging activity occurs.

An environmental offset may be required as a condition of approval for undertaking certain activities where, following consideration of avoidance and mitigation measures, the activity is likely to result in a significant residual impact on prescribed environmental matters.

Maintenance dredging activities in Queensland have usually met avoidance and mitigation obligations. Consequently, offsets for maintenance dredging have historically not been required. In many instances offsets for capital dredging may have encompassed future maintenance dredging requirements.

However, it is still necessary for ports to consider, in consultation with regulators, the need for offsets should a significant impact be likely, particularly during any capital dredging program that requires additional ongoing maintenance dredging.

This Strategy acknowledges that it is part of a broader set of actions as set out in the Reef 2050 Plan. It aims to leverage off and link to other actions from the Plan to ensure that a holistic approach is undertaken in managing impacts to the Reef.

Consequently, this Strategy will be guided by the outcomes of other Reef 2050 Plan actions relating to net benefits and offsets, including:

- **Action EBA11** – to continue to refine and improve guidance and procedural requirements for avoiding, mitigating and offsetting impacts to the Reef from industry activities using standardised policies, procedures and guidelines, will provide further guidance on the use of offsets in situations where proposals are likely to affect the values of the GBR.
- **Action EHA8** – to develop a net benefit policy to restore ecosystem health, improve the condition of values and manage financial contributions to that recovery, will provide focus on driving action to improve the condition and trend of the Reef's values and ecosystem processes.
- **Action EHA19** – to develop guidelines for assessing cumulative impacts (including climate change pressures) on matters of national environmental significance including ecosystem and heritage values in the World Heritage Area, will provide guidance on reducing impacts from all sources on the Reef.

Any further guidance that these actions provide in the future will be considered to determine whether future strategies to manage maintenance dredging will need to be adapted.

8.3 Regulatory approvals

Depending on the sediment management solutions to be applied it is likely that a series of regulatory approvals and permits will be required. As outlined in Figure 2 these approvals will potentially overlap Commonwealth and state jurisdictions and may involve multiple regulators.

The development of LMDMPs is expected to allow regulators to base their assessments on consistent information, and for multiple regulators to have confidence and certainty regarding expected impacts of maintenance dredging activities, proposed measures and outcomes. It is anticipated that this will result in a more consistent and streamlined approvals process and avoid duplication in information used for permit applications, and in approval conditions. This may also provide for approvals that reflect the long-term nature of the solutions and management measures put in place.

These approval processes are subject to stakeholder consultation.

It is aimed that improved regulatory coordination by the multiple regulators in imposing permit conditions and other management measures that GBRWHA ports will need to comply with will result in better management of the risks to the GBR's OUV.

Principle 12

Cumulative impacts, offsets and providing net benefits



LMDMPs will take into account any Reef 2050 Plan policy developments in relation to cumulative impacts, offsetting impacts and providing net benefits.





Implementing management options

Execute approved solution(s)

- Execution actions should be informed by the LMDMP, including the outcomes from monitoring and adaptive management arrangements.

Monitoring

- Implement a monitoring program based on identified risks and key indicators. Monitoring should provide information on values condition/health, effectiveness of management measures and execution outcomes.
- Results should be provided to regulators and to broader monitoring programs such as Reef 2050 Integrated Monitoring and Reporting Program.
- Access to monitoring information and results should also be available to the public and stakeholders to reinforce the transparency of the process.

Adaptive Management

- Alter and apply management measures in response to monitoring results and forecast achievement of desired outcomes and regulatory prescriptions. Adaptive management measures may include instigation of environmental windows, limits on activities, stop work procedures, project redesign and impact mitigation.
- Lessons learnt and identified improvements should be incorporated into a revised LMDMP to inform future actions.

Reporting

- Reports containing a summary of monitoring results, adaptive management measures and outcomes of execution actions will be published and made available to regulators, stakeholders and the broader community.

9.1 Executing approved solutions

Following the development of an LMDMP and the granting of corresponding approvals, the next phase is for a port to execute the approved solutions.

As shown in Figure 6 the execution of solutions developed in the LMDMP should be supported by a program of risk based monitoring, adaptive management (where applicable), and reporting that feeds back recurrently into the LMDMP to ensure that outcomes, lessons learnt and monitoring results can be used to improve future implementation.

This figure is consistent with the framework for long-term maintenance dredging management planning provided in this Strategy (Figure 4).



Figure 6 Planning, Execution, Monitoring and Adaptive Management cycle



The **fourth and final phase** focuses on ensuring that there is a robust process in place for monitoring and adaptively managing the maintenance dredging activities and also reporting on the outcomes and findings from any monitoring and management activities in a transparent and consistent manner.

9.2 Monitoring

Monitoring ensures that the information generated by the risk management process is captured, used and maintained and provides assurance that the risk management processes in place are achieving their objectives. The monitoring requirements should be site and project specific, and commensurate with the level of risk.

Monitoring programs are critical for:

- identifying if management measures are working effectively during the dredging project - or indicating that contingency plans need to be implemented
- assessing the effectiveness of management measures at the end of the dredging project to measure that objectives were achieved, and indicating where management measures may need to be adapted
- improving the long-term understanding of the impacts of dredging on the ecosystem to guide adaptive management measures and contribute to the understanding of cumulative impacts and net benefits resulting from dredging
- providing transparency to regulators, the public and stakeholders that impacts and implementation are consistent with expectations.

The NAGD 2009 provide a framework for monitoring of environmental impacts and the effectiveness of management measures.

Queensland and Australian Government regulators require Ports to provide details of monitoring programs as part of their applications for permission to conduct maintenance dredging projects.

Monitoring programs need to be developed through a risk-based approach during the planning stage when objectives and performance standards have been identified. The methodology needs to ensure that data is collected before, during and after the programs, and is sufficient to assess performance against the identified objectives.

Further, the results of monitoring need to be incorporated into broader monitoring programs such as the Reef 2050 Integrated Monitoring and Reporting Program. By sharing this data, trends in broader ecosystem health and considerations regarding, for example, cumulative impacts and net benefits can be identified. The Reef 2050 Integrated Monitoring and Reporting Program project may also identify gaps in current knowledge which will in turn require additional or different monitoring.

In considering maintenance dredging monitoring programs in a broad ecosystem context, necessary to identify potential long-term trends against a variety of environmental values, it is apparent that the design, reporting and analysis of the data should be an integral component of a long-term dredge management plan.

GBRWHA ports current monitoring programs comply with the ISO14001, and hence monitoring currently undertaken is of a high standard. An example is NQBP's Long-term Ambient Marine Water Quality monitoring program which covers the entire Mackay-Whitsunday region. This program is designed primarily to measure the natural changes in marine water quality and therefore better understand the changes that might be observed during port activities such as maintenance dredging.

In addition, a number of GBRWHA ports have developed partnerships with regional stakeholders to take a nested approach to reporting and align and integrate a range of regional monitoring programs. These partnerships seek to take a whole-of-catchment approach to planning, and integrate management approaches across organisations. Current partnerships include:

- Mackay-Whitsunday Healthy Rivers to Reef Partnership
- Gladstone Healthy Harbour Partnership
- Wet Tropics Healthy Waterways Partnership.

However, whilst the level of environmental monitoring undertaken by ports has typically been robust, there are opportunities for improved consistency and transparency.

Principle 13

Monitoring



Appropriate monitoring programs for maintenance dredging activities at GBRWHA ports will be:

- determined by a risk assessment process
- informed by ongoing port and regional monitoring programs
- activity and port-specific
- focused on environmental values and activities of higher risk or that are indicative of broader ecosystem health.

9.3 Adaptive management

The monitoring and reporting activities undertaken by GBRWHA ports under a LMDMP should provide for regular and formal assessment of the effectiveness of the strategies put in place to manage impacts on the GBR's environmental condition.

It seeks management measures to be altered at appropriate times to take into account any lessons learnt from monitoring results and assessment of the effectiveness of strategies put in place, as well as incorporating any new science or technologies that will improve management strategies.

It is important that the adaptive management process is transparent and collaborative, involving consultation with stakeholders including through the relevant TACC.

In recent years there has been a growing emphasis on the collection and analysis of data to improve understanding of the impacts of dredging on the GBR. Queensland Ports have been proactive in this area and conducted a range of monitoring and research projects described in some detail in the Technical Supporting Document. As a result, scientific knowledge of maintenance dredging and dredge material relocation within GBRWHA ports is growing.

Although monitoring and research regarding maintenance dredging and dredge material relocation activities has improved, it does vary across GBRWHA ports, with some ports having a much more detailed understanding of maintenance dredging and ecosystem response. The ports with the greatest potential risk, largest volume and frequency of dredging projects have invested the most in understanding maintenance dredging related risk to the environment.

However, the Technical Supporting Document identified a need for further field based measurements and research, for example, to improve understanding of long-term sediment dynamics. It is expected the Reef 2050 action *WQA17 Understand the port sediment characteristics and risks at the four major ports and how they interact and contribute to broader catchment contributions within the World Heritage Area* (QPA is lead for this action) will go some way to address this knowledge gap.



In addition, *WQA23 Expand 'nested' integrated water quality monitoring and report card programs at major ports and activity centres (e.g. Gladstone), in priority catchments (e.g. Mackay Whitsundays) and Reef-wide, to guide local adaptive management frameworks and actions* will also provide valuable guidance on adaptive management strategies.

It is expected the outcomes from such reports will contribute to the future design of management strategies. The analysis of the data can then inform adaptive management processes to improve performance in future dredging campaigns.

Improvements in dredging practices, technology and sediment management measures are required to be monitored to allow early incorporation through adaptive measures.

Principle 14

Adaptive management



GBRWHA ports will apply adaptive management strategies and continual improvement processes to ensure that leading practice management is maintained. This will involve monitoring the effectiveness of strategies put in place and assessing potential benefits from altering or applying new management measures.

9.4 Reporting

In addition to the importance of monitoring, the Reef 2050 Integrated Monitoring and Reporting Program (Action GA15) recognises that reporting is an important part of evaluating performance and guiding adaptive management.

It is intended that in addition to compliance monitoring, as well as issue-specific and long-term monitoring of environmental values and impact, the Reef 2050 Integrated Monitoring and Reporting Program will provide integration and a more comprehensive and systematic understanding of the condition of values, and the scale of impacts, through:

- standardising protocols for information collection, collation, modelling, analysis and reporting to improve scalability and the synthesis of information from different sources
- explicit links to management actions, targets, objectives and outcomes
- unifying monitoring through an adaptive management framework
- incorporating new information and knowledge into monitoring.

Data and information from GBRWHA ports' monitoring of maintenance dredging activities will contribute to better understanding impacts of maintenance dredging activities on the GBR's environmental values. Such information will be important in identifying future opportunities to further strengthen the management of maintenance dredging activities, and consequently this Strategy expects that data and monitoring results need to be provided to the Reef 2050 Integrated Monitoring and Reporting Program.

In addition, one of the key principles of decision-making outlined in the Reef 2050 Plan is to adopt a partnership approach to management of the GBRWHA. Under this approach, governance arrangements are to be transparent and accountable.

Communication and transparency are key components of best practice risk management systems, and mechanisms to ensure transparency around monitoring and reporting need to be part of the management process.

Whilst it is acknowledged that ports already communicate and report on maintenance dredging activities through their existing TACCs, GBRWHA ports will make available data and information from monitoring programs for stakeholders and publish a publicly-available report on all maintenance dredging activities annually, including timelines, volumes, evaluation of disposal options and spoil placement locations and outcomes of monitoring.

Transparency and ease of access to monitoring data as well as other maintenance dredging activity information will allow better accountability and ensure that stakeholders are informed on all aspects of dredging including programming and outcomes of monitoring and management activities.

Principle 15

Reporting



Maintenance dredging, monitoring and reporting programs by GBRWHA ports will be available for inclusion in the Integrated Monitoring and Reporting Program for the Reef 2050 Plan (Action GA15).

Principle 16

GBRWHA ports will provide mechanisms for stakeholders to access data and information from monitoring programs.

Action 4

GBRWHA ports will publish a publicly-available report on all maintenance dredging activities annually, including timelines, volumes, evaluation of dredge material disposal options and spoil placement locations, and outcomes of monitoring.



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Reviewing this Strategy's effectiveness

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The application of principles such as those proposed in this Strategy should help to guide maintenance dredging within ports in a way that is predictable for stakeholders, is adaptive and achieves optimised environmental outcomes. It should also assist to ensure that operational activities are adaptive and continually improve in response to emerging technology and information. It is intended that the Strategy will provide benefits to all stakeholders through:

- a more efficient assessment process through better coordination
- a consistent approach between all ports with best practice maintenance dredging management providing regulators with greater confidence when issuing longer term permits
- a region wide management approach which will provide greater certainty for ports, regulators and stakeholders throughout the assessment process
- enabling an improved coordination of risk based monitoring between all ports within the GBRWHA
- identifying benefits of related research activities, such as the NESP
- improved transparency for all interested parties.

It is imperative that the strategy be continually improved and updated to ensure it remains relevant and in line with leading practice management techniques and is adaptable to changing economic, social and political climates.

Principle 17

Review



Action 5

TMR will review this Strategy in five years to assess its effectiveness in achieving the objectives of ensuring the ongoing protection of the GBR OUV and the continued operating efficiency of GBRWHA ports.

This Strategy will be reviewed every five years to ensure that opportunities for improvement are determined, and any legislative or policy changes that will provide those improvements are identified and implemented. As this Strategy has presented a number of guiding principles to carry out improvements identified at this time, it also seeks to ensure that the outcomes from undertaking these guiding principles are monitored and evaluated.

It is considered that five years is an appropriate timeframe for review, given advances in dredging technology and the scientific understanding of marine ecosystems in the GBR that may emerge within this timeframe could result in better management strategies. The significant investment by all levels of governments, industry and the wider community towards protecting and managing the Great Barrier Reef, including the many actions in the Reef 2050 Plan, are expected to contribute to these advances.



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Glossary

DMPAs	Dredged Material Placement Areas
Dredging	Digging, excavating or removing material from waterways to deepen channels, create harbours, and keep channels and approaches to ports at defined depths. Dredging can either be capital dredging, for new channels and berths, or maintenance dredging, necessary to maintain existing and approved dredging areas.
DSD	Department of State Development
DUKC	Dynamic under keel clearance
EA	Environmental Authority
EIA	Environmental Impact Assessment
Environmental value	Particular values or uses of the environment that are important for a healthy ecosystem or for public benefit, welfare, safety or health and that require protection from the effect of pollution, waste discharges and deposits. (ANZECC/ARMCANZ 2000)
Environmental windows	When impact on an environmental value can be minimised by not carrying out an activity for a period of time to avoid periods of high risk or greater stress and critical or sensitive phases of the life cycle of marine species.
EP Act	<i>Environmental Protection Act 1994</i>
EPBC Act	<i>Environmental Protection and Biodiversity Conservation Act 1999 (Cth)</i>
Far North Queensland Ports Corporation Limited	See 'Ports North'
GBR	Great Barrier Reef
GBR Marine Park	Great Barrier Reef Marine Park
GBRWHA	Great Barrier Reef World Heritage Area
GBRWHA ports	Ports located within the GBRWHA: Ports of Cairns, Cape Flattery, Cooktown, Mourilyan, Quintell Beach, Townsville, Lucinda, Abbot Point, Hay Point, Mackay, Gladstone and Rockhampton (Port Alma)
GPC	Gladstone Ports Corporation Limited, responsible for management of Gladstone and Rockhampton (Port Alma).
IMO	International Maritime Organisation
LMDMP	Long-term Maintenance Dredging Management Plans
London Protocol	An international agreement to promote the effective control of all sources of marine pollution and to prevent, reduce and where practicable eliminate pollution caused by dumping or incineration at sea of wastes or other matter.

MSQ	Maritime Safety Queensland
NAGD	National Assessment Guidelines for Dredging
NESP	National Environmental Science Programme
NQBP	North Queensland Bulk Ports Corporation Limited, responsible for management of ports of Abbot Point, Hay Point, Mackay.
Outstanding Universal Value (OUV)	Cultural and/or natural significance which is so exceptional as to transcend national boundaries and to be of common importance for present and future generations of all humanity.
PBPL	Port of Brisbane Pty Ltd
PIANC	Permanent International Association of Navigation Congresses, with modern official name as the World Association for Waterborne Transport Infrastructure
Ports North	Trading name for Far North Queensland Ports Corporation Limited responsible for management of ports of Cairns, Cape Flattery, Cooktown, Mourilyan and Quintell Beach.
Port of Townsville	Responsible for ports of Townsville and Lucinda
Port limits	The maritime limits of Queensland ports are defined in Schedule 1 of the <i>Transport Infrastructure (Ports) Regulation 2005</i> under the <i>Transport Infrastructure Act 1994</i> (Qld). Ports within and adjoining the Great Barrier Reef World Heritage Area are located at Gladstone, Rockhampton (Port Alma), Hay Point, Mackay, Abbot Point, Townsville, Lucinda, Mourilyan, Cairns, Cooktown, Cape Flattery, and Quintell Beach.
Ports North	Far North Queensland Ports Corporation Limited
POTL	Port of Townsville Limited
Priority Ports	The ports of Gladstone, Abbot Point, Townsville and Hay Point/Mackay as declared under the <i>Sustainable Ports Development Act 2015</i> where major capital dredging for the development of new or expansion of existing port facilities in the GBRWHA.
QPA	Queensland Ports Association
REMP	Receiving Environmental Management Plan
SPD Act	<i>Sustainable Ports Development Act 2015</i>
TACC	Technical Advisory and Consultative Committee
TIA	<i>Transport Infrastructure Act 1994</i>
TSHD Brisbane	Trailer Suction Hopper Dredger “Brisbane”
WQA#	Water Quality Action number (listed in the Reef 2050 Plan)

