

Priority port master planning

Evidence base documentation

Addendum to evidence base

Priority Port of Gladstone

Queensland | Australia | January 2017

The Department of State Development

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**Priority Port of Gladstone master
planning**

Addendum to the evidence base

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Priority Port of Gladstone master planning

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1 Introduction

1.1 Port master planning

The Queensland Government is currently advancing master planning for the priority ports of Gladstone, Abbot Point, Townsville, and Hay Point/Mackay in accordance with the *Sustainable Ports Development Act 2015* (Qld) (Ports Act).

Master planning for priority ports is one of the port-related actions of the Reef 2050 Long-Term Sustainability Plan (Reef 2050), and is mandated under the Ports Act. Priority port master planning has a timeframe up to 2050 to align with the Reef 2050 (DSD 2016a).

Through port master planning, the Queensland government seeks to effectively manage the land and marine areas needed for the efficient development and operation of the priority ports, while ensuring that the Outstanding Universal Value (OUV) of the Great Barrier Reef World Heritage Area (GBRWHA) is an intrinsic consideration in port development, management and governance (DSD 2016a).

The overarching purpose of master planning for each of Queensland's priority ports is to:

- Define a long term strategic vision, objectives and desired outcomes for each port master planned area
- Identify the state interests in relation to the priority ports and articulate how those interests are to be considered in all planning decisions made within each port master planned area
- Present an environmental management framework (EMF) that states priority management measures (PMMs) for managing potential impacts on environmental values in the master planned area and surrounding areas in accordance with principles of ecologically sustainable development (ESD).

As part of master planning, the Ports Act prescribes the requirement for a port overlay to be made for each master planned area. The port overlay is a regulatory tool to implement the master plan over the master planned area.

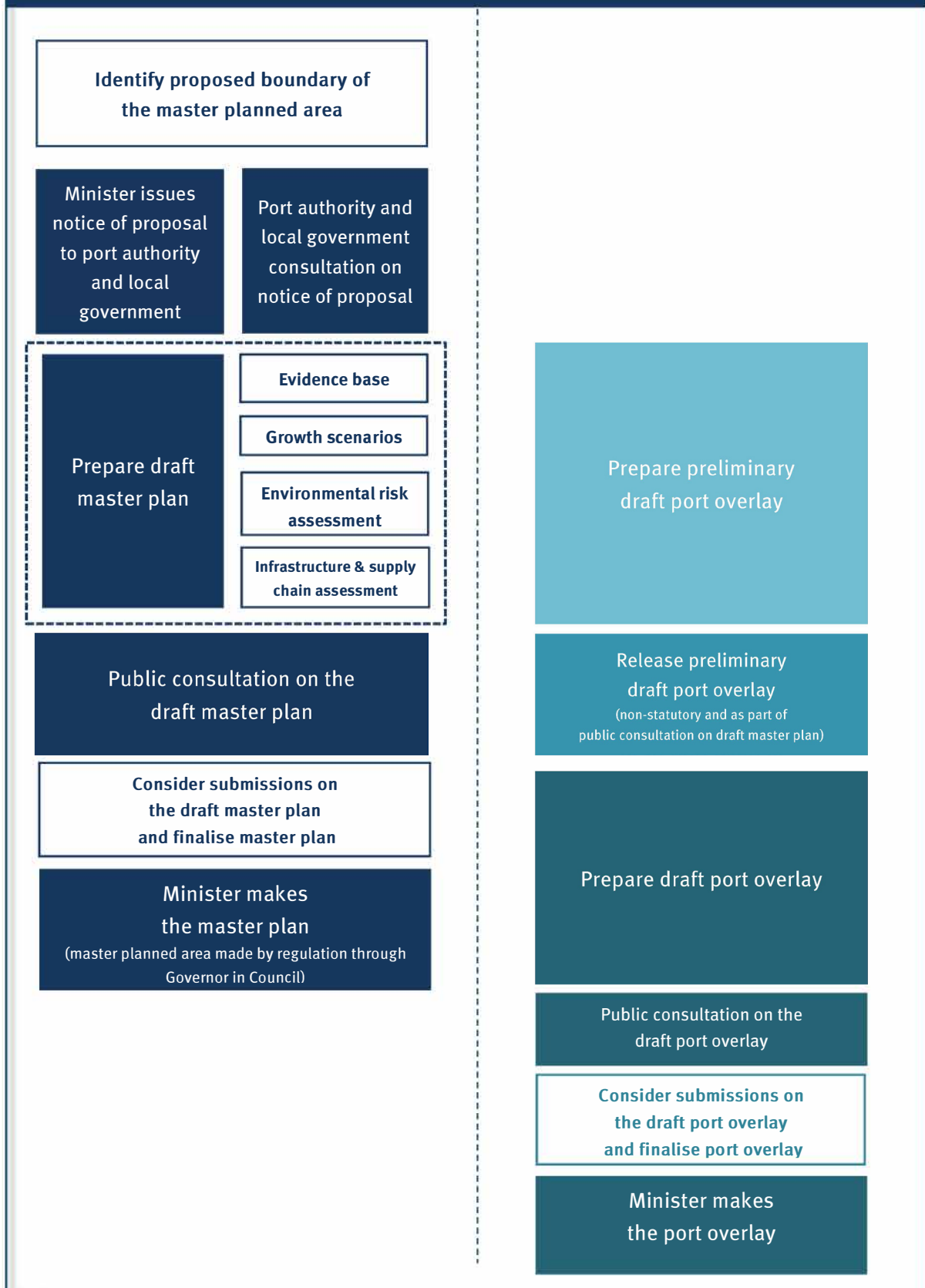
1.2 Master planning for the priority Port of Gladstone

The priority Port of Gladstone is located within the GBRWHA and is Queensland's largest multi-cargo port and the fifth largest coal export terminal in the world (by throughput). The port is located within a diverse region containing a range of urban communities, major industrial precincts and environmental values of international importance. There is significant opportunity for continued growth in the import and export of a range of commodities to Australia and the world, with the Port of Gladstone playing a pivotal role in the future growth of the national port trade. The Gladstone Ports Corporate (GPC) is the relevant port authority, responsible for the operation and management of the Port of Gladstone under the *Transport Infrastructure Act 1994* (Qld) (Transport Infrastructure Act).

The Department of State Development (DSD) is currently progressing preparation of a draft master plan for the priority Port of Gladstone. In parallel with DSD's preparation of the master plan, Aurecon has been commissioned by DSD to prepare a preliminary draft port overlay for the priority Port of Gladstone.

Figure 1 details the current master planning process for Gladstone, including the parallel processes associated with the master plan and port overlay.

Priority Port of Gladstone master planning—indicative process



1.3 Evidence base for the priority Port of Gladstone

As part of the master planning process, DSD has developed an evidence base to support and inform the preparation of the master plan and port overlay for the priority Port of Gladstone. The evidence base collates information on the economic, environmental, community and cultural aspects of the priority Port of Gladstone. The evidence base supports the master planning process and includes:

- Evidence Base Report for the Proposed Gladstone Port Master Planned Area (AECOM 2016)
- Priority Port of Gladstone growth scenarios (DSD 2016a)
- Priority Port of Gladstone master planning – Infrastructure and Supply Chain Requirements Assessment (PSA Consulting 2016)
- Priority Port of Gladstone master planning – Risk Assessment (Aurecon 2016).

1.4 Purpose and content of this addendum

During the preparation of the master plan and preliminary draft port overlay additional evidence base investigations, analysis and reporting were required in the following areas:

- Identifying and mapping the local expression of the OUV of the GBRWHA within the master planned area and surrounding areas (refer Part A)
- Identifying and mapping the existing environmental values monitoring and reporting programs that operate within the master planned area and surrounding areas (refer Part B)
- Further assessment of the infrastructure and supply chain requirements (refer Part C), in particular supporting port infrastructure (marine and landside) for the evidence base growth scenario 3 (port throughput of 294 million tonnes per annum (Mtpa)), including:
 - Potential port throughput by specific commodity and description of the corresponding marine infrastructure and shipping requirements
 - Potential marine infrastructure requirements for growth scenario 3 (ie potential berth numbers, locations, capital dredging requirements and dredged material placement requirements)
 - Potential port supply chain linkages and infrastructure corridors required to support the port growth
 - Discussion on port optimisation principles and processes relevant to the Port of Gladstone
 - Key issues to consider in the master planning process
- Revising the evidence base risk assessment based on the outcomes of the additional evidence base investigations, analysis and reporting (refer Part D)
- Identifying the evidence base key issues that have been incorporated into master planning (refer Part E).

1.5 References

AECOM 2016, Evidence Base Report for the Proposed Gladstone Port Master Planned Area, Prepared for the Queensland Department of State Development, AECOM, Brisbane

Aurecon 2016 Priority Port of Gladstone master planning – Risk assessment, Prepared for the Queensland Department of State Development, Aurecon, Brisbane

Department of State Development (DSD) 2016a, *Draft master plan for the priority Port of Gladstone*, State of Queensland, Department of State Development, Brisbane.

Department of State Development (DSD) 2016b, *Guideline: master planning for priority ports*, State of Queensland, Department of State Development, Brisbane

PSA Consulting 2016, Priority Port of Gladstone Master Planning – Infrastructure and Supply Chain Requirements Assessment Final Report, prepared for the Queensland Department of State Development, PSA Consulting, Brisbane

Part A

Local expression of OUV
of the GBRWHA





**Priority Port of Gladstone Master
Planning**

Local expression of the OUV of the
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EMF Panel methodology for identifying the local expression of the OUV of the GBRWHA

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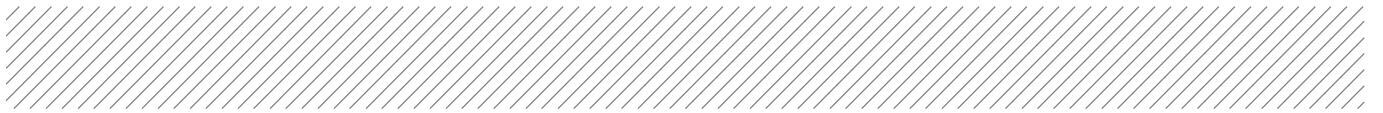
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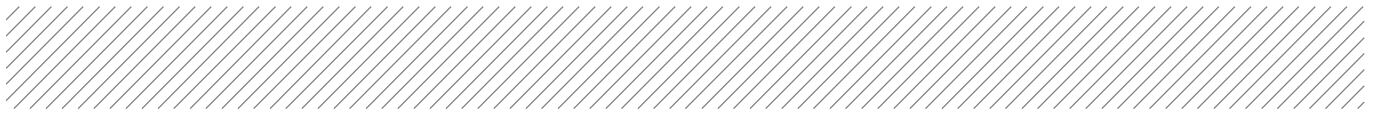


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Acronyms and abbreviations

Acronym/abbreviation	Definition
ACH Act	<i>Aboriginal Cultural Heritage Act 2003 (Qld)</i>
AHD	Australian Height Datum
AIMS	Australian Institute of Marine Science
DSD	Department of State Development
DoEE	Department of the Environment and Energy
DoE	Department of the Environment
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities
EAAF	East Asian-Australasian Flyway
EMF	Environmental management framework
EP Act	<i>Environmental Protection Act 1994 (Qld)</i>
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999 (Cth)</i>
Evidence Base Report	Evidence Base Report for Gladstone Port Master Planned Area
FHA	Fish Habitat Area
GBR	Great Barrier Reef
GBRMP	Great Barrier Reef Marine Park
GBRWHA	Great Barrier Reef World Heritage Area
GHP	Gladstone Healthy Harbour Partnership
GPC	Gladstone Ports Corporation
GPC Port LUP	GPC 2012 Land Use Plan
GRC	Gladstone Regional Council
GRC Planning Scheme	Gladstone Regional Council Planning Scheme 2015
GSDA	Gladstone State Development Area
ha	hectares
IUCN	International Union for Conservation of Nature
JCU	James Cook University
km	kilometres
master plan	priority Port of Gladstone master plan
m	metres
NC Act	<i>Nature Conservation Act 1992 (Qld)</i>
OUV	Outstanding Universal Value
PPG	priority Port of Gladstone
PMM	priority management measure
Ports Act	<i>Sustainable Ports Development Act 2015 (Qld)</i>



Acronym/abbreviation	Definition
Qld	Queensland
Reef 2050	Reef 2050 Long-Term Sustainability Plan
RE	Regional Ecosystem
SPL	Strategic Port Land
TEC	Threatened Ecological Community
TSSC	Threatened Species Scientific Committee
TUMRA	Traditional Use of Marine Resource Agreement
VM Act	<i>Vegetation Management Act 1999 (Qld)</i>
WHA	World Heritage Area

Glossary of terms

Term	Meaning
attributes	World Heritage attributes are specific elements or features of a World Heritage property that contribute to its outstanding universal value (OUV). They collectively link to one or more criteria for World Heritage listing.
environmental value	<p>'Environmental value' is defined under the <i>Environmental Protection Act 1994</i> (EP Act) and the <i>Sustainable Ports Development Act 2015</i> (Ports Act) as:</p> <ul style="list-style-type: none"> ■ A quality or physical characteristic of the environment that is conducive to ecological health or public amenity or safety; or ■ Another quality of the environment identified and declared to be an environmental value under an environmental protection policy or regulation <p>For the purpose of the priority port master planning process, environmental value also includes the OUV of the Great Barrier Reef World Heritage Area (GBRWHA) and other environmental values.</p>
Great Barrier Reef coastal zone	The Great Barrier Reef (GBR) coastal zone includes areas adjacent to the Great Barrier Reef and includes Queensland waters, islands and adjacent inland areas, 5 kilometres (km) inland and 10 metres (m) Australian Height Datum (AHD), whichever is further.
Great Barrier Reef Marine Park	The area subject to protection under the <i>Great Barrier Reef Marine Park Act 1975</i> covering 344,400 km ² including the subsoil beneath the seabed (1000 m below) and the airspace above (915 m high). It is a multiple-use marine park area that supports a range of communities and industries that depend on the Reef for recreation or their livelihoods (including tourism, fishing, boating and shipping). The Great Barrier Reef Marine Park (GBRMP) is a matter of national environmental significance and the Great Barrier Reef Marine Park Authority (GBRMPA) is responsible for its protection and management.
Great Barrier Reef World Heritage Area	<p>The GBRWHA extends from the top of Cape York in north-east Australia to just north of Bundaberg, and from the low water mark on the Queensland coast to the outer boundary of the GBRMP, which is beyond the edge of the continental shelf. The area was declared a World Heritage Area in 1981 because of its OUV.</p> <p>About 99 per cent of the World Heritage Area is within the GBRMP but encompasses:</p> <ul style="list-style-type: none"> ■ Some 980 islands which are under Queensland jurisdiction ■ Some internal waters or Queensland (for examples, some deep bays, narrow inlets or channels between islands) ■ All waters seaward of the low water mark from north of Bundaberg to Cape York.
local expression of OUV	Environmental values present in the priority port and surrounds and that contribute to the OUV of the GBRWHA.
master planned area	The area identified in the priority Port of Gladstone (PPG) master plan as the master planned area for the port, and is approved by regulation.

Term	Meaning
nesting beach	In relation to marine turtles, a nesting beach is a location where marine turtle species have been observed nesting. Nesting beaches may contain only scattered records of nesting turtles, or may contain rookeries of marine turtles (ie breeding colonies).
other environmental values	Refer to definition of environmental values. Other environmental values are those environmental values that are not considered to contribute to the OUV of the GBRWHA.
Outstanding Universal Value	Outstanding universal value is the central idea of the World Heritage Convention. The Operational Guidelines (paragraph 49) defines OUV as cultural and/or natural significance that is so exceptional as to transcend national boundaries and to be of common importance for present and future generations of all humanity.
OUV of the GBRWHA	<p>The GBR was inscribed on the World Heritage List in 1981 in recognition of its OUV. The World Heritage Committee listed the GBR for the following natural criteria:</p> <ul style="list-style-type: none"> ■ Criterion (vii) – contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance ■ Criterion (viii) – be outstanding examples representing major stages of earth's history, including the record of life, significant ongoing geological processes in the development of landforms, or significant geomorphic or physiographic features ■ Criterion (ix) – be outstanding examples representing significant ongoing ecological and biological processes in the evolution and development of terrestrial, freshwater, coastal and marine ecosystems and communities of plants and animals ■ Criterion (x) – contain the most important and significant natural habitats for in situ conservation of biological diversity, including those containing threatened species of OUV from the point of view of science or conservation. <p>This term is used throughout this report and refers to environmental values within the master planned area and surrounds that contribute to the local expression of the OUV of the GBRWHA.</p>
rookery	A colony of breeding animals, particularly a breeding colony of marine turtles.
surrounds	<p>For the purposes of this assessment, surrounds includes areas outside of the priority Port of Gladstone master planned area. Specifically, surrounds includes all areas where it is not unreasonable to assume that potential impacts may occur as a result of the activities identified for the scenarios assessed as part of the master planning risk assessment (Aurecon 2016).</p> <p>Due to the range of potential future activities within the master planned area, the different potential impact pathways, varying sensitivities of receptors, and different biological traits (eg behaviours and responses to stress) of receptors, the definition of surrounds is specific to each future activity, environmental value or local attribute.</p>



1 Introduction

1.1 Project background

The Port of Gladstone is located within the Great Barrier Reef World Heritage Area (GBRWHA) and is Queensland's largest multi-cargo port and the fifth largest coal export terminal in the world (by throughput). The port is located within a diverse region containing a range of urban communities, major industrial precincts and environmental values of international importance. There is significant opportunity for continued growth in the import and export of a range of commodities to Australia and the world, with the Port of Gladstone playing a pivotal role in the future growth of the national port trade.

Under the *Sustainable Ports Development Act 2015* (Qld) (Ports Act), the Port of Gladstone is defined as one of four priority ports in Queensland (along with Port of Abbot Point, Ports of Hay Point and Mackay, and Port of Townsville), requiring a port master plan to ensure sustainable development of the port into the future.

The master planning process for the priority Port of Gladstone (PPG) is being led by the Department of State Development (DSD). Once finalised, the PPG master plan will be implemented through the port overlay. The port overlay will state how priority management measures (PMMs) are to be achieved and the responsible entity or entities for implementing the PMMs (DSD 2016). The port overlay will also include other content to implement the master plan strategic vision, objectives, desired outcomes and state interests.

Priority port master planning delivers certainty for priority ports and associated industries within a sustainable development framework (DSD 2016). Priority port master planning is a commitment in the Reef 2050: Long Term Sustainability Plan (Reef 2050) and will ensure the Outstanding Universal Value (OUV) of the Great Barrier Reef World Heritage Area (GBRWHA) is an intrinsic consideration in the future port development, management and governance (DSD 2016).


1.2 Purpose of this report

The purpose of this report is to identify the presence and local expression of OUV within the PPG master planned area and surrounding areas, and the contribution they make to the OUV of the GBRWHA.

The key items addressed in this report include:

- The OUV of the GBRWHA attributes that occur within the priority Port of Gladstone master planned area and surrounds based on the best available information
- Definition of the environmental values that are included in the OUV of the GBRWHA attributes for the master planned area and surrounds
- For the OUV of the GBRWHA attributes, an analysis of the presence of these attributes in the PPG master planned area and surrounds was undertaken
- Classification of the contribution level of the locally expressed attributes, in the context of their contribution to the OUV of the GBRWHA
- Local statement of integrity to provide clarity and understanding of how the draft master plan relates to the integrity of the World Heritage Area.

This document does not consider the statutory approval processes in place in the PPG and what approvals may be required for proposed development activities. It is not intended for the information within this report to replace the requirement for a proponent to adhere to part/all of the statutory approval processes.



The results of this report will be included into the PPG master planning evidence base in the following ways:

- As a benchmark for the review of the risk assessment report (Aurecon 2016) to determine if amendments are required (eg review of potential impacts, environmental value 'sensitivity' ratings, review of PMMs and development of additional PMMs if required)
- To provide input into PMM 2 (environmental values monitoring and reporting program) and the port overlay supporting report in terms of identifying the key environmental values to be monitored and gaps in the existing monitoring programs for the key environmental values that contribute to the OUV of the GBRWHA
- To inform the future preparation of other guidelines and management plans required to be prepared under the port overlay (eg environmental assessment guideline, land management plan guideline and land management plans).

1.3 Great Barrier Reef World Heritage Area and the priority Port of Gladstone

The Great Barrier Reef (GBR) was inscribed on the World Heritage List in recognition of its OUV in 1981 for all four of the natural heritage criteria. The boundary of the GBRWHA is shown in Figure 1.1, covering an area of approximately 348,000 km², including:


- Approximately 2,000 km of Queensland coast, from the top of Cape York to just north of Fraser Island
- All islands within the outer boundary (over 900 islands)
- All waters seaward of low water mark (including internal waters of Queensland and port waters)
- Eleven (11) trading ports.

OUV is the fundamental concept of the World Heritage Convention and underpins the listing of properties on the World Heritage List. To be considered of OUV, a property needs to:

- Meet one or more of ten criteria set out in the convention
- Meet the conditions of integrity
- If a cultural heritage property, meet the conditions of authenticity
- Have an adequate system of protection and management to safeguard its future.

The natural criteria that the GBRWHA was inscribed for are:

- **Criterion (vii)** – contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance
- **Criterion (viii)** – be outstanding examples representing major stages of earth's history, including the record of life, significant ongoing geological processes in the development of landforms, or significant geomorphic or physiographic features
- **Criterion (ix)** – be outstanding examples representing significant ongoing ecological and biological processes in the evolution and development of terrestrial, freshwater, coastal and marine ecosystems and communities of plants and animals
- **Criterion (x)** – contain the most important and significant natural habitats for in situ conservation of biological diversity, including those containing threatened species of OUV from the point of view of science or conservation.



The boundary of the nominated GBRWHA addressed the holistic and interconnected nature of the OUV of a complex coastal marine system covering a very large area (DSEWPaC 2013). At the time of inscription, substantial areas of the GBR had not been surveyed, and while the nomination provided a broad description and inventory of the natural and cultural heritage values at a broad scale, the nomination documents were not required to provide more specific information on the values (DSEWPaC 2013).

The GBRWHA was nominated on the basis of management for conservation and reasonable multiple use, and the inscription recognises long standing uses, such as: port operations; shipping; commercial, recreational and Indigenous fisheries; recreation; tourism; and activities on islands, coastal lands and catchments within, adjacent to or discharging into the waters of the GBRWHA (DSEWPaC 2013).

The GBRWHA includes waters seaward of the low water mark, including those within the Port of Gladstone (refer Figure 1.1). Approximately 59% of the PPG master planned area is situated within the GBRWHA, however is located outside of the state and Commonwealth marine parks boundaries.

The area of the master plan within the GBRWHA contributes only 0.1% of the total area of the GBRWHA.

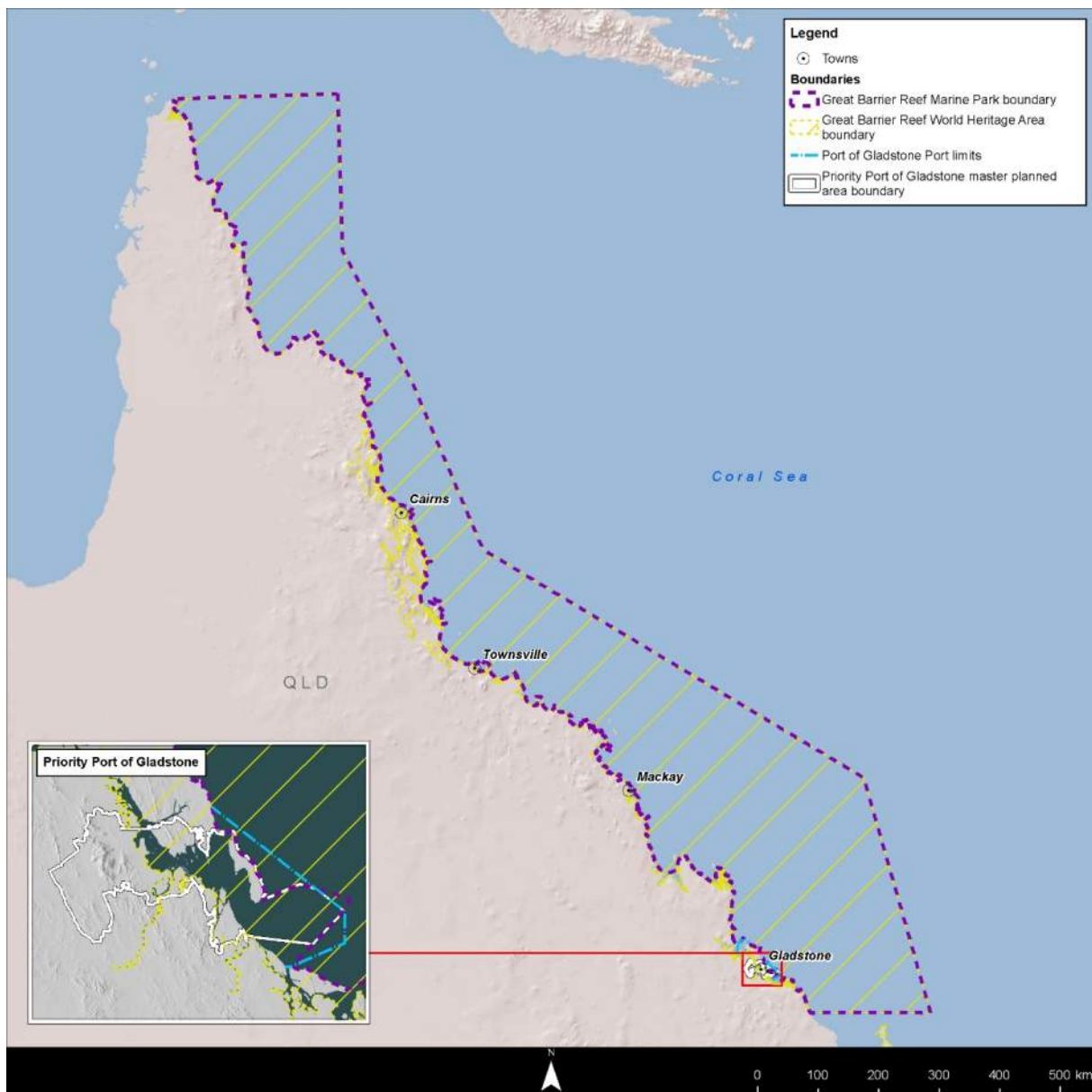


Figure 1.1 The priority Port of Gladstone and the Great Barrier Reef World Heritage Area

1.4 Priority Port of Gladstone master planned area

The PPG master planned area covers approximately 73,400 ha and comprises land where development is regulated and managed under a number of statutory instruments, including:

- Gladstone State Development Area (GSDA) (approximately 27,000 ha) where land use is regulated by the Coordinator-General via the GSDA Development Scheme 2015
- Strategic Port Land (SPL) (approximately 4,300 ha) where development is regulated by Gladstone Ports Corporation (GPC) via the GPC 2012 Land Use Plan (Version 2, February 2016) (GPC Port LUP)
- Gladstone Regional Council (GRC) areas (approximately 7,210 ha of land) where land use is regulated by GRC via the GRC Planning Scheme 2015 (GRC Planning Scheme)
- Other statutory requirements and operational environmental management process.

Approximately 59% of the master planned area is within the GBRWHA, including approximately 38,600 ha of marine and intertidal areas. Whilst there are some statutory/operational requirements that apply to these areas, there is currently no planning instrument. The master planned area is illustrated in Figure 1.2.

The area of the master plan within the GBRWHA contributes 0.1% of the total area of the GBRWHA.

1.5 Environmental values within the master planned area and surrounds

The environmental values within and surrounding the master planned area were identified and mapped for the PPG evidence base, which includes:

- Evidence Based Report for the Proposed Gladstone Port Master Planned Area (AECOM 2016)
- Priority Port of Gladstone Master Planning – Risk Assessment (Aurecon 2016).

Environmental values within the master planned area and surrounds are as defined under the *Environmental Protection Act 1994* (Qld) (EP Act) and the Ports Act as:

- A quality or physical characteristic of the environment that is conducive to ecological health or public amenity or safety; or
- Another quality of the environment identified and declared to be an environmental value under an environmental protection policy or regulation.

For the purpose of the priority port master planning process, environmental values also includes the OUV of the GBRWHA and all other environmental values (ie not considered to contribute to the OUV of the GBRWHA).

The area surrounding the master planned area (ie the ‘surrounds’) is defined as areas outside of the PPG master planned area where it is not unreasonable to assume that there is potential for impacts to occur as a result of activities in the master planned area (ie the scenarios and activities assessed in the master planning risk assessment). Due to the range of future activities that may within the master planned area occur during the master plan timeframe, the different potential impact pathways, varying sensitivities of receptors, and different biological traits (eg behaviours and responses to stress) of receptors, the definition of surrounds is specific to each future activity, environmental value or local attribute.

Table 1.1 lists the environmental values known to occur within the master planned area and surrounds as identified in the evidence base, including an indication of whether the value contributes to the OUV of the GBRWHA, or is considered an ‘other environmental value’.

The information in Table 1.1 provides the basis for the assessment of the local expression of the OUV of the GBRWHA for the PPG master planned area and surrounds (ie this report).

Table 1.1 Environmental values within and surrounding the master planned area and surrounds as identified in the evidence base

Environmental value	Relevant OUV criteria ¹				Other environmental value (not relevant to the OUV of the GBRWHA)	Mapping reference for figures within the evidence base risk assessment report (Aurecon 2016)
	vii ²	viii ³	ix ⁴	x ⁵		
Fringing reefs	✓	✓	✓	✓	–	Figure A.7 shows the extent of reefs using indicative reef boundaries.
Inshore turbid reefs	–	✓	✓	✓	–	
Coral species – diversity and extent	✓	✓	✓	✓	–	

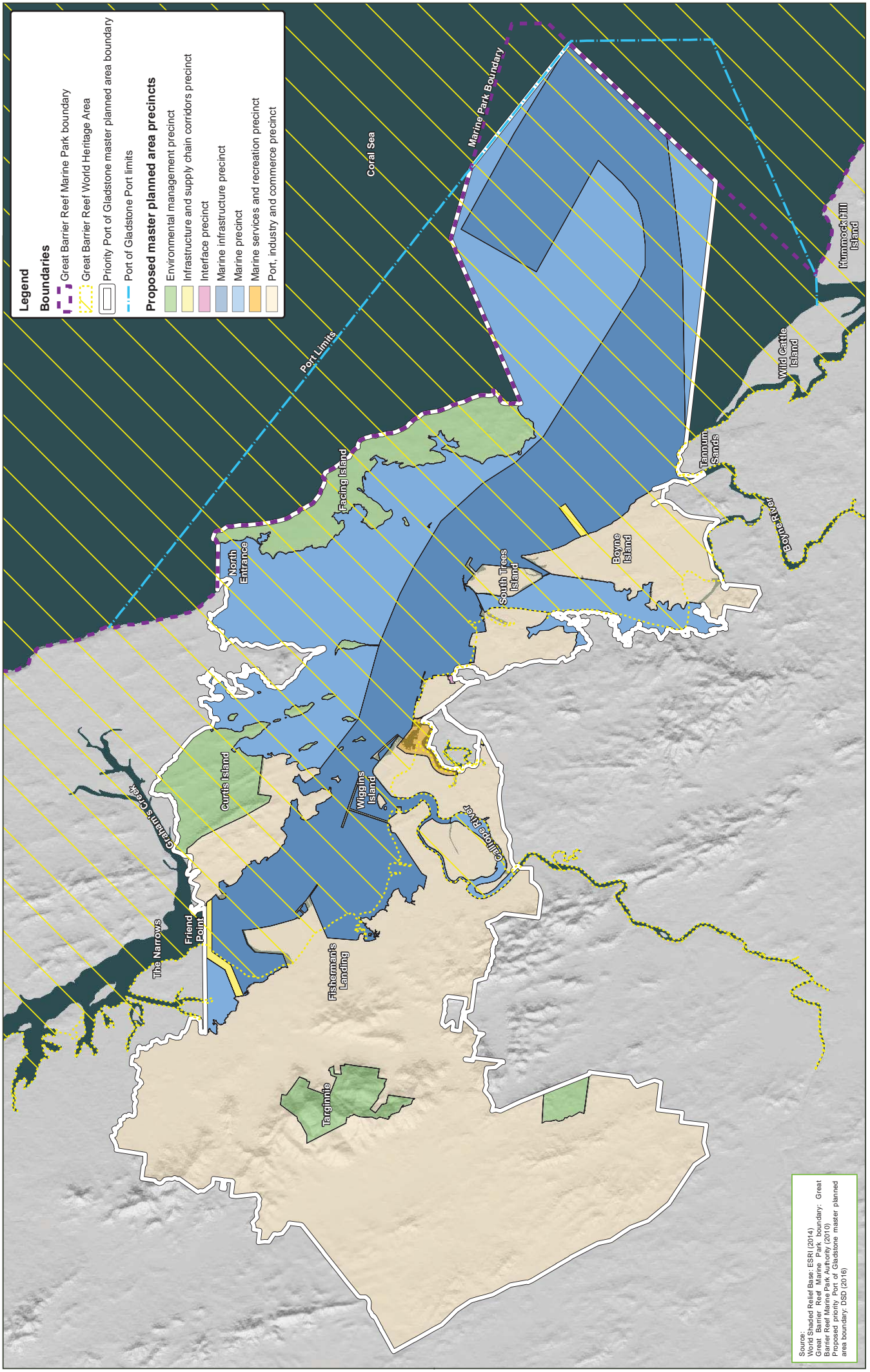
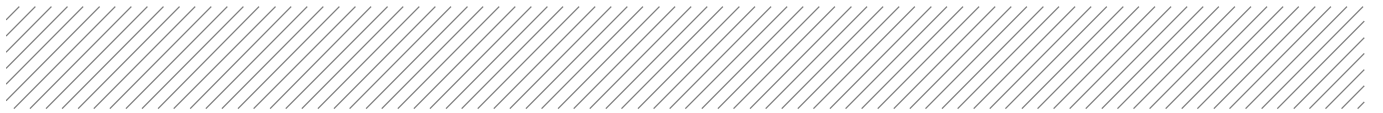


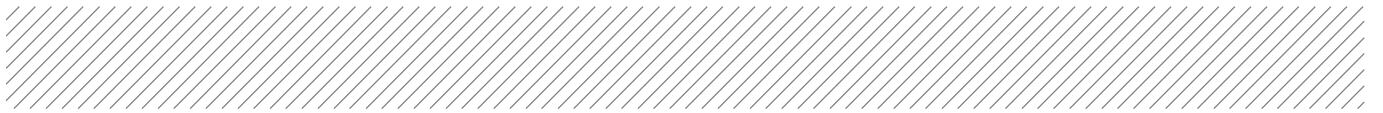
Figure 1.2: The priority Port of Gladstone master planned area

Environmental value	Relevant OUV criteria ¹				Other environmental value (not relevant to the OUV of the GBRWHA)	Mapping reference for figures within the evidence base risk assessment report (Aurecon 2016)
	vii ²	viii ³	ix ⁴	x ⁵		
Marine water quality	–	–	✓	✓	–	No associated mapping.
Fresh water and groundwater quality	–	–	–	–	✓	No associated mapping.
Fish and nekton	✓	–	✓	✓	–	Habitat areas considered to be important to fish and nekton include (but are not limited to) Figure A.5 (Regional Ecosystems containing mangroves), Figure A.6 (Extent of seagrass meadows), Figure A.7 (Reefs), Figure A.8 (Benthic macroalgae distribution and density), and Figure A.9 (Fish habitat areas and fish movement passages).
Marine megafauna	✓	–	✓	✓	–	The density of dugong has been mapped based on the results of aerial surveys and is shown in Figure A.10 (Relative dugong density based on aerial surveys from 1986 to 2005 and Dugong Protection Areas). Habitat considered important to dugong has also been mapped in Figure A.6 (Extent of seagrass meadows) and Figure A.8 (Benthic macroalgae and macroinvertebrate distribution and density).
Marine turtles and other marine reptiles	✓	–	–	✓	–	Turtle nesting areas are situated on the eastern side of Facing Island and are mapped in Figure A.11 (Marine turtle nesting areas). Other areas that are important habitat or foraging resources for marine turtles and other marine reptiles are mapped in Figure A.6 (Extent of seagrass meadows), Figure A.7 (Reefs) and Figure A.8 (Benthic macroalgae and macroinvertebrate distribution and density).
Macroinvertebrates	✓	✓	✓	✓	–	Macroinvertebrate communities are shown in Figure A.8 (Benthic macroalgae and macroinvertebrate distribution and density).
Shorebirds, migratory birds and seabirds	✓	–	✓	✓	–	A diverse range of habitat types occur within the master planned area as shown in Figure A.12 (Shorebird habitat), providing foraging and roosting habitat for a range of migratory bird species.



Environmental value	Relevant OUV criteria ¹				Other environmental value (not relevant to the OUV of the GBRWHA)	Mapping reference for figures within the evidence base risk assessment report (Aurecon 2016)
	vii ²	viii ³	ix ⁴	x ⁵		
Threatened and endangered flora and fauna species	–	–	–	✓	–	Threatened flora and fauna species habitat have been mapped using a range of data sources: known records of threatened flora species and 'high risk' areas are shown in Figure A.1 (Herbrecs threatened flora species records and protected plan survey 'high risk' trigger areas); important habitat for threatened flora and/or fauna species is mapped collectively in Figure A.13 (Essential Habitat for threatened terrestrial flora and fauna species) and Figure A.14 (Matters of local and state environmental significance); and a series of predictive habitat models developed by EHP. Predictive flora and fauna habitat models developed by DSITI are provided in Appendix B of the evidence base risk assessment, Figures B.1 to B.66.
Terrestrial vegetation communities (including threatened ecological communities)	✓	–	✓	✓	–	Terrestrial vegetation communities are mapped in Figure A.2 (Threatened ecological communities), Figure A.3 (Endangered and Of concern Regional Ecosystems), Figure A.4 (Least concern Regional Ecosystems), and Figure A.18 (Biodiversity Planning Assessment mapping areas).
Mangroves and intertidal vegetation communities	✓	✓	✓	✓	–	Mangrove ecosystems are mapped in Figure A.5 (Regional Ecosystems containing mangroves).
Seagrass and macroalgae	✓	✓	✓	✓	–	The extent of seagrass meadows (from surveys between 2002 and 2014) is mapped in Figure A.6 (Extent of seagrass meadows) and the extent of benthic macroalgae is mapped in Figure A.8 (Benthic macroalgae and macroinvertebrate distribution and density).

Environmental value	Relevant OUV criteria ¹				Other environmental value (not relevant to the OUV of the GBRWHA)	Mapping reference for figures within the evidence base risk assessment report (Aurecon 2016)
	vii ²	viii ³	ix ⁴	x ⁵		
Wetlands	✓	✓	✓	✓	–	Within the port master planned there are two areas mapped as nationally significant wetlands: the Port Curtis wetland complex and The Narrows wetland complex, as shown in Figure A.16 (Directory of Important Wetlands). There are also several locations within the master planned area that are mapped as being wetlands of State environmental significance and are of 'High Ecological Significance' (Figure A.14 (Matters of local and state environmental significance). Figure A.15 (Wetlands) shows the location and extent of coastal/subcoastal, estuarine and riverine wetlands within the region.
Continental islands	✓	✓	✓	✓	–	Terrestrial connectivity is mapped in Figure A.18 (Biodiversity Planning Assessment mapping areas), which shows fauna movement corridors (ie areas of connective habitat) which have been mapped based on a desktop assessment and relevant expert knowledge.
Beaches	✓	–	–	–	–	
Dune systems	✓	✓	–	–	–	
River deltas	✓	✓	✓	✓	–	
Connectivity: cross-shelf, longshore and vertical	–	✓	✓	✓	–	
Protected areas	–	–	–	–	✓	A range of protected areas are present within the master planned area and surrounds as listed under the provisions of state and Commonwealth legislation. These areas are mapped in Figure A.17 (Protected areas), Figure A.19 (Great Barrier Reef Marine Park Zones – Commonwealth) and Figure A.20 (Great Barrier Reef Marine Park Zones – State).
Acid sulfate soils	–	–	–	–	✓	Within the master planned area there are high risk/high probability areas associated with acid sulfate soils (ASS) (Figure A.21 (Atlas of Australian Acid Sulfate Soils)) and Fire ants (Figure A.22 (Gladstone Fire Ant Restricted Area)).
Pest and weeds	–	–	–	–	✓	
Social values						
Heritage properties	–	–	–	–	✓	Figure A.26 (World, Commonwealth and National Heritage Places) Figure A.27 (State and local heritage places)
Socio-economic factors	–	–	–	–	✓	No associated mapping.
Social and community infrastructure	–	–	–	–	✓	Figure A.28 (Social and community infrastructure)



Environmental value	Relevant OUV criteria ¹				Other environmental value (not relevant to the OUV of the GBRWHA)	Mapping reference for figures within the evidence base risk assessment report (Aurecon 2016)
	vii ²	viii ³	ix ⁴	x ⁵		
Recreational opportunities and natural amenity	–	–	–	–	✓	Figure A.29 (Recreational opportunities and natural amenity)
Cultural heritage values						
Traditional Owner interaction with the natural environment	–	–	✓	–	✓	The figure references below identify areas of potential cultural heritage significance within the master planned area. Figure A.25 (Indigenous land use agreements)
Native Title	–	–	–	–	✓	Figure A.24 (Native title determination areas)
Culturally Significant Heritage Sites	–	–	–	–	✓	Figure A.23 (Indigenous cultural heritage sites)

Table notes:

- 1 Adapted from the Independent Review of the Port of Gladstone – Report on Findings, July 2013 (DSEWPaC 2013)
- 2 vii Aesthetic values and superlative natural phenomena
- 3 viii Ongoing geological processes
- 4 ix Ecological and biological processes
- 5 x Biodiversity conservation

The local expression of the OUV of the GBRWHA mapping contained in this report updates the OUV of the GBRWHA mapping within the evidence base risk assessment report. It is also noted that the list of local attributes in this report (refer Section 3.1, Table 3.1) replaces the list of local attributes within the master planned area and surrounds that contribute to the OUV of the GBRWHA presented in the evidence base risk assessment report (refer Table 1.1).

2 Methodology

To identify and describe the local expression of the OUV of the GBRWHA which occur within the master planned area and surrounds, the 'Method for identifying the presence of OUV within the Great Barrier Reef World Heritage Area' (Adaptive Strategies et al. 2016) has been applied.

The full methodology is provided in Appendix A and is summarised below. Figure 2.1 provides an overview of the methodology for identifying the local expression of the OUV of the GBRWHA.

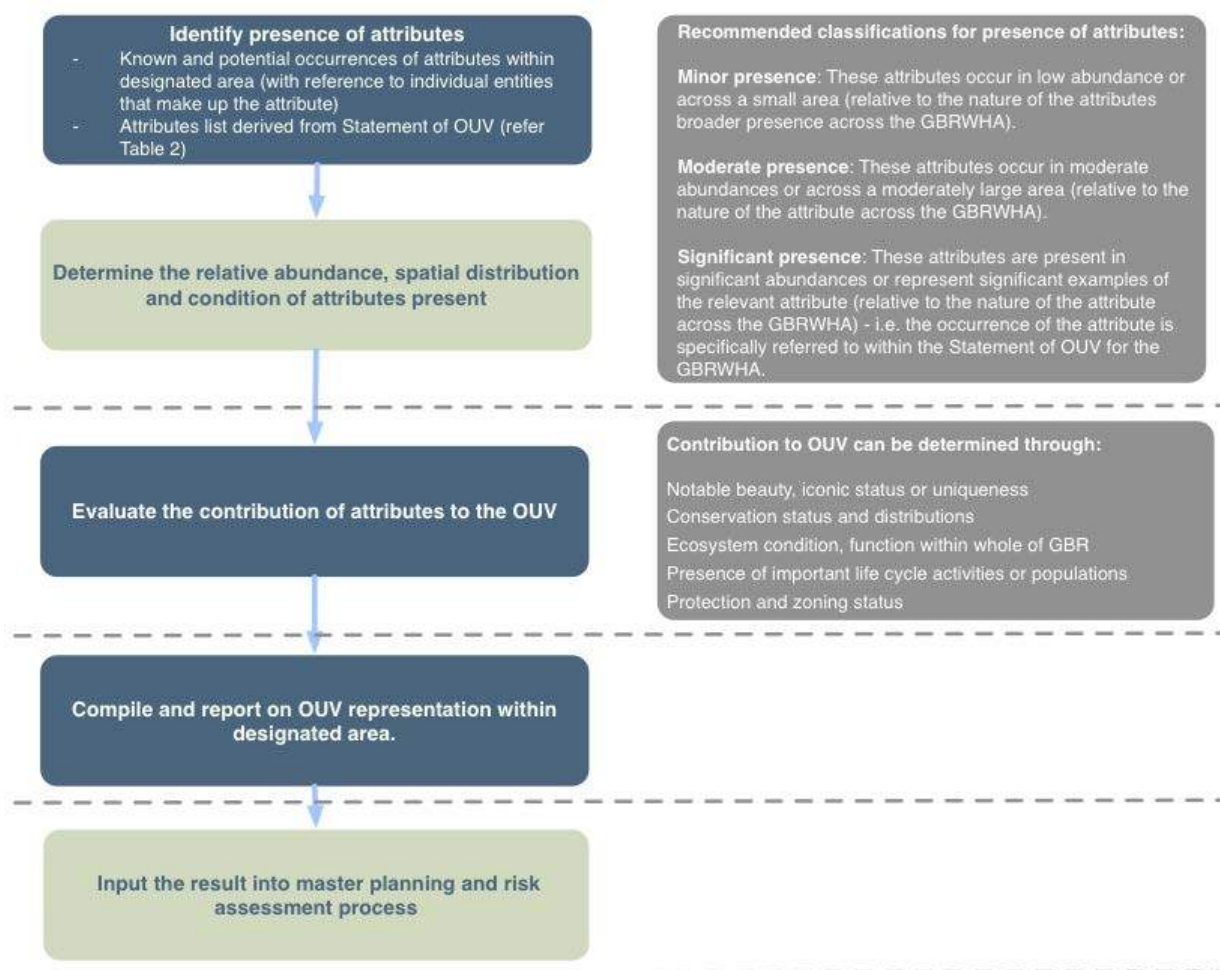


Figure 2.1 Overview of the methodology for identifying the local expression of the OUV of the GBRWHA

Source: (Adaptive Strategies et al. 2016)

2.1 Key information sources

To identify the local expression of the OUV of the GBRWHA for the PPG master planned area and surrounds, the best available information was accessed and reviewed. It is acknowledged that additional information may become available in the future, or the environmental values within the GBRWHA or the PPG master planned area and surrounds may change. It is recommended that this report is reviewed and revised as new information becomes available.

Table 2.1 lists the key information sources utilised for contextual information about the OUV of the GBRWHA and to determine at a local scale, the presence of attributes and their contribution to the OUV of the GBRWHA.

Table 2.1 Key information sources utilised to identify the local expression of the OUV of the GBRWHA

Key information source	Primary uses of information source
Independent Review of the Port of Gladstone (DSEWPaC 2013)	<ul style="list-style-type: none"> ■ Identification of the attributes expressed within the Port of Gladstone and surrounds ■ Information to support the assessment of presence and contribution for locally expressed attributes
Great Barrier Reef Marine Park Authority (GBRMPA) Great Barrier Reef Outlook Report 2014	<ul style="list-style-type: none"> ■ Information on the condition and trend of the OUV of the GBRWHA ■ Contextual information regarding the presence and extent of attributes, and the values which form part of the attributes ■ Information to support the assessment of the contribution of locally expressed attributes to the OUV of the GBRWHA
Evidence Base Report for the Proposed Gladstone Port Master Planned Area (AECOM 2016) Priority Port of Gladstone Master Planning Risk Assessment Report (Aurecon 2016)	<ul style="list-style-type: none"> ■ Information and mapping for the PPG master planned area and surrounds to supplement and support the assessment of presence and contribution for locally expressed attributes ■ The risk assessment report provided a basis for the identification of the locally expressed attributes
Retrospective statement of the Outstanding Universal Value of the Great Barrier Reef, Property ID 154 (UNESCO 2012) and the key OUV attributes identified in the <i>Environment Protection and Biodiversity Conservation Act 1999</i> (Cth) (EPBC Act) referral guidelines for the Outstanding Universal Value of the Great Barrier Reef World Heritage Area (DoE 2014) The Outstanding Universal Value of the Great Barrier Reef World Heritage Area (Lucas et al. 1997)	<ul style="list-style-type: none"> ■ Background and context of the attributes which contribute to the OUV of the GBRWHA
Great Barrier Reef Coastal Zone Strategic Assessment (DSD 2014)	<ul style="list-style-type: none"> ■ Contextual information regarding the presence and extent of attributes, and the values which form part of the attributes
Great Barrier Reef Region Strategic Assessment – Strategic Assessment Report (GBRMPA 2014b)	<ul style="list-style-type: none"> ■ Information to support the assessment of the contribution of locally expressed attributes to the OUV of the GBRWHA
Great Barrier Reef Region Strategic Assessment – Strategic Assessment Report – Supplementary Report (GBRMPA 2014c)	<ul style="list-style-type: none"> ■ Information to support the assessment of the contribution of locally expressed attributes to the OUV of the GBRWHA
Flora and fauna database searches (refer Appendix C)	<ul style="list-style-type: none"> ■ Identification of the attributes expressed within the Port of Gladstone and surrounds



2.2 Identification of local attributes expressed within the master planned area and surrounds

As summarised in Table 2.1 in Section 2.1, there were four key documents utilised to identify the local attributes expressed within the PPG master planned area and surrounds, including:

- Independent Review of the Port of Gladstone (DSEWPaC 2013)
- Priority Port of Gladstone Master Planning Risk Assessment Report (Aurecon 2016)
- Method for identifying the local expression of OUV within the GBRWHA (Adaptive Strategies et al. 2016)
- Great Barrier Reef Marine Park Authority (GBRMPA) Great Barrier Reef Outlook Report 2014.

The independent review of the Port of Gladstone identified that the OUV of the GBRWHA is expressed within the Port of Gladstone and provided summary information on how the OUV of the GBRWHA were locally expressed. Appendix 6 of the independent review is a table which identifies the attributes expressed in the Port of Gladstone and surrounds, and how they relate to the OUV of the GBRWHA listing criteria.

This information formed the basis of the local attributes expressed within the PPG master planned area and surrounds that contribute to the OUV of the GBRWHA for the evidence base risk assessment report (refer Section 1.3 and Table 1.1).

Following the development of the method for identifying the local expression of OUV of the GBRWHA document, a review of the local attributes listed in the risk assessment report and the independent review report was undertaken. This review cross-referenced the description of the key attributes listed in the methodology (refer Appendix A, Table 2) and the more detailed description of these attributes in the GBR Outlook Report 2014.

As outlined in local expression of the OUV of the GBRWHA methodology, most attributes are comprised of multiple environmental values (eg in the GBRWHA six marine turtles and their nesting/breeding habitat comprise the 'marine turtles' attribute). As such, during the review of the key information sources (refer Figure 2.2), the environmental values that comprise an attribute were identified using the best available information and the known ecology of species and/or habitats within the PPG master planned area. A complete reference list of sources is provided in Section 6, and in Appendix B.

As is outlined in the independent review, understanding and knowledge of how the OUV of the GBRWHA are expressed in specific areas (ie locally) has evolved over time. Furthermore, the EPBC Act referral guidelines for the OUV of the GBRWHA acknowledges that attributes can change over time (DoE 2014).

The local attributes identified in this report and their local expression (ie presence and contribution to the OUV of the GBRWHA) are based on the best available information at this time. Information supporting the local expression assessment is provided in Appendix B.

Local expression of the OUV methodology for PPG

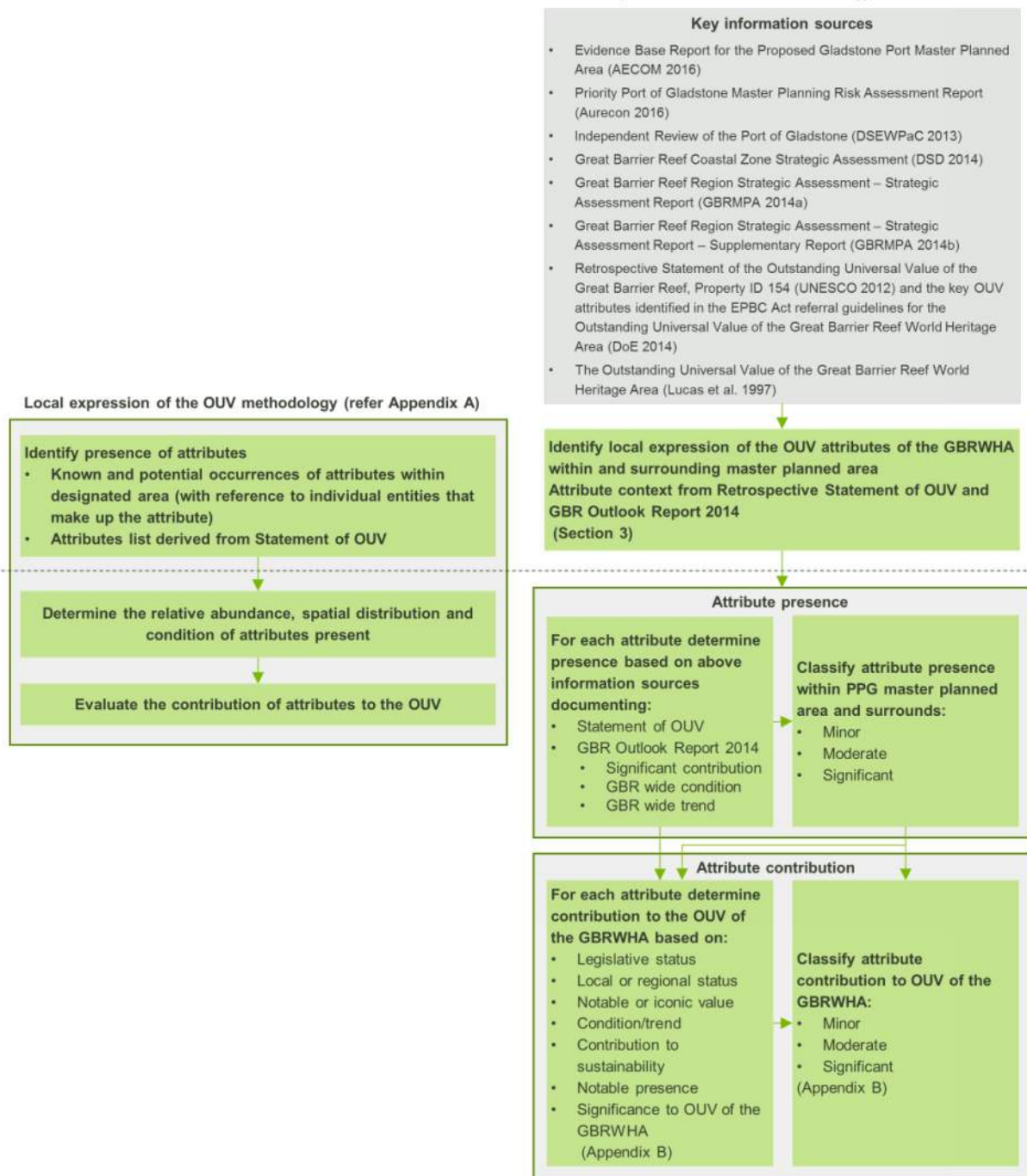


Figure 2.2 Detailed methodology for identifying local expression of OUV of the GBRWHA in the PPG master planned area and surrounds

2.3 Presence of local attributes

For those attributes which were identified within the master planned area and surrounds as being locally expressed, their ‘relative abundance/presence’ was assessed. An analysis was conducted to determine the abundance/presence of the attribute within the context of the whole of the GBRWHA, thereby defining the level of presence for each locally expressed attribute.

The level of presence, or distribution, of the attribute within the master planned area and surrounds was mapped. The attributes level of presence was then categorised as per the following:

- **Minor presence:** The attribute occurs in low abundance or across a small area (relative to the nature of the attributes broader presence across the GBRWHA)
- **Moderate presence:** The attribute occurs in moderate abundance or across a moderately large area (relative to the nature of the attribute across the GBRWHA)
- **Significant presence:** The attribute occurs in significant abundances or represents significant examples of the relevant attribute (relative to the nature of the attribute across the GBRWHA)

The spatial extent figures for locally expressed attributes within the master planned area and surrounds were developed utilising existing datasets (refer Appendix B). While some of these datasets have been synthesised using field collected data, it is acknowledged that some of the datasets are the result of desktop studies (ie not all mapping has been confirmed through field survey). Appendix B identifies supplementary datasets and reports which have been used to map the local attributes within the master planned area and surrounds. Appendix C contains key database searches undertaken for the master planned area and surrounds, and includes a Wildlife Online search and the EPBC Act protected matters search report.

Information on the presence of the attributes was used to identify the extent of the key environmental values (which comprise the attribute) within the PPG master planned area and surrounds, thus providing context and quantitative information to feed into the contribution assessment outlined below.

2.4 Contribution of the local attribute to the OUV of the GBRWHA

An assessment was conducted to determine the level of contribution of a local attribute to the OUV of the GBRWHA. The assessment of contribution utilised information collated from the presence assessment (refer Section 2.3) (ie specific to the PPG master planned area and surrounds) and assessed the importance and value in the context of the GBRWHA.

This assessment included consideration of a range of key factors which were equally weighted in terms of their importance.

Table 2.2 provides the key factors which were considered during the level of local attribute contribution assessment.

The assessment of the contribution of the local attributes considers the 'loss' of a particular attribute from the PPG master planned area and surrounds, and quantifies the potential consequences of that loss in the context of the expression of the OUV of the GBRWHA. The assessment of the loss of attributes is not intended to represent a realistic scenario for the PPG, rather it assists in understanding the importance of the attribute in the context of the GBRWHA.

Table 2.2 Assessment of contribution of the local attribute to the OUV of the GBRWHA

Contribution factor	Summary of considerations
Commonwealth or state attribute status	<ul style="list-style-type: none"> ■ Is the attribute listed under legislation (eg threatened species, Ramsar site, heritage register)? ■ Does the attributes local presence meet EPBC Act (or other) definitions of significance, important population or critical habitat?
Local or regional attribute status	<ul style="list-style-type: none"> ■ Is the presence of the attribute specifically protected in addition to Commonwealth and state legislative protections (eg local or regional reserve)?

Contribution factor	Summary of considerations
Notable or iconic attribute value	<ul style="list-style-type: none"> ■ Is the attribute recognised or mentioned in publications as a prime example or value of the region? ■ For instance, the attribute is essential for maintaining the beauty of the World Heritage Area. Is it a site or feature that is mentioned in the retrospective statement of OUV, a local focal point or significant Reef related tourist attraction?
Condition/trend of the attribute	<ul style="list-style-type: none"> ■ What is the condition/trend of the attribute, as recorded in the latest GBR Outlook Report? ■ Rarer attributes in good condition will be of greatest value but also attributes that are in decline may require particular focus.
Contribution to attribute sustainability	<ul style="list-style-type: none"> ■ Does the local presence of the attribute contribute to the ongoing sustainability of the attribute more broadly? ■ For biodiversity attributes, is the local presence a key aggregation, breeding, feeding or recruitment location? Does it support an important proportion of the greater population? ■ Would the loss or decline of the local attribute affect the overall conservation status of the attribute (potentially altering its legal listing status)?
Notable presence of the attribute	<ul style="list-style-type: none"> ■ Is the local presence, unique, unusual or highly notable? ■ Is it a prime example of the attribute locally or regionally or do better and multiple examples exist elsewhere with the GBR region?
Significance of attribute to the preservation of the GBRWHA	<ul style="list-style-type: none"> ■ Would the loss of the attribute locally result in a loss or significant decline in the OUV of the whole of the GBRWHA? ■ For instance, would the loss put the GBR at risk of being listed as a World Heritage Area in danger? (refer World Heritage Guidelines).

The contribution of local attributes to the OUV of the GBRWHA within the master planned area and surrounds were categorised as per the following:

- **Minor contribution:** The attribute is present however it occurs in low abundance or singularly and:
 - Is not essential to the sustainability of the attribute (eg substantial breeding population)
 - Is not recognised as a key feature of the GBRWHA
 - Is not included in the retrospective statement of OUV
 - Is not iconic, unique or a high quality example of the attribute
- **Moderate contribution:** The attribute occurs in moderate abundance or across a moderately large area but are not the prime occurrence or representation of the attribute within the GBRWHA. The attribute does however represent a feature for which the GBR was listed as World Heritage.
- **Significant contribution:** The attribute represents locally important examples of the attribute relative to the nature of the attribute across the GBRWHA. Such an attribute may be specifically referred to within the retrospective statement of OUV for the GBRWHA or defined by other legislation, planning instrument or values assessment (eg GBR Outlook Report). The occurrence of the attribute locally is a prime example of the features mentioned in the retrospective statement of OUV. Prime examples are listed in Tables 3 to 6 of the local expression of the OUV methodology (Adaptive Strategies et al. 2016) (refer Appendix A).

3 OUV of the GBRWHA within the master planned area and surrounds

3.1 Independent Review of the Port of Gladstone and the local attributes present within the master planned area and surrounds

An independent review of the Port of Gladstone was conducted in 2013, with the findings documented in the Independent Review of the Port of Gladstone – Report on Findings, July 2013 (DSEWPaC 2013). The independent review identified attributes of the OUV of the GBRWHA present within the Port of Gladstone, which included:

- Connectivity
- Geological features
- Biological diversity
- Human interaction

The independent review identified the local OUV attributes within the Port of Gladstone, and the corresponding OUV criteria of the GBRWHA. The independent review key attributes and the retrospective statement of the OUV of the GBRWHA (DoE 2014) have been utilised to determine the relevant local attributes within the master planned area and surrounds that contribute to the OUV of the GBRWHA (refer Table 3.1).

Table 3.1 Local attributes within the master planned area and surrounds, and the associated OUV criteria

Category	Local attribute	Relevant OUV criteria ¹			
		vii ²	viii ³	ix ⁴	x ⁵
Coral reefs	Fringing reefs	✓	✓	✓	✓
	Inshore turbid reefs	-	✓	✓	✓
	Coral species diversity and extent	✓	✓	✓	✓
Marine water quality	Marine water quality	-	-	✓	✓
Fish	Fish species and diversity	✓	-	✓	✓
Marine megafauna	Dugong	-	-	-	✓
	Species of whales	-	-	-	✓
	Migrating whales	✓	-	-	-
	Species of dolphins	✓	-	-	✓
Marine turtles	Breeding colonies of marine turtles	✓	-	-	✓
	Green turtle breeding	✓	-	-	✓
	Marine turtle rookeries	✓	-	-	✓
	Nesting turtles	✓	-	-	-
Seagrass and macroalgae	Seagrass	✓	✓	✓	✓
	Beds of <i>Halimeda</i> algae	-	-	✓	-
Shorebirds and migratory seabirds	Seabirds	✓		✓	✓
	Shorebirds and migratory birds	-	-	-	✓

Category	Local attribute	Relevant OUV criteria ¹			
		vii ²	viii ³	ix ⁴	x ⁵
Flora, fauna and ecological communities	Threatened and endangered flora and fauna species (including threatened ecological communities)	✓	-	-	✓
	Vegetated mountains	✓	-	-	-
	Mangroves	✓	✓	✓	✓
	Mangrove species diversity	-	-	-	✓
	Vast mangrove forests	✓	-	-	-
Continental islands	Continental islands and green vegetated islands	✓	✓	-	-
	Plant species diversity and endemism (species being unique to a defined geographic location)	-	-	-	✓
	Vegetation of the continental islands	-	-	✓	✓
Geomorphology	Beaches	✓	-	-	-
	Dune systems	✓	✓	-	-
	River deltas	✓	✓	✓	✓
	Connectivity: cross-shelf, longshore and vertical	-	✓	✓	✓
Cultural heritage values	Traditional Owner interaction with the natural environment	-	-	✓	-
Marine fauna	Marine faunal groups diversity (including sharks, rays, megafauna, marine turtles and other marine reptiles)	✓	-	✓	✓
Total species diversity	Total species diversity	✓	-	✓	✓

Table notes:

2 Adapted from the Independent Review of the Port of Gladstone – Report on Findings, July 2013 (DSEWPac 2013)

2 vii Aesthetic values and superlative natural phenomena

3 viii Ongoing geological processes

4 ix Ecological and biological processes

5 x Biodiversity conservation

3.2 Presence of local attributes

The local attributes identified within the master planned area and surrounding areas that contribute to the OUV of the GBRWHA are provided in Table 3.2.

Appendix B provides the context of the presence of each local attribute (including the key environmental values that make up the local attribute) within the master planned area and surrounds, and also within the broader context of the GBRWHA. Figure references are provided in Appendix B to support the presence information and categorisation into the following categories:

- Minor presence
- Moderate presence
- Significant presence

Information presented in Table 3.2 regarding the value and distribution/abundance of the local attribute within the master planned area and surrounds was reviewed to determine the relative importance of the local attribute, and subsequently, the level of presence of the attribute.

Table 3.2 Presence classification for local attributes expressed within and surrounding the master planned area and surrounds

Category	Local attribute	Presence classification ¹	Justification for the presence classification cross reference to relevant section of Appendix B
Coral reefs	Fringing reefs	Minor	Section 1.1
	Inshore turbid reefs	Minor	
	Coral species diversity and extent	Minor	
Marine water quality	Marine water quality	Significant	Section 2.1
Fish	Fish species and diversity	Minor	Section 3.1
Marine megafauna	Dugong	Minor	Section 4.1.1
	Species of whales	Minor	Section 4.2.1
	Migrating whales	Minor	Section 4.2.1
	Species of dolphins	Moderate	Section 4.3.1
Marine turtles	Breeding colonies of marine turtles	Moderate	Section 5.1
	Green turtle breeding	Moderate	
	Marine turtle rookeries	Moderate	
	Nesting turtles	Moderate	
Seagrass and macroalgae	Seagrass	Moderate	Section 6.1.1
	Beds of <i>Halimeda</i> algae	Minor	Section 6.2.1
Shorebirds and migratory seabirds	Seabirds	Minor	Section 7.1.1
	Shorebirds and migratory birds	Significant	Section 7.2.1
Flora, fauna and ecological communities	Threatened and endangered flora and fauna species (including threatened ecological communities)	Moderate	Section 8.1.1
	Vegetated mountains	Minor	Section 8.1.1
	Mangroves	Minor	Section 8.2.1
	Mangrove species diversity	Minor	Section 8.2.1
	Vast mangrove forests	Minor	Section 8.2.1
Continental islands	Continental islands and green vegetated islands	Significant	Section 9.1
	Plant species diversity and endemism (species being unique to a defined geographic location)	Significant	
	Vegetation of the continental islands	Significant	
Geomorphology	Beaches	Minor	Section 10.1
	Dune systems	Minor	
	River deltas	Minor	
	Connectivity: cross-shelf, longshore and vertical	Moderate	

Category	Local attribute	Presence classification ¹	Justification for the presence classification cross reference to relevant section of Appendix B
Cultural heritage values	Traditional Owner interaction with the natural environment	Moderate	Section 11.1
Marine fauna	Diversity supporting marine species (global conservation significance)	Moderate	Section 12.1
Total species diversity	Total species diversity	Moderate	Section 13.1

Table notes:

1 Presence classification definitions:

Minor presence: These attributes occur in low abundance or across a small area (relative to the nature of the attributes broader presence across the GBRWHA)

Moderate presence: These attributes occur in moderate abundance or across a moderately large area (relative to the nature of the attribute across the GBRWHA)

Significant presence: These attributes are present in significant abundances or represent significant examples of the relevant attribute (relative to the nature of the attribute across the GBRWHA) - ie the occurrence of the attribute is specifically referred to within the retrospective statement of OUV for the GBRWHA

2 As defined in the EPBC Act Policy Statement 3.21 (DoE 2015)

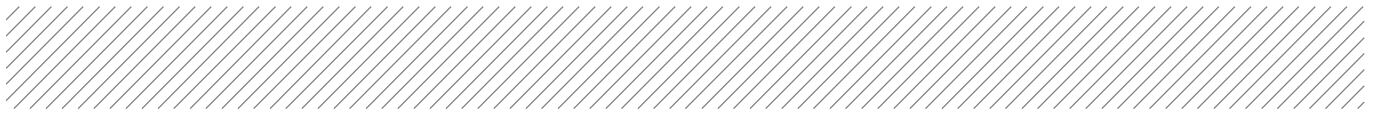
4 Contribution of local attributes to the OUV of the GBRWHA

To provide context to the assessment of local attribute contribution to the OUV of the GBRWHA, the GBR wide condition, trend and significant contributing factors of the attribute to the OUV of the GBRWHA were considered. This information was sourced from the GBR Outlook Report 2014 (GBRMPA 2014) and is summarised in Table 3 to Table 6 of the local expression of OUV methodology (Adaptive Strategies et al. 2016) (refer Appendix A).

Table 4.1 provides a summary of the contribution classifications for the local expression of the OUV attributes present within the PPG master planned area and surrounds. Appendix B provides an assessment and justification for the contribution classification for the local expression of the OUV attributes and their corresponding contribution to the OUV criteria, and key environmental values.

Table 4.1 Contribution of local attribute to the OUV of the GBRWHA for the master planned area and surrounds

Category	Local attribute	Relevant OUV criteria and contribution classifications ¹				Justification for the contribution classification cross reference to relevant section of Appendix B	Key environment values
		vii ²	viii ³	ix ⁴	x ⁵		
Coral reefs	Fringing reefs	Min	Min	Min	Min	Section 1.2	Fringing coral reefs
	Inshore turbid reefs	-	Min	Min	Min	Section 1.2	Inshore turbid coral reefs
	Coral species diversity and extent	Min	Min	Min	Min	Section 1.2	Various coral species
Marine water quality	Marine water quality	-	-	Mod	Mod	Section 2.2	Marine water quality
Fish	Fish species and diversity	Min	-	Min	Min	Section 3.2	Colosseum Inlet Fish Habitat Area Proposed Calliope River Fish Habitat Area Coral reefs, seagrass meadows, mangrove communities, hard and soft benthic substrates, beach habitats, estuaries, creeks and rivers
Marine megafauna	Dugong	-	-	-	Mod	Section 4.1	Dugong species Seagrass meadows
	Species of whales	-	-	-	Min	Section 4.2	Minke whales Sperm whales Humpback whales



Category	Local attribute	Relevant OUV criteria and contribution classifications ¹				Justification for the contribution classification cross reference to relevant section of Appendix B	Key environment values
		vii ²	viii ³	ix ⁴	x ⁵		
	Migrating whales	Min	-	-	-	Section 4.2	Humpback whales and calving habitat
	Species of dolphins	Min	-	-	Sig	Section 4.3	Australian humpback dolphins
Marine turtles	Breeding colonies of marine turtles	Mod	-	-	Mod	Section 5.2	Flatback turtle rookery on Curtis Island Nesting beaches on Facing and Curtis Islands
	Green turtle breeding	Min	-	-	Min	Section 5.2	
	Marine turtle rookeries	Mod	-	-	Mod	Section 5.2	
	Nesting turtles	Min	-	-	-	Section 5.2	
Seagrass and macroalgae	Seagrass	Min	Min	Mod	Mod	Section 6.1	Seagrass meadows
	Beds of <i>Halimeda</i> algae	-	-	Min	-	Section 6.2	Beds of <i>Halimeda</i> algae
Shorebirds and migratory seabirds	Seabirds	Min	-	Min	Min	Section 7.1	Potential foraging habitat
	Shorebirds and migratory birds	-	-	-	Sig	Section 7.2	Threatened migratory shorebird species Shorebird habitat and important roost sites (note these vary from year to year)
Flora, fauna and ecological communities	Threatened and endangered flora and fauna species (including threatened ecological communities)	Min	-	-	Mod	Section 8.1	Coastal Saltmarsh Threatened Ecological Community
	Vegetated mountains	Min	-	-	-	Section 8.1	Mount Larcom
	Mangroves	Min	Min	Min	Min	Section 8.2	Various mangrove sp.
	Mangrove species diversity	-	-	-	Min	Section 8.2	Various mangrove sp.
	Vast mangrove forests	Mod	-	-	-	Section 8.2	Mangrove sequences at The Narrows

Category	Local attribute	Relevant OUV criteria and contribution classifications ¹				Justification for the contribution classification cross reference to relevant section of Appendix B	Key environment values
		vii ²	viii ³	ix ⁴	x ⁵		
Continental islands	Continental islands and green vegetated islands	Mod	Mod	-	-	Section 9.2	Curtis Island
	Plant species diversity and endemism (species being unique to a defined geographic location)	-	-	-	Sig	Section 9.2	Curtis Island
	Vegetation of the continental islands	-	-	Sig	Sig	Section 9.2	Curtis Island
Geomorphology	Beaches	Min	-	-	-	Section 10.2	Curtis Island beaches Facing Island beaches Boyn Island Beach
	Dune systems	Min	Min	-	-	Section 10.2	Parabolic dunes Curtis Island
	River deltas	Min	Min	Min	Min	Section 10.2	Marine tidal sand deltas (Curtis Island, Boyne River, Colosseum Inlet)
	Connectivity: cross-shelf, longshore and vertical	-	Min	Min	Min	Section 10.2	The Narrows tidal passage
Cultural heritage values	Traditional Owner interaction with the natural environment	-	-	Mod	-	Section 11.2	Indigenous cultural heritage sites and values
Marine fauna	Diversity supporting marine fauna species (global conservation significance)	Min	-	Min	Mod	Section 12.2	A diverse range of marine fauna species
Total species diversity	Total species diversity	Mod	-	Mod	Mod	Section 13.2	A diverse range of marine, intertidal and terrestrial flora and fauna species

Table notes:

- 1 Min Minor
Mod Moderate
Sig Significant
- 2 vii Aesthetic values and superlative natural phenomena
- 3 viii Ongoing geological processes
- 4 ix Ecological and biological processes
- 5 x Biodiversity conservation

5 Conclusion

This report and associated appendices provide an evaluation and assessment of the local expression of the OUV attributes within and surrounding the PPG master planned area in accordance with the recommended methodology (refer Appendix A). The evaluation and assessment was undertaken based on the best available information at the time of preparation. It is acknowledged that as additional information becomes available, or where the environmental values within either the GBRWHA or PPG master planned area and surrounds change significantly, that the information in this report may no longer represent an accurate assessment of the presence and/or contribution of the local expression of the OUV of the GBRWHA. It is recommended that as information on the environmental values and knowledge change over time, this report be reviewed and revised accordingly.

The evaluation and assessment of the local attributes of the OUV of the GBRWHA expressed within and surrounding the PPG master planned area have determined that **four** local attributes provide a **significant contribution** to the OUV of the GBRWHA within and surrounding the PPG master planned area, including:

- **Species of dolphins (Australian humpback dolphins)** (refer Appendix B, Section 4.3)
 - There are seven species of dolphin that have the potential to utilise habitat within the PPG master planned area, which contributes significantly to the dolphin species biodiversity of the GBRWHA. On the basis of the limited population information available for the Australian humpback dolphin, the PPG master planned area is considered to be an important location within the GBRWHA for this species. Furthermore, the Australian humpback dolphin populations are at risk of undetectable population declines (where less than 20% decline annually) (GBRMPA 2014).
- **Shorebirds and migratory birds (threatened migratory shorebird species and shorebird habitat)** (refer Appendix B, Section 7.3)
 - Important habitat for migratory shorebirds is present at a number of locations within the PPG master planned area (eg Friend Point, Port Central and surrounds, and Facing Island, refer to Figure 7.2). There are currently no shorebird population estimates available specifically for the GBRWHA. However it is considered that due to the presence of important habitat within the master planned area and in the surrounding areas, and the proportion of the Queensland populations of migratory shorebirds, that the PPG master planned area and surrounds contributes significantly to the shorebird attribute of the OUV of the GBRWHA.
- **Plant species diversity and endemism (Curtis Island)** (refer Appendix B, Section 9.2)
 - Curtis Island is identified as having among the most diverse terrestrial flora in the GBRWHA (Lucas et al. 1997), with approximately 590 flora species. The continental island flora species diversity and endemism represented on Curtis Island is also supported by the remnant vegetation values on the other continental islands in the PPG master planned area (eg Facing Island, She Oak Island, Diamantina Island), as they are mapped as supporting similar vegetation communities (DNRM 2016, RE mapping version 8).
- **Vegetation of the continental islands (Curtis Island)** (refer Appendix B, Section 9.2)
 - As outlined above, Curtis Island and the other continental islands within the PPG master planned area contain remnant vegetation communities. Curtis Island alone represents more than 57% of the total island flora species diversity recorded within the whole of the GBRMP (Batianoff and Dillewaard 1995).

Eleven local attributes provide a **moderate contribution** to the OUV of the GBRWHA within and surrounding the PPG master planned area, including

- **Marine water quality** (refer Appendix B, Section 2.2)
 - Due to the importance of marine water quality to the local expression of other attributes that contribute to the OUV of the GBRWHA (eg seagrass meadows, fish species and diversity, coral reefs). Marine water quality is also a management priority for the GBRWHA.
- **Dugong (Dugong and seagrass meadows)** (refer Appendix B, Section 4.1)
 - The seagrass meadows within the PPG master planned area provide important connective habitat for Dugong, and represents the only known major areas of seagrass between Shoalwater Bay and Hervey Bay (Blair 2012, Sheppard et al. 2006, Sobotzick et al. 2013). It is not considered that the PPG master planned area supports an important population in isolation, or contributes significantly to the number of Dugong within the GBRWHA. However the PPG master planned area provides important connective habitat which supports the movement of Dugongs (between key centres of distribution) and transfer of genetic material between key sub-populations.
- **Breeding colonies of marine turtles (Flatback turtles on Curtis Island and nesting beaches on Curtis and Facing Islands)** (refer Appendix B, Section 5.2)
 - Marine turtle nesting beaches are located on Facing Island (on the boundary of the PPG master planned area) and on Curtis Island (on the boundary of the PPG master planned area and/or outside of the master planned area). Three species of marine turtle have been recorded in these areas (ie Flatback, Green and Loggerhead turtles). Marine turtles will also utilise habitat within the PPG master planned area (eg seagrass meadows). Though not a prime or iconic marine turtle nesting site, the PPG master planned area and surrounds provides important foraging habitat resources.
- **Marine turtle rookeries (Flatback turtles on Curtis Island)** (refer Appendix B, Section 5.2)
 - Approximately 20% of Queensland's endemic Flatback turtle population are recorded to nest on inshore islands of the Gladstone region, with South End beach on Curtis Island identified by Limpus et al. (2013) as one of four key rookeries in eastern Australia, which is situated within the PPG master planned area. This contributes towards maintaining species diversity and the aesthetic values of GBRWHA.
- **Seagrass (seagrass meadows)** (refer Appendix B, Section 6.1)
 - Seagrass meadows are located within the PPG master planned area, as well as in surrounding areas. The seagrass meadows in the PPG master planned area play a major role in supporting other local OUV attributes in the PPG master planned area and surrounds (eg Dugong, dolphins, marine turtles, fish species and diversity). Though more notable and iconic examples exist within the GBRWHA, the loss of the seagrass meadows within the PPG master planned area would result in significant impacts on a range of attributes that contribute to the OUV of the GBRWHA.
- **Threatened and endangered flora and fauna species (Coastal Saltmarsh threatened ecological community)** (refer Appendix B, Section 8.1)
 - The PPG master planned area supports a diverse range of threatened flora and fauna species, however, the habitat mapping currently available has limitations (eg not available for all species, includes areas that have been previously cleared, does not include mapping for continental islands). Of the information/mapping that is available, the PPG master planned area is identified as containing approximately 20% of the EPBC Act listed Subtropical and Temperate Coastal Saltmarsh TEC within the GBRWHA (ie contributing to the biodiversity of the GBRWHA). This is due to the Gladstone region representing the northernmost extent of this TEC.

- **Vast mangrove forests (mangrove sequences at The Narrows)** (refer Appendix B, Section 8.2)
 - The GBRWHA supports approximately 2,069 km² of mangrove forests (Lucas et al. 1997). Approximately 31.11 km² of remnant mangrove forests are present within the PPG master planned area, representing approximately 1.50% of the GBRWHA mangrove areas. The vast mangrove forests of The Narrows (situated outside of and adjacent to the master planned area) are noted as a notable example of mangrove sequences in the GBRWHA (Lucas et al. 1997).
- **Continental islands and green vegetated islands (Curtis Island)** (refer Appendix B, Section 9.2)
 - The continental islands, including Curtis and Facing Islands, contribute to the aesthetic values of the GBRWHA. Though there are approximately 600 continental islands within the GBRWHA (Lucas et al. 1997), Curtis Island represents a significant and notable example and with commensurate flora species value to Hinchinbrook Island (situated approximately 800 km to the north of the PPG master planned area).
- **Traditional owner interaction with the natural environment (Indigenous cultural heritage sites and values)** (refer Appendix B, Section 11.2)
 - There are 353 known cultural heritage artefacts/site in the PPG master planned area and surrounds. It is considered that the loss of these values would have a significant impact on the preservation of cultural heritage of the Indigenous people represented by the Port Curtis Coral Coast group. The Port Curtis Coral Coast group have entered into a Traditional Use of Marine Resource Agreement (TUMRA) which includes the Capricorn-Bunker Group of reefs, cays and islands, and the PPG master planned area and surrounds.
- **Diversity supporting marine fauna species (global conservation significance) (a diverse range of marine fauna)** (refer Appendix B, Section 12.2)
 - Based on the database search results for the PPG master planned area (refer Appendix C), there are 18 globally significant threatened marine species with the potential to occur within the PPG master planned area and surrounds (though not able to be directly correlated with information from the Outlook Report 2014, refer Section 12 of Appendix B). There are also several marine fauna species present within the PPG master planned area which are considered to have a moderate to significant contribution to the OUV of the GBRWHA (eg Dugong, marine turtles and Australian humpback dolphin). This diversity is supported by a range of habitat present within the master planned area (eg coral reefs, seagrass meadows, mangrove communities).
- **Total species diversity (a diverse range of marine, intertidal and terrestrial flora and fauna species)** (refer Appendix B, Section 13.2)
 - The diversity of available habitat types within the PPG master planned area contributes to the total species diversity, including continental islands, coastal saltmarsh, coral reefs, seagrass meadows, mangrove communities, hard and soft benthic substrates and beach habitats. Though the habitats within the PPG master planned area and surrounds are not considered to be unique in the context of the GBRWHA, some habitats are considered important regionally (eg seagrass meadows) or nationally (eg The Narrows vast mangrove forests, migratory shorebird habitat). The diversity of seagrass species, mangrove species, and whale and dolphin species of the GBRWHA are well represented within the PPG master planned area and surrounds.

Twenty-two local attributes provide a **minor contribution** to the OUV of the GBRWHA within and surrounding the PPG master planned area (refer Table 4.1).

Table 5.1 lists the local expression of the attributes relevant to each of the four OUV criteria, categorising each attribute into the relevant contribution classifications (ie significant, moderate and

minor). This summary identifies that the local expression of OUV attributes within the PPG master planned area and surrounds contributes significantly to two of the four OUV criteria, including:


- **Criterion (ix)** – be outstanding examples representing significant ongoing ecological and biological processes in the evolution and development of terrestrial, freshwater, coastal and marine ecosystems and communities of plants and animals:
 - Vegetation of the continental islands
- **Criterion (x)** – contain the most important and significant natural habitats for in situ conservation of biological diversity, including those containing threatened species of OUV from the point of view of science or conservation:
 - Species of dolphin
 - Shorebirds and migratory birds
 - Plant species diversity and endemism
 - Vegetation on the continental islands.

Table 5.1 Locally expressed attributes within the PPG master planned area and surrounds and the contribution to the four OUV criteria

Relevant OUV contribution classification and the associated locally expressed attributes		
Significant	Moderate	Minor
<i>Criterion (vii) – contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance</i>		
<ul style="list-style-type: none"> ■ N/A 	<ul style="list-style-type: none"> ■ Breeding colonies of marine turtles ■ Marine turtle rookeries ■ Vast mangrove forests ■ Continental islands and green vegetated islands ■ Total species diversity 	<ul style="list-style-type: none"> ■ Fringing reefs ■ Coral species diversity ■ Fish species and diversity ■ Migrating whales ■ Species of dolphin ■ Green turtle breeding ■ Nesting turtles ■ Seagrass ■ Seabirds ■ Threatened and endangered flora and fauna species ■ Vegetated mountains ■ Mangroves ■ Beaches ■ Dune systems ■ River deltas ■ Diversity supporting marine fauna species (global conservation significance)
<i>Criterion (viii) – be outstanding examples representing major stages of earth's history, including the record of life, significant ongoing geological processes in the development of landforms, or significant geomorphic or physiographic features</i>		



Relevant OUV contribution classification and the associated locally expressed attributes		
Significant	Moderate	Minor
<ul style="list-style-type: none"> N/A 	<ul style="list-style-type: none"> Continental islands and green vegetated islands 	<ul style="list-style-type: none"> Fringing reefs Inshore turbid reefs Coral species diversity and extent Seagrass Mangroves Dune systems River deltas Connectivity: cross-shelf, longshore and vertical
<p>Criterion (ix) – be outstanding examples representing significant ongoing ecological and biological processes in the evolution and development of terrestrial, freshwater, coastal and marine ecosystems and communities of plants and animals</p>		
<ul style="list-style-type: none"> Vegetation of the continental islands 	<ul style="list-style-type: none"> Seagrass Traditional Owner interaction with the natural environment Total species diversity Marine water quality 	<ul style="list-style-type: none"> Fringing reefs Inshore turbid reefs Coral species diversity and extent Fish species and diversity Beds of <i>Halimeda</i> algae Seabirds Mangroves River deltas Connectivity: cross-shelf, longshore and vertical Diversity supporting marine fauna species (global conservation significance)
<p>Criterion (x) – contain the most important and significant natural habitats for in situ conservation of biological diversity, including those containing threatened species of OUV from the point of view of science or conservation</p>		
<ul style="list-style-type: none"> Species of dolphin Shorebirds and migratory birds Plant species diversity and endemism Vegetation on the continental islands 	<ul style="list-style-type: none"> Dugong Breeding colonies of marine turtles Marine turtle rookeries Seagrass Threatened and endangered flora and fauna species Diversity supporting marine fauna species (global conservation significance) Total species diversity Marine water quality 	<ul style="list-style-type: none"> Fringing reefs Inshore turbid reefs Coral species diversity and extent Fish species and diversity Species of whales Green turtle breeding Seabirds Mangroves Mangrove species diversity River deltas Connectivity: cross-shelf, longshore and vertical



The findings of this report will be included into the PPG master planning evidence base and will be used to review the master planning risk assessment report (and revise as required) and to provide input on the key environmental values to be monitored on an ongoing basis (ie PMM 2 of the draft master plan and preliminary draft port overlay). The information will also be utilised to assist in the future preparation of guidelines and management plans that are required under the PPG master plan preliminary draft port overlay.

It is recommended that as additional environmental values information and knowledge becomes available relevant to the local expression of the OUV attributes in the PPG master planned area and surrounds, that a review of the new information is undertaken, and this report is revised as required. Similarly, in the event that there is a significant change in the OUV of the GBRWHA, or the attributes that contribute to the OUV of the GBRWHA, this report and the findings may require review and revision to take into account potential changes to the presence or contribution of the local expression of the OUV of the GBRWHA.

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Appendix A

EMF Panel methodology for
identifying the local expression of
the OUV of the GBRWHA



Method for identifying the local expression of Outstanding Universal Value within the Great Barrier Reef World Heritage Area

Prepared by: Tom Kaveney, Adaptive Strategies Pty Ltd (2017)

The assistance of staff of the Department of State Development (Qld) and from Kerry Neil and Sally Wilson (GHD) and Rick Morton (RMC) is acknowledged and appreciated.

INTRODUCTION AND RATIONALE

This paper presents a method for identifying the local presence and importance of environmental attributes (also referred to as features) that contribute to the Outstanding Universal Value (OUV) of the Great Barrier Reef World Heritage Area (GBRWHA). It provides a mechanism to evaluate environmental attributes and their contribution to OUV and understand if the Integrity of the World Heritage property is altered in any way as a result of proposed master planning outcomes.

It is adapted from previously accepted approaches and references important policy such as:

- EPBC Act referral guidelines for the Outstanding Universal Value of the Great Barrier Reef World Heritage Area (Commonwealth of Australia 2014)
- Great Barrier Reef Region Strategic Assessment (GBRMPA 2014a)
- Great Barrier Reef Outlook Report (GBRMPA 2014b)
- Reef 2050 Long Term Sustainability Plan (Commonwealth of Australia 2015).

The Reef 2050 LTSP requires master planning to adopt the best practice principles identified in the Independent Review of the Port of Gladstone (CoA 2013) and integrate those principles into port planning and development.

Principle 1 of the Independent Review states that the OUV of the GBRWHA should be an intrinsic consideration in all aspects of environmental management and governance of ports in the Great Barrier Reef region. The Independent Review recognises that planning processes require an understanding of how the OUV of the GBRWHA is expressed in specific areas (i.e. each priority port).

The Ports Act requires master planning to manage impacts on all environmental values within and surrounding the master planned area (including those that contribute to OUV).

This proposed methodology will help determine which environmental attributes at each priority port contribute to OUV (i.e. the local expression of OUV) and also help document and understand how integrity is maintained and potentially impacted at a local level associated with implementation of the master plan. By using this methodology, future risk assessment processes for priority ports will indicate which environmental attributes contribute to the local expression of OUV. Potential impacts on all environmental attributes (regardless of their contribution to OUV) will also still be addressed by the risk assessment. It may be that some features that do not contribute to the local expression of OUV remain a high risk and need to be addressed through the master planning process.

This proposed methodology represents a stand-alone component of the master planning process. This supports transparency about how the OUV of the GBRWHA has been intrinsically considered in priority port master planning. One of the key benefits of the master planning process is that the methodology and subsequent identification of the local expression of OUV in a priority port master planned area will provide an input into future development assessment processes providing benefit for proposed projects.

This method for identifying the contribution to OUV was initially developed and applied to understand the relevant OUV attributes of the GBRWHA at the Port of Abbot Point for the purposes of a cumulative impact assessment of proposed port expansion (ELA and Open Lines 2013). This work was informed by contributions from eminent environmental scientists and world heritage experts, in particular:

- Associate Professor Peter Valentine (James Cook University)
- Professor Peter Harrison (Southern Cross University)
- Emeritus Professor Peter Saenger (Southern Cross University)
- Dr Peter Driscoll (consulting scientist).

This methodology recognises that for a World Heritage property of the size and diversity of the GBR it is necessary to develop a method that evaluates contributions to OUV at a local or site specific scale to ensure protective management measures can be identified.

The methodology has been adapted and applied to a number of projects and reports.

Formal studies that have previously used this methodology (or a variation on this methodology) include:

- Adaptive Strategies 2015. Port of Hay Point Sustainable Sediment Management Project (in prep).
- Adaptive Strategies and Open Lines Environmental Consulting (Open Lines) 2016. Abbot Point Strategic Planning Project – environmental, values input. Prepared for North Queensland Bulk Ports.
- Adaptive Strategies and Open Lines Environmental Consulting (Open Lines) 2015. Abbot Point Master Planning. Supporting report – environmental, social and cultural heritage values. Prepared for the Queensland Department of State Development.
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- Eco Logical Australia (ELA) and Open Lines Environmental Consulting (Open Lines) 2013. Abbot Point Cumulative Impact Assessment. Prepared for North Queensland Bulk Ports Corporation Limited.
- Worley Parsons Consulting (WPC) 2014. Abbot Point Port and Wetland Project. Preliminary Documentation.
- Worley Parsons Consulting (WPC) 2014. Abbot Point Dredging and Onshore Placement of Dredged Material Project.

Additionally the application of this methodology in the Abbot Point Cumulative Impact Assessment was used as a case study in the:

- State of Queensland (Qld) 2014. Great Barrier Reef Coastal Zone Strategic Assessment.
- Great Barrier Reef Marine Park Authority 2014. Great Barrier Reef Region Strategic Assessment: Strategic assessment report.

1. USING THIS METHODOLOGY

This methodology provides a guide for identifying the local presence and contribution of environmental attributes to the OUV within the GBRWHA. The methodology does not replace the need to engage and consult with experts, local managers and community on what might contribute to OUV at a local scale. A level of analysis and thought about contributions will also still be required.

The methodology should be applied with consideration of Commonwealth Government and Queensland Government legislation, and policies relevant to environmental protection, particularly to the OUV of the GBRWHA.

The methodology has been developed with a focus on supporting priority port master planning under the *Sustainable Ports Development Act 2015*, however it may form a reference tool for other initiatives and projects within the Great Barrier Reef (GBR) region.

The methodology has drawn on a number of informative sources and guidelines, which should be read in conjunction with this methodology:

- Commonwealth of Australia (CoA) 2015. Reef 2050 Long Term Sustainability Plan.
- Department of Environment (DoE) 2014. EPBC Act referral guidelines for the Outstanding Universal Value of the Great Barrier Reef World Heritage Area.
- Great Barrier Reef Marine Park Authority (GBRMPA) 2014a. Great Barrier Reef Outlook Report 2014.
- UNESCO 2016. Operational Guidelines for the Implementation of the World Heritage Convention. World Heritage Committee, Paris.

More specifically the methodology has been informed and has incorporated relevant elements from the:

- Commonwealth of Australia (CoA) 2016. Reef 2050 Plan – Policy guideline for decision makers.

The methodology will ensure that the OUV of particular development locations (for example, priority ports master planned areas) is properly considered and incorporated into future planning and decision-making.

2. METHOD FOR IDENTIFYING THE LOCAL PRESENCE OF OUV WITHIN THE GBRWHA

The method comprises two components:

1. Contextual information about OUV and the GBRWHA to provide a framework for the analysis; and
2. A process to be applied at the local scale.

CONTEXTUAL INFORMATION ABOUT OUV AND THE GBRWHA

All World Heritage properties have OUV. The concept of OUV underpins the basis for listing properties on the World Heritage List and protecting and managing World Heritage properties. OUV is defined in the *Operational Guidelines for the Implementation of the World Heritage Convention* (the Guidelines, UNESCO 2016). The definition states that OUV is “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.”

For a World Heritage Property to be considered to have OUV, it must:

- a) meet one or more of the ten World Heritage criteria listed in the Guidelines (UNESCO 2016);
- b) meet the conditions of integrity and/or authenticity (noting that authenticity is not relevant to the GBR as a natural area); and
- c) have an adequate protection and management system.

STATEMENT OF OUV FOR THE GBRWHA

The OUV of a World Heritage Property is articulated in a Statement of OUV that is normally prepared at the time of inscription. Besides describing the features of the property that contribute to its OUV, the Statement of OUV provides the basis for the future protection and management of the property.

A Statement of OUV was not prepared for the GBRWHA at the time of inscription in 1981. However a retrospective Statement of OUV was prepared and adopted by the World Heritage Commission in July 2012 (GBRMPA 2012). The statement includes the following:

“As the world’s most extensive coral reef ecosystem, the Great Barrier Reef (GBR) is a globally outstanding and significant entity... The latitudinal and cross-shelf diversity, combined with diversity through the depths of the water column, encompasses a globally unique array of ecological communities, habitats and species. This diversity of species and habitats, and their interconnectivity, make the GBR one of the richest and most complex natural ecosystems on earth. There are over 1,500 species of fish, about 400 species of coral, 4,000 species of mollusc, and some 240 species of birds, plus a great diversity of sponges, anemones, marine worms, crustaceans, and other species. No other World Heritage property contains such biodiversity. This diversity, especially the endemic species, means the GBR is of enormous scientific and intrinsic importance, and it also contains a significant number of threatened species. At time of inscription, the IUCN evaluation stated “...if only one coral reef site in the world were to be chosen for the World Heritage List, the Great Barrier Reef is the site to be chosen.”

CRITERIA FOR ASSESSING OUV

For a property to be listed, it must meet one or more of the following World Heritage criteria:

- Criterion (i) represent a masterpiece of human creative genius.
- Criterion (ii) exhibit an important interchange of human values, over a span of time or within a cultural area of the world, on developments in architecture or technology, monumental arts, town-planning or landscape design.
- Criterion (iii) bear a unique or at least exceptional testimony to a cultural tradition or to a civilization which is living or which has disappeared.
- Criterion (iv) be an outstanding example of a type of building, architectural or technological ensemble or landscape that illustrates (a) significant stage(s) in human history.

- Criterion (v) be an outstanding example of a traditional human settlement, land-use, or sea-use which is representative of a culture (or cultures), or human interaction with the environment especially when it has become vulnerable under the impact of irreversible change.
- Criterion (vi) be directly or tangibly associated with events or living traditions, with ideas, or with beliefs, with artistic and literary works of outstanding universal significance. (The Committee considers that this criterion should preferably be used in conjunction with other criteria).
- Criterion (vii) contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance.
- Criterion (viii) be outstanding examples representing major stages of earth's history, including the record of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features.
- Criterion (ix) be outstanding examples representing significant on-going ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals.
- Criterion (x) contain the most important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened species of Outstanding Universal Value from the point of view of science or conservation.

The GBRWHA meets four of the ten World Heritage criteria: Criterion (vii), Criterion (viii), Criterion (ix) and Criterion (x).

The table on the following pages is derived from the retrospective Statement of OUV and provides an outline of the features that contribute to the OUV of the GBRWHA.

It is also worth noting that the Statement of OUV for the GBRWHA acknowledges that, " Human interaction with the natural environment is illustrated by strong ongoing links between Aboriginal and Torres Strait Islanders and their sea-country, and includes numerous shell deposits (middens) and fish traps, plus the application of story places and marine totems." Accordingly, while not directly part of the listing criteria for the GBRWHA it is also worth recording and considering any important cultural heritage sites or links that exist within the study area. Such cultural features may be expressed through a clear and continuing linkage to the use and significance of the area, as demonstrated by the presence of artefacts, use or story telling.

Table 1: Description of the OUV against the relevant World Heritage Criteria

World Heritage listing criteria	OUV descriptions
<p><u>Criterion vii</u>: contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance</p>	<ul style="list-style-type: none"> • The GBR is one of a few living structures visible from space. • From the air the GBR is a vast mosaic pattern of reefs, islands and coral cays, which produce an unparalleled aerial panorama of seascapes comprising diverse shapes and sizes. • On many of the cays there are spectacular and globally important breeding colonies of seabirds and marine turtles. • Beneath the ocean surface, there is an abundance and diversity of shapes, sizes and colours. • Other superlative natural phenomena include the annual coral spawning, migrating whales, nesting turtles, and significant spawning aggregations of many fish species.
<p><u>Criterion viii</u>: be outstanding examples representing major stages of earth's history</p>	<ul style="list-style-type: none"> • The GBR extends 2,000 km along Queensland's coast and is a globally outstanding example of an ecosystem that has evolved over millennia • The area has been exposed and flooded by at least four glacial and interglacial cycles, and over the past 15,000 years reefs have grown on the continental shelf.

World Heritage listing criteria	OUV descriptions
	<ul style="list-style-type: none"> • During glacial periods, sea levels dropped, exposing the reefs as flat-topped hills of eroded limestone. Large rivers meandered between these hills and the coastline extended further east. • During interglacial periods, rising sea levels caused the formation of continental islands, coral cays and new phases of coral growth. • The environmental history of the GBR can be seen in cores of old massive corals. • Today the GBR forms the world's largest coral reef ecosystem, ranging from inshore fringing reefs to mid-shelf reefs, and exposed outer reefs, including examples of all stages of reef development.
<p><u>Criterion ix:</u> be outstanding examples representing significant ongoing ecological and biological processes</p>	<ul style="list-style-type: none"> • The globally significant diversity of reef and island morphologies reflects ongoing geomorphic, oceanographic and environmental processes. • The complex cross-shelf, longshore and vertical connectivity is influenced by dynamic oceanic currents and ongoing ecological processes such as upwellings, larval dispersal and migration. • Ongoing erosion and accretion of coral reefs, sand banks and coral cays combine with similar processes along the coast and around continental islands. • Biologically the unique diversity of the GBR reflects the maturity of an ecosystem that has evolved over millennia; evidence exists for the evolution of hard corals and other fauna. • Globally significant marine faunal groups include over 3,000 species of molluscs, over 1,500 species of fish, plus a great diversity of sponges, anemones, marine worms, crustaceans, and many others. • Human interaction with the natural environment is illustrated by strong ongoing links between Aboriginal and Torres Strait Islanders and their sea-country.
<p><u>Criterion x:</u> contain the most important and significant natural habitats for in-situ conservation of biological diversity</p>	<ul style="list-style-type: none"> • The enormous size and diversity of the GBR means it is one of the richest and most complex natural ecosystems on earth, and one of the most significant for biodiversity conservation. • The GBR contain ~ 400 species of corals in 60 genera. There are also large ecologically important inter-reefal areas. • The shallower marine areas support half the world's diversity of mangroves and many seagrass species. • The waters also provide major feeding grounds for one of the world's largest populations of the threatened dugong. • At least 30 species of whales and dolphins occur here, and it is a significant area for humpback whale calving. • Six of the world's seven species of marine turtle occur in the GBR. As well as the world's largest green turtle breeding site at Raine Island, the GBR also includes many regionally important marine turtle rookeries. • Some 242 species of birds have been recorded in the GBR.

INTEGRITY

All World Heritage properties are required to meet the conditions of integrity. This is defined by the Operational Guidelines (UNESCO 2016) as “a measure of the wholeness and intactness of the natural and/or cultural heritage and its features.” An assessment of the integrity of a property is required to determine the extent to which the property:

- Includes all elements necessary to express its OUV;
- Is of adequate size to ensure the complete representation of the features and processes which convey the property’s significance; and
- Suffers from adverse effects of development and/or neglect.

For properties nominated under criteria (vii) - (x), such as the GBR, bio-physical processes and landform features should be relatively intact. However, it is recognised within the Guidelines that areas may not be entirely pristine and that natural areas are in a dynamic state, and to some extent involve interactions with people.

In the case of the GBR this aspect is particularly important given the large size of the property; its location adjacent to and including human settlements and the pre-existing presence of human settlements, infrastructure and urban recreational and industrial activities within the property prior to its listing. Accordingly an important aspect of integrity is the state and condition of the property at time of listing. As such the (retrospective) Statement of OUV is an important reference document when considering integrity.

The Statement of OUV (GBRMPA 2012) concludes that in relation to integrity:

- The integrity of the GBR is “enhanced by the unparalleled size and current good state of conservation across the area.”
- While a number of natural pressures occur (e.g. cyclones and crown-of-thorns starfish outbreaks), given the scale of the GBR “most habitats or species groups have the capacity to recover from disturbance or withstand ongoing pressures.”
- “The property is largely intact and includes the fullest possible representation of marine ecological, physical and chemical processes from the coast to the deep abyssal waters enabling the key interdependent elements to exist in their natural relationships.”
- Effective conservation programs are essential in areas adjacent to the GBR (e.g. coastal catchments) given that some of the key processes of the reef occur outside its boundaries.

This methodology provides a means to develop a local statement of integrity for the area once the local attributes of OUV have been identified and their contribution evaluated.

WORLD HERITAGE AREA MANAGEMENT

All World Heritage properties are required to be adequately managed to ensure that their OUV (including the conditions of integrity at the time of inscription) are sustained or enhanced over time (UNESCO 2016).

The Operational Guidelines outline the broad level requirements for effective management. This includes:

- Appropriate legislative, regulatory and contractual measures;
- Boundaries for effective protection;
- Buffer zones; and
- Appropriate management systems.

Finally, the Operational Guidelines also provide for the sustainable use of World Heritage properties where that use does not adversely impact on the OUV of the property.

The Statement of OUV (GBRMPA 2012) outlines the management arrangements that are in place for the GBRWHA. Responsibility for management is shared between the Commonwealth and Queensland Governments. Broadly these arrangements are:

- GBRMPA (an independent Australian Government agency) is responsible for protection and management of the GBR Marine Park. They administer *The Great Barrier Reef Marine Park Act 1975*, which is a component of the broader environment portfolio.
- The Queensland Government is responsible for management of the Great Barrier Reef Coast Marine Park which is established under the *Marine Parks Act 2004* (Qld). This area is contiguous with the GBR Marine

Park and covers the “area between low and high water marks and many of the waters within the jurisdictional limits of Queensland.” The Queensland Government is also responsible for management of most of the islands within the GBR. Both marine parks have consistent zoning and permitted activity schemes.

- The Commonwealth Government is responsible for administration of the EPBC Act, which provides an overarching mechanism for protecting World Heritage areas from inappropriate development, including actions taken inside or outside the GBRWHA, which could impact on its value.
- A range of other Queensland and Commonwealth legislation also protects the World Heritage of the GBR, for example, by addressing such matters as water quality, shipping management, port planning, sea dumping (dredging), fisheries and environmental management.
- There are a range of non-statutory mechanisms in place that protect the World Heritage of the GBR (e.g. industry codes of practice, stewardship programs).

In addition to these broad governance arrangements, the Australian and Queensland Governments have introduced a number of administrative and guidance documents to help protect the GBR, these include:

- ***Intergovernmental Agreement***

In 2009, both the Australian and Queensland Governments signed the Great Barrier Reef Intergovernmental Agreement, formalising the approach to manage marine and land environments within the GBRWHA.

- ***GBR Strategic Assessment***

The Australian and Queensland Governments have completed two complimentary strategic assessments of the GBR region:

- State of Queensland (Qld) 2014. Great Barrier Reef Coastal Zone Strategic Assessments. July 2014
- Great Barrier Reef Marine Park Authority 2014a, Great Barrier Reef Region Strategic Assessment: Strategic assessment report. July 2014.

Strategic assessments enable a 'big-picture' approach to environment and heritage protection that provides certainty in the long term, by determining suitable areas for protection, development and the type of development that should be allowed and the conditions under which such development may proceed.

- ***Reef 2050 Long-Term Sustainability Plan***

Stemming from the outcomes of the strategic assessment a Reef 2050 Long-Term Sustainability Plan (CoA 2015) has been developed that targets areas of action and seeks to address gaps for future management of the GBRWHA.

- ***EPBC Act Referral Guidelines***

The EPBC Act protects the World Heritage values of the GBRWHA from actions that have, will have or are likely to have a significant impact on those values. The protection and management of World Heritage properties should ensure that their values at the time of inscription are sustained and enhanced over time. This is done primarily through the protection of a property's OUV. These referral guidelines are intended to provide guidance to proponents on the need to refer an action to the Commonwealth Minister for the Environment and Energy for assessment and a decision.

- ***Great Barrier Reef Outlook Report***

Produced every 5 years the GBR Outlook Report provides an assessment and findings on the Great Barrier Reef's health, pressures and likely future condition.

KEY ATTRIBUTES OF THE GBRWHA

The Statement of OUV identifies the key features that contribute to the OUV of the GBRWHA. It is noted in the EPBC Act Referral Guidelines (DoE 2014) that features may not be expressed equally over the whole GBRWHA and that features can change over time.

Table 2: Key features of OUV for the GBRWHA (DOE 2014)

Natural beauty and natural phenomena (Criterion (vii))	Major stages of the Earth's evolutionary history (Criterion (viii))	Ecological and biological processes (Criterion (ix))	Habitats for conservation of biodiversity (Criterion (x))
Superlative natural beauty above and below the water	Continental shelf	Significant diversity of reef and island morphologies that reflects ongoing geomorphic, oceanographic and environmental processes	Diversity supporting marine and terrestrial species (global conservation significance)
String of reef structures	Flat-topped hills of eroded limestone	Cross-shelf, longshore and vertical connectivity	Coral reefs (400 species of corals in 60 genera)
Mosaic patterns of reefs, islands and coral cays that produce an unparalleled aerial panorama of seascapes	Continental islands	Coral reefs, sand banks and coral cays	Diversity of mangroves
Green vegetated islands	Coral cays	Beds of <i>Halimeda</i> algae	Diversity of seagrass
Spectacular sandy beaches	New phases of coral growth	Evolution of hard corals	Dugong
Azure waters	Old massive corals	Other fauna, including microfauna	Species of whales
Vast mangrove forests	Coral reef ecosystem	Over 4000 species of molluscs and over 1500 species of fish, plus a great diversity of sponges, anemones, marine worms, crustaceans	Species of dolphins
Vegetated mountains	Inshore fringing reefs, mid-shelf reefs, and exposed outer reefs	Vegetation of the cays and continental islands	Humpback whale calving
Lush rainforest gullies	Processes of geological and geomorphic evolution	Important role of birds, such as the pied imperial pigeon, in processes such as seed dispersal and plant colonisation	Marine turtles
Breeding colonies of seabirds and marine turtles	Unique and varied seascapes and landscapes		Green turtle breeding

Natural beauty and natural phenomena (Criterion (vii))	Major stages of the Earth's evolutionary history (Criterion (viii))	Ecological and biological processes (Criterion (ix))	Habitats for conservation of biodiversity (Criterion (x))
Green turtle breeding	Continental slope		Marine turtle rookeries
Over-wintering butterflies	Deep oceanic waters		242 species of birds
Hard and soft corals	Abyssal plains		22 seabird species breeding (cays and some continental islands have globally significant breeding sites)
Thousands of species of reef fish			Plant species and diversity and endemism (species being unique to a defined geographic location)
Coral spawning			Coral cays
Migrating whales			
Nesting turtles			
Significant spawning aggregations of many fish species			

3. PROCESS FOR DETERMINING LOCAL REPRESENTATION AND CONTRIBUTION OF OUV

The process for determining the local representation and contribution of OUV within the GBRWHA (that is, the local expression of OUV) is based around understanding which attributes are present and how important those attributes are within the context of the wider GBRWHA.

Most environmentally important areas are made up of multiple attributes, such as various landforms, seascapes or biological entities such as species, habitats and ecosystems. For instance the presence of important populations of migratory shorebirds will be achieved through the presence of multiple species, varying habitats (feeding, nesting, roosting) and locations.

In the case of the GBR, its OUV is a reflection of the collective expression of a vast number of values. As such, the process for determining the local expression of OUV involves:

1. Identification of the attributes that occur within the local area (or surrounds)
2. Analysis of the ‘importance’ of the presence of those attributes within the context of the broader GBRWHA.

In other words words “what” and “where” are attributes located and “why” are they important in the context of the GBR’s World Heritage listing?

Figure 1 outlines the process to follow to identify attributes and there contribution to the local expression of OUV. The process is then further explained below.

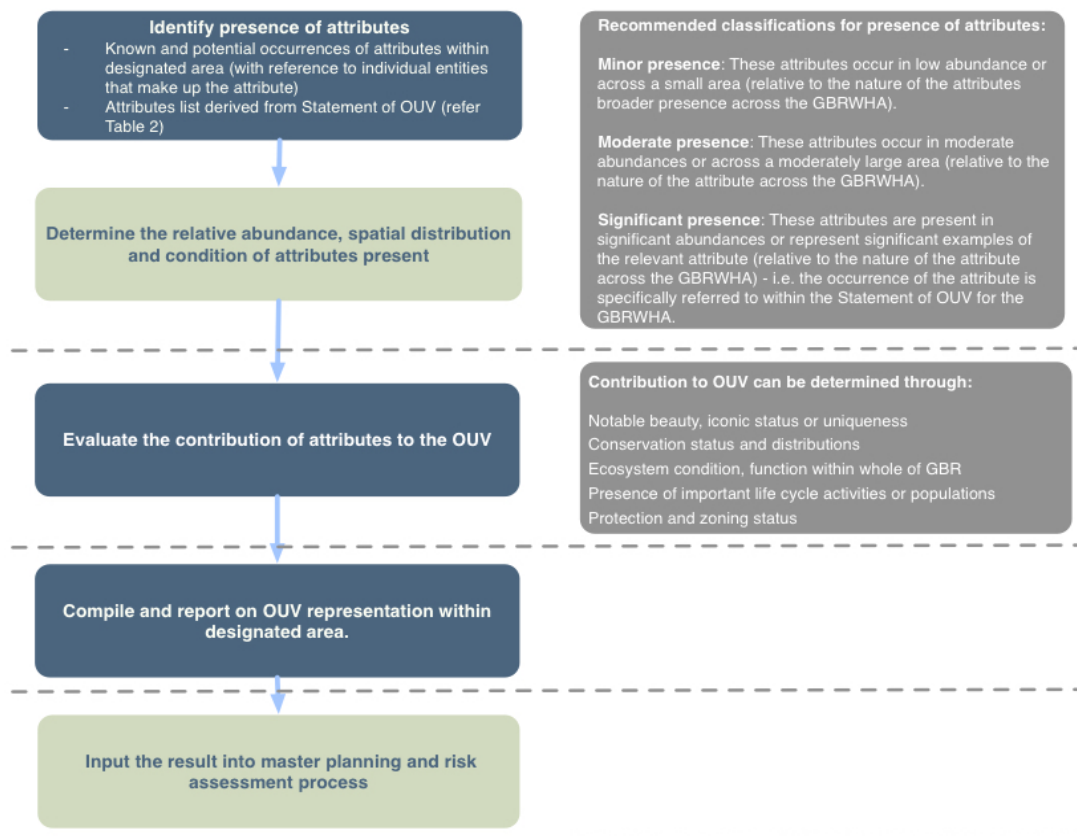


Figure 1: Process for determining local contribution to OUV

IDENTIFICATION OF ATTRIBUTES

Identification of attributes that occur within the local area (or surrounds) should be based on the best available information.

Information can be derived from a range of sources and may not require additional specific studies if sufficient information already exists. Likely sources of information include:

- Port environmental management plans
- Port monitoring programs (e.g. regular coral, seagrass, water quality data)
- Port customer monitoring (e.g. tailwater and dust data)
- Local Government Environment Plans and studies
- Baseline studies for development proposals (Environmental Impacts Statements, etc.)
- Great Barrier Reef Region Strategic Assessment (GBRMPA 2014a)
- Great Barrier Reef Coastal Zone Strategic Assessment (State of Queensland 2014)
- Great Barrier Reef Outlook Report (GBRMPA 2014b)
- Qld Department. of the Environment and Heritage Protection databases
- Commonwealth DoEE Protected Matters Search Tool
- Subject matter experts, traditional owners and local residents.

It may also be necessary to commission specific studies where gaps in information are identified to ensure that all relevant environmental attributes are addressed, outlining the respective condition and contribution of those attributes. Significantly contributing attributes can then be considered further as part of the environmental risk assessment process.

Accordingly, an early step in the process is to identify which environmental attributes are present and need to be considered as contributing to OUV. The GBR Outlook Report, the EPBC Act listings for matters of National Environmental Significance (such as threatened species and migratory species), the Nature Conservation Act listings and other materials and publications provide a useful reference for this work.

PRESENCE OF ATTRIBUTES

For those attributes that are present, an analysis should be carried out to determine the location, extent and distribution of the attribute within the study area. This should where possible be accompanied by information (spatial or contextual) on the distribution and occurrence more broadly within the GBRWHA or adjacent coastal areas. The following terms and definitions are recommended as a means of classifying the presence of attributes:

- **Minor presence:** These attributes occur in low abundance or across a small area (relative to the nature of the attributes broader presence within the GBRWHA). Noting that a low abundant attribute that is rare within the GBRWHA may still be important. Temporary fluctuations or seasonal variation should be considered. Example of low abundance might include:
 - Small isolated natural ecosystems (coral, vegetation communities etc) of less than 10 or 20 hectares
 - Small number of non breeding species (turtles, dolphins dugong etc) that are foraging in the area
 - Individual occurrences of natural attributes (headlands, beaches, islands) that are not unique or notable.
- **Moderate presence:** These attributes occur in moderate abundance or across a moderately large area (relative to the nature of the attribute across the GBRWHA). Examples may include:
 - Migratory shorebird aggregations of less than 0.1% of flyway population
 - Endangered ecosystems and habitats of 20-100 h
 - Minor nesting beaches for turtles (e.g. with small numbers of nesting turtles <20)
- **Significant presence:** These attributes are present in significant abundances or represent significant examples of the relevant attribute (relative to the nature of the attribute across the GBRWHA). Examples:
 - Raine Island turtle nesting
 - Caley Valley wetland migratory bird habitats
 - Whitsunday Islands and beaches
 - Northern GBR reefs and islands

ATTRIBUTE CONTRIBUTION TO OUV

The specific attributes of the OUV of the GBRWHA in relation to the World Heritage criteria are numerous and collectively contribute to the OUV of the GBR. The occurrence and distribution of these attributes are inconsistently spread across the whole 348,000 sq. km of the World Heritage Area with some more numerous than others.

A particular attribute may be present in a particular location and may well be of importance due to its locally high value in terms of representation, appreciation or biological contribution; while in another area it may be a lower value as it does not provide the same ecological function (e.g. recruitment and breeding), representation of heritage or amenity. The influences of human appreciation, geography, climatic distribution, geology, oceanography and ecological life cycles all influence where and at what level a particular attribute may contribute to OUV.

Many of the attributes presented in the Statement of OUV are relevant to several listing criteria. Therefore, any analysis of OUV may be easier to structure around individual attributes rather than the listing criteria *per se*.

The following terms and definitions are recommended as a means of classifying the contribution of locally occurring attributes to OUV:

- **Minor contribution:** The attribute is present however it occurs in low abundance or singularly and is not:
 - essential to the sustainability of the attribute (e.g. substantial breeding population)
 - recognised as a key feature of the GBRWHA
 - included in the retrospective Statement of OUV
 - iconic, unique or a high quality example of the attribute.
- **Moderate contribution:** These attributes occur in moderate abundance or across a moderately large area but are not the prime occurrence or representation of the attribute within the GBRWHA. The attribute does however represent an attribute for which the GBR was listed as World Heritage.
- **Significant contribution:** These attributes represent locally important examples of the attribute relative to the nature of the attribute across the GBRWHA. Such an attribute may be specifically referred to within the Statement of OUV for the GBRWHA or defined by other legislation, planning instrument or environmental assessment (e.g. GBR Outlook Report). The occurrence of the attribute locally is a prime example mentioned in the retrospective Statement of OUV. Prime examples are listed in Tables 3 to 6. These attributes should be considered environmental values.

PROCESS FOR THE DETERMINATION OF OUV AT A LOCAL SCALE

The determination of whether the local presence of an attribute is making a contribution to OUV should consider:

- The notable or iconic status of the attribute locally, is it recognised or mentioned in publications as a prime example or value of the region. For instance, the attribute is essential for maintaining the beauty of the WHA. Is it a site or attribute that is mentioned in the retrospective Statement of OUV, a local focal point or significant Reef related tourist attraction?
- The conservation status of the attribute at a National or State level – is the attribute listed under legislation (e.g. threatened species, Ramsar site, Heritage register, etc.). Does its local presence meet EPBC Act (or other) definitions of significance, important population or critical habitat?
- What is the condition/trend of the attribute as recorded in the latest GBR Outlook Report. Rarer attributes in good condition will be of greatest value but also attributes that are in decline may require particular focus.
- Does the local presence of the attribute contribute to the ongoing sustainability of the attribute more broadly, for instance key questions to ask are:
- For biodiversity attributes, is the local presence a key aggregation, breeding, feeding or recruitment location? Does it support an important proportion of the greater population?
- Would the loss or decline of the local attribute affect the overall conservation status of the attribute (potentially altering its legal listing status)?
- Is the local presence, unique, unusual or highly notable? Is it a prime example of the attribute locally or regionally or do better and multiple examples exist elsewhere with the GBR region?

-
- Is the presence of the attribute specifically protected in addition to National and State legislative protections (e.g. local or regional reserve)?
 - Would the loss of the attribute locally result in a loss or significant decline in the OUV of the whole of the GBRWHA? For instance, would the loss put the GBR at risk of being listed as a WHA in danger? (refer to World Heritage Guidelines).

The following series of tables provide an outline of specific examples and descriptions of what may constitute a contribution to OUV for each attribute.

TABLE 3: CONTAIN SUPERLATIVE NATURAL PHENOMENA OR AREAS OF EXCEPTIONAL NATURAL BEAUTY AND AESTHETIC IMPORTANCE (CRITERION VII)

The following table identifies the key attributes that contribute to the OUV of natural beauty and natural phenomena (Criterion vii) of the GBRWHA. The condition and trend for the attribute is taken from GBR Outlook Report 2014 – these are GBR wide ratings that provide context only. The final column provides examples or descriptions of when each attribute might be considered to make a significant contribution to OUV.

GRB wide attributes – Natural beauty and natural phenomena (Criterion (vii))	GBR Wide Condition	GBR Wide Trend	Significant contribution to OUV (with examples)
Superlative natural beauty above and below the water	Good	-	Superlative natural beauty is especially evident in the northern and offshore coral reefs and aerial vistas. Hinchinbrook Island is an example of a location that has retained its spectacular natural scenery. Coral spawning, migrating whales, nesting turtles and spawning aggregations of fish species are all contributors to the definition of superlative natural beauty.
Mosaic patterns of reefs, islands and coral cays that produce an unparalleled aerial panorama of seascapes	Good	-	Pristine and good condition natural environments are considered significant contributions to OUV and would include: <ul style="list-style-type: none"> • Continental islands with vegetation coverage and sandy beaches • Coral cays and fringing reefs. • Reef systems with corals, fish and other marine life. • Abundance of natural features, reefs, islands.
Azure water	-	-	
String of reef structures	Poor	Deteriorating	Prime examples include: Whitsunday Islands, Princess Charlotte Bay, outer reef systems and the outer Capricorn-Bunker Group.
Coral assemblages of hard and soft corals	Poor	Deteriorating	Most coral spawning occurs annually in October or November and is a natural phenomenon that attracts interest from scientists and tourists. Essential for the continued health and growth of the coral reef system.
Coral spawning	-	-	
Thousands of species of reef fish & significant spawning aggregations of fish	Good	Deteriorating	Genetic connectivity between reef areas. Pristine and good condition reefs with a high abundance and diversity of species
Migrating whales	Good	Improving	Dwarf minke whales continue to visit the northern region each winter. Populations of humpback whales continue to increase - notable aggregation areas for breeding and resting are well documented, however, with an increasing population new areas may arise at different times.

GRB wide attributes – Natural beauty and natural phenomena (Criterion (vii))

Significant contribution to OUV (with examples))

	GBR Wide Condition	GBR Wide Trend	
Breeding colonies of marine turtles	Poor	No consistent trend	Six of the world's seven species of marine turtle occur within the GBR, with globally significant nesting areas for four species: loggerhead, green, hawksbill and flatback turtles. The significance of Raine Island as an important turtle rookery is recognised in the World Heritage listing.
Green vegetated islands	Good	Deteriorated	See above
Spectacular white sandy beaches	Good	Stable	See above
Vast mangrove forests	Good	Stable	The highest diversity of mangrove forests occurs in the far north. Vast forests in Hinchinbrook Channel. Many bays and river systems support areas of mangrove forest. Good connectivity between catchments, mangrove communities and coral reefs provide flow-on benefits for coastal ecosystems and contribute to coral reef resilience.
Vegetated mountains	-	-	See above
Lush rainforest gullies	Good		Wet Tropics Rainforest, which is inscribed separately on the World Heritage List.
Over-wintering butterflies	-	-	Seen by the Australian Government to enhance the aesthetic value of the GBR. Occur on islands and on the edge of tropical rainforest.
Breeding colonies of seabirds	Poor	No consistent trend	Islands and cays supporting breeding populations. Important seabird areas include Raine Island, Michaelmas Cay, the islands of the Capricorn-Bunker Group and the cays of the Swain Reefs.
Green turtle breeding & nesting turtles	Poor	No consistent trend	High density turtle nesting locations and sites where nesting and recruitment help support and maintain the wider population such as Raine Island. Other important nesting islands include Milman Island, Moulter Cay, Wild Duck Island. Peak Island and cays of the Capricorn-Bunker Group.

TABLE 4: BE OUTSTANDING EXAMPLES REPRESENTING MAJOR STAGES OF EARTH'S HISTORY, INCLUDING THE RECORD OF LIFE, SIGNIFICANT ON-GOING GEOLOGICAL PROCESSES IN THE DEVELOPMENT OF LANDFORMS, OR SIGNIFICANT GEOMORPHIC OR PHYSIOGRAPHIC ATTRIBUTES (CRITERION VIII)

The following table identifies the key attributes that contribute to the OUV of major stages of Earth's evolutionary history (Criterion viii) of the GBRWHA. The condition and trend for the attribute is taken from GBR Outlook Report 2014 – these are GBR wide ratings that provide context only. The final column provides examples or descriptions of when each attribute might be considered to be contributing to OUV.

GRB wide attributes – Major stages of the Earth's evolutionary history (Criterion (viii))	GBR Wide Condition	GBR Wide Trend	Significant contribution to OUV (with examples)
Unique and varied seascapes and landscapes	Poor	-	<p>Unique, diverse, extensive and natural vistas and ecosystems.</p> <p>Seascapes include island groups such as the Whitsunday Group of islands that has a broad diversity of islands, natural features and sea passages. Outer reef systems, coral cays and fringing reefs.</p> <p>Landscapes including continental islands with vegetation cover, mainland coastal mountains, wetlands and mangroves. Sandy beaches and river systems.</p> <p>Unique landscapes include the adjacent Wet Tropics World Heritage Area which extends from Cooktown to Townsville (contains almost 30 rainforest communities, with many species in many layers of vegetation).</p>
Continental shelf	-	-	The continental slope is a complex area composed of relic reefs, landslides, canyons and plateau that extends down to more than 1000 metres. It comprises approximately 15 per cent of the Region or about 51,900 square kilometres.
Flat-topped hills of eroded limestone	-	-	Large reef complexes associated with outer regions of the GBR provide evidence of flat topped hills of eroded limestone which developed during glacial periods when sea levels dropped.
Continental islands	-	-	<p>Islands that are geologically related to the Australian mainland and were typically formed when rising seas (for example, at the end of an ice age) cut off part of the land from the continent.</p> <p>Inshore islands such as Curtis Island and Magnetic Island and offshore groups such as the Brampton and Lindeman island groups.</p>

GRB wide attributes – Major stages of the Earth’s evolutionary history (Criterion (viii)) **GBR Wide Condition** **GBR Wide Trend** **Significant contribution to OUV (with examples)**

Coral cays			
Old massive corals			Large and intact areas of coral reefs and cays.
Coral reef ecosystem	Poor	Decline	The islands and reefs of the Capricorn and Bunker Island group provide an example of an ecosystem that has evolved over millennia, has all stages of reef development and almost all geomorphological evolutionary processes remain intact.
Inshore fringing reefs, mid-shelf reefs, and exposed outer reefs including examples of all stages of reef development	Poor	Decline	
Processes of geological and geomorphic evolution	-	-	Coral reefs, cays and continental islands. Most components of the GBR complex (coral reefs, cays and continental islands) provide examples of geological and geomorphic evolution.
Deep oceanic waters	-	-	Deep oceanic waters east of the Great Barrier Reef in the Coral Sea (an area that is still experiencing geological formation processes as partly evidenced by seismic activity).

TABLE 5: BE OUTSTANDING EXAMPLES REPRESENTING SIGNIFICANT ON-GOING ECOLOGICAL AND BIOLOGICAL PROCESSES IN THE EVOLUTION AND DEVELOPMENT OF TERRESTRIAL, FRESH WATER, COASTAL AND MARINE ECOSYSTEMS AND COMMUNITIES OF PLANTS AND ANIMALS (CRITERION IX)

The following table identifies the key attributes that contribute to the OUV of natural beauty and natural phenomena (Criterion ix) of the GBRWHA. The condition and trend for the attribute is taken from GBR Outlook Report 2014 – these are GBR wide ratings that provide context only. The final column provides examples or descriptions of when each attribute might be considered to be contributing to OUV.

GRB wide attributes – Ecological and biological processes (Criterion (ix))	GBR Wide		Significant contribution to OUV (with examples)
	Condition	Trend	
Significant diversity of reef and island morphologies that reflects ongoing geomorphic, oceanographic and environmental processes	-	-	Coral reefs are the cornerstone of the Great Barrier Reef ecosystem and its evolutionary history. Their species diversity, habitat and natural beauty are major contributors to the Reef's outstanding universal value as a world heritage area. The Great Barrier Reef is the world's largest coral reef ecosystem; ranging over 14 degrees in latitude and comprising more than 2900 separate coral reefs.
Vegetation of the cays and continental islands	-	-	Large and intact areas of coral reefs and cays.
Evolution of hard corals	-	-	The islands and reefs of the Capricorn and Bunker Island group provide an example of an ecosystem that has evolved over millennia, has all stages of reef development and almost all geomorphological evolutionary processes remain intact.
Coral reefs, sand banks and coral cays	-	-	
Cross-shelf, longshore and vertical connectivity	Good	Stable	The Region has a total water volume of around 7200 cubic kilometres. This open water habitat is critical to the healthy functioning of the whole Great Barrier Reef ecosystem. It provides connectivity between other habitats, from the coast to beyond the continental slope. Open water is dominated by microorganisms (plankton) and supports a range of other plants and animals such as invertebrates, fishes, reptiles and marine mammals.
Beds of <i>Halimeda</i> algae	Very Good	Stable	There is limited information on <i>Halimeda</i> banks. Given the habitat is remote and in deep water it is generally isolated from direct land-based impacts or development.

GRB wide attributes – Ecological and biological processes (Criterion (ix))

Significant contribution to OUV (with examples)

GBR Wide Condition
GBR Wide Trend

Other fauna, including microfauna - - Little is known about most invertebrates. Changing environmental conditions in central and southern inshore areas, as well as some fishing activity, are likely to have affected invertebrates. Unlikely to be present in a manner that contributes to OUV.

Over 4000 species of molluscs and over 1500 species of fish, plus a great diversity of sponges, anemones, marine worms, crustaceans and many others Good Decline Abundant biodiversity is present in association with coral reefs and other shallow water environments.

Important role of birds, such as the pied imperial pigeon, in processes such as seed dispersal and plant colonisation. Poor - Islands and cays within the Great Barrier Reef support breeding populations of 20 seabird species. It is estimated that between 1.4 and 1.7 million seabirds breed throughout the Great Barrier Reef each year. This represents more than 25 per cent of Australia’s tropical seabirds, more than 50 per cent of offshore–foraging black noddies and approximately 25 per cent of wedge-tailed shearwaters, brown and masked boobies and red-tailed tropic birds.²²⁴ The number of non-breeding birds (birds which use the Region for feeding but breed elsewhere) is estimated to be about 425,000, giving a total seabird population that may exceed two million.

Key locations include wetlands, shorelines, offshore islands and coral cays. Pied imperial pigeon is found on offshore islands and the mainland of northern and north-eastern Australia. It is found in a variety of wooded habitats, such as mangroves, rain forest and in forests of Eucalyptus and Melaleuca. Island habitats provide a refuge for the species away from most human development.

TABLE 6: THE MOST IMPORTANT AND SIGNIFICANT NATURAL HABITATS FOR IN-SITU CONSERVATION OF BIOLOGICAL DIVERSITY, INCLUDING THOSE CONTAINING THREATENED SPECIES OF OUTSTANDING UNIVERSAL VALUE FROM THE POINT OF VIEW OF SCIENCE OR CONSERVATION (CRITERION X)

The following table identifies the key attributes that contribute to habitats for conservation of biodiversity (Criterion x) of the GBRWHA. The condition and trend for the attribute is taken from GBR Outlook Report 2014 – these are GBR wide ratings that provide context only. The final column provides examples or descriptions of when each attribute might be considered to be contributing to OUV.

GRB wide attributes – Habitats for conservation of biodiversity (Criterion (x))		GBR Wide Condition	GBR Wide Trend	Significant contribution to OUV (with examples)
Diversity supporting marine and terrestrial species (global conservation significance)	Good	Decline	See tables above.	
Coral reefs (400 species of corals in 60 genera)	Poor	Decline	See tables above.	
Diversity of mangroves	Good	Stable	See tables above.	
Diversity of seagrass	Poor	Decline	See tables above.	
Dugong	Poor	Decline	The Region is home to a globally significant population of dugongs and provides essential habitat and connectivity between populations in the Torres Strait and the waters off south-east Queensland. The Region's population is recognised as contributing to its outstanding universal value. Seagrass meadows provide the key habitat area, many of which are included in reserves and dugong protection areas.	
Species of whales	Good	Improve	See above.	
Species of dolphins	Good	Decline	There is estimated to be 18 species of dolphin throughout the GBRWHA, with some species solely inhabiting inshore waters and others typically being found far from the coast.	

GRB wide attributes – Habitats for conservation of biodiversity (Criterion (x))

GBR Wide Condition

GBR Wide Trend

Significant contribution to OUV (with examples)

It is estimated that there are less than 100 Australian snubfin dolphins in Cleveland–Halifax Bays and about 70 in Keppel Bay–Fitzroy River. An aggregation has also been recorded at Princess Charlotte Bay–Bathurst Bay on Cape York Peninsula. There have been population estimates for Indo-Pacific humpback dolphins in Cleveland Bay (50 or less); the Capricorn coast (about 64); Keppel Bay (about 107); and Port Curtis (about 85).

Humpback whale calving

Good

Improve

The humpback whale is continuing to recover strongly after being decimated by whaling. From an east Australian population as low as 500 animals when whaling ceased, numbers have grown consistently with an estimated annual recovery rate of between 10.5 and 12.3 per cent. The most recent 2010 survey provides no evidence that the rate of population growth is slowing significantly with an absolute population abundance in that year of over 14,500.

Key locations include the Whitsunday Islands where calving occurs.

Marine turtles

Poor

-

See tables above.

Green turtle breeding

Poor

-

Marine turtle rookeries

242 species of birds

Poor

-

See tables above.

22 seabird species breeding (cays and some continental islands have globally significant breeding sites)

-

-

See tables above.

Plant species and diversity and endemism

Good

Decline

The region supports 1000s of species of plants, many of which are endemic to the region. Notable are the vast and diverse mainland mangrove forests and, in places, unique island vegetation.

4. EXPRESSION OF OUV

From the analysis undertaken it should be possible to identify those attributes that are contributing to each of the four (4) listing criteria in a manner that supports and validates the inclusion of the GBR on the World Heritage list.

Where the contribution is significant (i.e. unique, notable of ecological importance) it is reasonable to assume that the presence and function of that attribute is part of the OUV of the GBRWHA. Where the contribution is moderate or minor then the representation of OUV locally can be considered to be non-critical to maintaining the World Heritage values of the whole GBR.

Detailed below are the example results from the Port of Abbot Point (Adaptive Strategies 2015) to demonstrate how the OUV attributes for a particular area can be described using the methodology in this paper.

ABBOT POINT EXAMPLE

The evaluation of key attributes of the OUV of the GBRWHA expressed within the Abbot Point study area has determined that there is one attribute providing a significant contribution and a number of attributes providing a minor contribution to OUV in the study area. No attributes were found to have a moderate contribution within the study area. These attributes are summarised in Table 7.

Table 7: Example of OUV contributions from the Port of Abbot Point

Attribute	OUV Criteria contribution				Summary of contribution	Environmental value
	VII	VIII	IX	X		
Diversity supporting marine and terrestrial species (global conservation significance)	Sig			Sig	There is a <u>significant</u> contribution to OUV from migratory birds within the Caley Valley Wetlands, with important populations of four species occurring within the study area. The habitats of the wetland also support in excess of 15 species of migratory birds making it critical habitat (EPBC Act definition).	Important populations of Latham's Snipe; Red-necked Stint; Australian painted snipe and Sharp-tailed sandpiper occur within the wetland. A diverse range of other migratory bird species also occurs.
Marine turtles	Min			Min	There is a <u>minor</u> contribution to OUV from marine turtles, with low-level Green turtle breeding occurring on adjacent beaches.	Green turtles
Migrating whales	Min			Min	There is a <u>minor</u> contribution to OUV from migrating whales, with Humpback whales being sighted within the port area occasionally.	Humpback whales
Species of dolphin				Min	There is a <u>minor</u> contribution to OUV from inshore dolphins within the port area.	Indo-pacific humpback and Snubfin dolphins
Mangrove forests	Min			Min	There is a <u>minor</u> contribution to OUV from mangroves fringing the coast.	Various Mangrove sp.
Seagrass habitat				Min	There is a <u>minor</u> contribution to OUV from seagrass that has been recorded in the nearshore areas of the port.	Seagrass sp.

The findings indicate that the OUV of the GBRWHA is expressed at Abbot Point through the presence of important populations of shorebirds and minor occurrences of marine species and terrestrial and marine ecosystems.

5. LOCAL STATEMENT OF INTEGRITY

From the analysis undertaken to identify the attributes contributing to OUV it will now be possible to evaluate the wholeness and intactness of these attributes in order to prepare a 'Local Statement of Integrity' for the local area.

The Local Statement of Integrity should contain:

- Information on the Integrity of the wider GBR World Heritage Area– see retrospective Statement of OUV
- Contextual information on the relevant priority port in relation to the World Heritage listing of the GBR – includes establishment date, size, boundary implications, areas affected, changes in use
- Summary of the significant local contributions to OUV
- A brief commentary on whether the proposed master plan will lead to a loss or alteration to the Integrity of the World Heritage Area.

The Local Statement of Integrity should consider the definition, advice and criteria contained within the Operational Guidelines (UNESCO 2016) in combination with the outcomes of the OUV assessment and the proposed master planning outcomes. When considering integrity it is also important to benchmark the analysis in the context of the (retrospective) Statement of OUV at the time of listing, including the pre-existing condition and use of the local area. In the GBR the existing human activities: commercial, industrial, recreational and social; were all recognised at the time of listing. Management of these activities forms part of the ongoing operational aspects of the GBRWHA.

It is also worth noting that where a attribute is contributing significantly to OUV (i.e. unique, notable of ecological importance) it is reasonable to assume that the presence and function of that attribute is part of the integrity of the property in terms of relative intactness, wholeness and condition. Where the contribution is moderate or minor then the condition locally of that attribute can be considered to be less critical to maintaining integrity.

The following criteria and considerations are provided to help evaluate the information that will inform a Local Statement of Integrity.

Table 8: Considerations for developing a Local Statement of Integrity

UNESCO CRITERIA	CONSIDERATIONS
Includes all elements necessary to express its Outstanding Universal Value	<ul style="list-style-type: none"> - Will the relevant local area continue to support the significantly contributing attributes of OUV in a sustainable and representative manner? - Will the diversity of the WH property be altered or diminished? - Will the significantly contributing attributes be maintained and protected to ensure the property continues to represent high levels of biological diversity?
Is of adequate size to ensure the complete representation of the features and processes which convey the property's significance	<ul style="list-style-type: none"> - Is the overall size of the WH property being altered or changed in a material way? - Will the boundary of the WH property be altered as a result of proposed planning and development? - Will the overall significance of the property be altered in any way? - Will the overall size and ecosystem functions within the WH property be altered in any way?
Suffers from adverse effects of development and/or neglect	<ul style="list-style-type: none"> - Will proposed plans and development result in an unmanaged level of impact or neglect to the local attributes that significantly contribute to OUV? - Will significantly contributing attributes be maintained and managed? - Will any impacts to significantly contributing attributes of natural beauty be assessed, minimised and managed as development proceeds?

It is also important to note and understand that a port master plan does not alter the need to conduct detailed environmental impact assessment for any proposed development. Any development that may impact significantly on World Heritage values will be required to be assessed and approved by the Commonwealth Minister for the Environment under the *Environment Protection and Biodiversity Conservation Act 1999*. Impacts to the integrity of the World Heritage Area would form part of any such assessment.

6. FUTURE MANAGEMENT

The analysis should also contribute to an understanding of the management measures required to ensure that the attributes are managed alongside the ongoing development of a priority port. The result from an evaluation of the OUV of the GBRWHA at the local level can be fed into the evidence base and Environmental Management Frameworks for each priority port to enhance master planning outcomes.

7. REFERENCES

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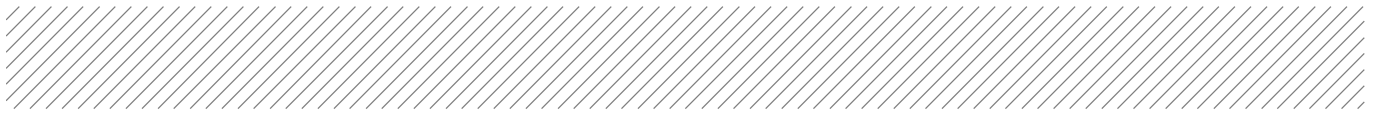
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Appendix B

Justification for the presence and contribution classifications for the locally expressed attributes of the OUV of the GBRWHA



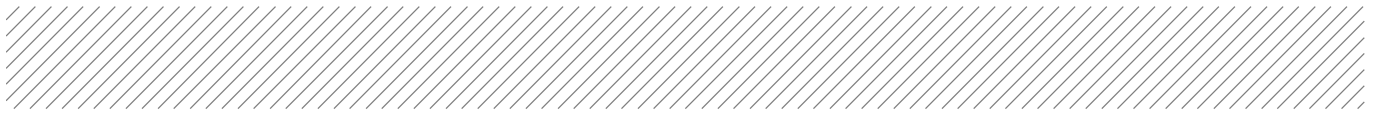


Appendix B – Justification for the presence and contribution classification for the local expression of attributes of the OUV of the GBRWHA

This appendix has been prepared to be read in conjunction with the main report (Priority Port of Gladstone Master Planning Local expression of the OUV of the GBRWHA, Rev 3, 30 January 2017, Aurecon), and is not intended to be a standalone report.

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1 Coral reefs

The relevant information from the retrospective statement of OUV and the Outlook Report 2014 relating to coral reefs is summarised in Table 1.1, with respect to the local expression of the OUV of the GBRWHA for the PPG master planned area and surrounds.

Table 1.1 OUV of the GBRWHA: Coral reefs

Attribute	Statement of OUV	GBR Outlook Report 2014			Relevant OUV criteria			
		GBR wide: Significant contribution to OUV	GBR wide condition	GBR wide trend	vii	viii	ix	x
Fringing reefs	<ul style="list-style-type: none"> The GBRWHA forms the world's largest coral reef ecosystem, ranging from inshore fringing reefs to mid-shelf reefs, and exposed outer reefs, including examples of all stages of reef development 	<ul style="list-style-type: none"> Species diversity, habitat value and natural beauty of the coral reefs in the GBRWHA are major contributors to the GBR's OUV as a world heritage area 	<ul style="list-style-type: none"> Poor 	<ul style="list-style-type: none"> Deteriorated 	✓	✓	✓	✓
Inshore turbid reefs	<ul style="list-style-type: none"> As the world's most complex expanse of coral reefs, the reefs contain some 400 species of corals in 60 genera 	<ul style="list-style-type: none"> Extent of coral cover is considered in the assessment of the overall health of coral reefs. Coral cover at inshore reefs of the GBRWHA is declining slightly 	<ul style="list-style-type: none"> Poor 	<ul style="list-style-type: none"> Deteriorated 	-	✓	✓	✓
Coral species diversity and extent	<ul style="list-style-type: none"> The reefal structures of the GBRWHA are one of few living structures visible from space The globally significant diversity of reef morphologies in the GBRWHA reflects ongoing geomorphic, oceanographic and environmental processes 	<ul style="list-style-type: none"> GBR is the world's largest coral reef ecosystem, ranging over 14 degrees in latitude and comprising more than 2,900 separate coral reefs 	<ul style="list-style-type: none"> Poor 	<ul style="list-style-type: none"> Deteriorated 	✓	✓	✓	✓

1.1 Fringing reefs

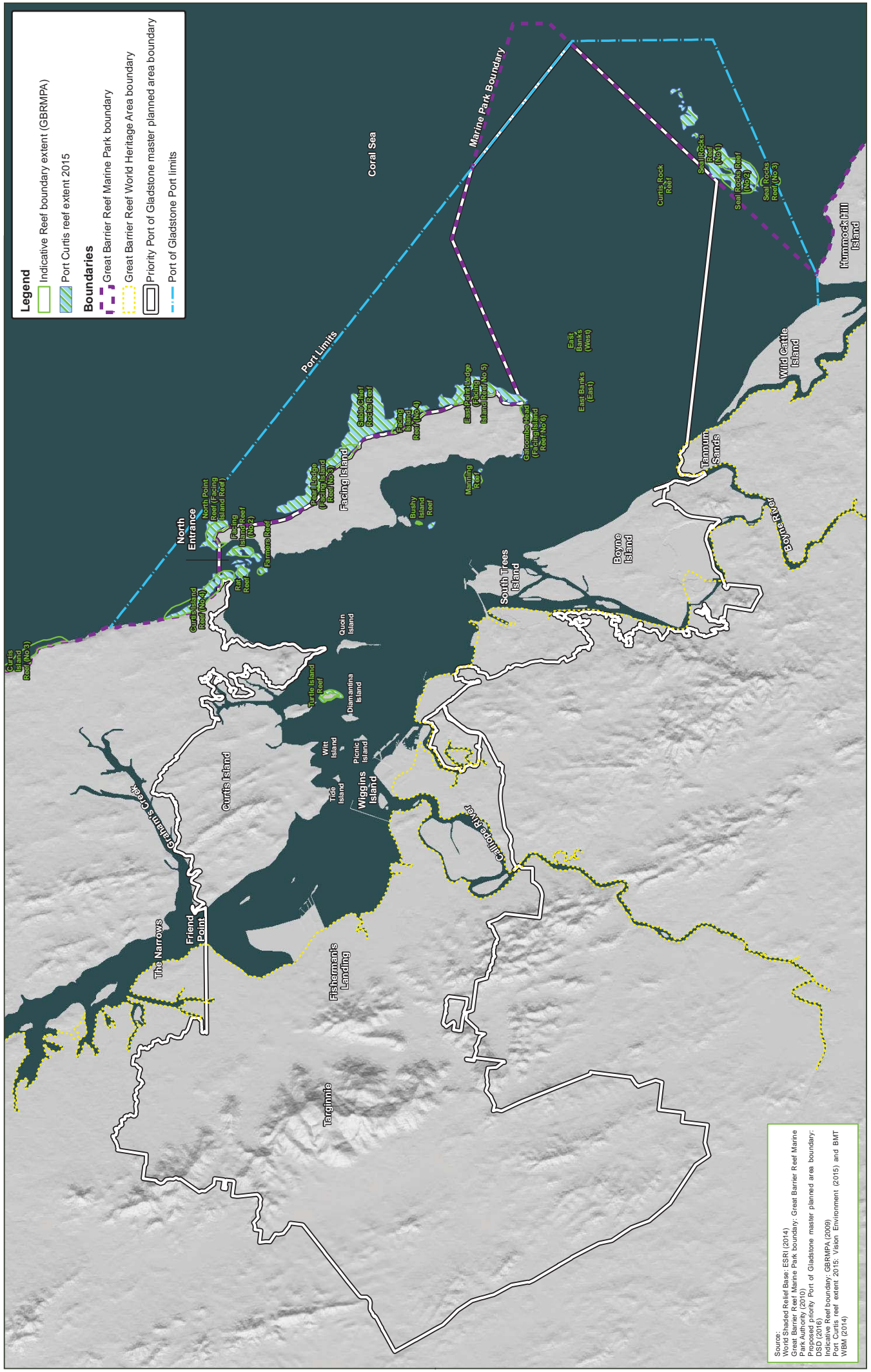
1.1.1 Presence of local attribute

Fringing reefs have a **minor presence** in the PPG master planned area and surrounds based on the following information:

- Fringing reefs are intertidal to subtidal reefs that grow along the mainland or around the margins of continental high islands (Smithers 2011). Fringing reefs on the GBR occur in three main coastal settings (Hopley et al. 2007):
 1. Attached to rocky headlands
 2. In embayments on continental high islands
 3. Adjacent to the beach base on usually linear stretches of sandy coast.
- Of the 2,904 named reefs identified by Hopley et al. (1989) in the Great Barrier Reef area, 758 are fringing reefs
- A wide range of reef habitat types are present within and surrounding the PPG master planned area, including fringing, platform and headland reefs, as well as rubble fields. Most reefs within this area can be classified as fringing reefs (BMT WBM 2009, DHI 2013).
- In a study by BMT WBM (2009), intertidal rocky shores were classified in the Port of Gladstone into three main types (ie fringing, platform and steep headland) on the basis of geomorphological characteristics and stated:

Fringing Reefs – which are defined areas where the supralittoral and upper intertidal zone was predominantly comprised of unconsolidated soft sediment (mud, sand and gravel), and the mid to lower intertidal zone was comprised of reef, either massive/bedrock platform reef, boulder fields or rubble fields. Fringing reefs generally had few intertidal rock pools or lagoons. Most sites surrounding the small islands and fringing western shoreline of Curtis Island were classified as fringing reefs, with mangroves often dominating in areas with soft sediment.
(BMT WBM 2009)

- Mapping by GBRMPA (2009) (refer Figure 1.1) outlines 19 reefs mapped in the region by the Great Barrier Reef Gazetteer most of which are intertidal rocky shores or shallow subtidal reefs. Based on information sourced from various ecological studies undertaken around the PPG master planned areas and surrounds, the GBRMPA mapped reefs (and corresponding reef number) which can be described as fringing reefs include:
 - Turtle Island (23-085)
 - Manning Reef (23-062)
 - Bushy Island Reef (23-086)
 - Curtis Island Reef #3 (23-059D)
 - Pearl Ledge (Facing Island Reef #3) (23-061C)
 - Sable Chief Rocks (23-064)
 - East Point Ledge (Facing Island Reef #5) (23-061E)
 - Facing Island Reef #4 (23-061D)
 - Seal Rocks Reef #1 (23-067A)
 - Seal Rocks Reef #2 (23-067B)
 - Seal Rocks Reef #3 (23-067C)



Legend

- Indicative Reef boundary extent (GBRMPA)
- Port Curtis reef extent 2015

Boundaries

- Great Barrier Reef Marine Park boundary
- Great Barrier Reef World Heritage Area boundary
- Priority Port of Gladstone master planned area boundary
- Port of Gladstone Port limits

Sources:
 World Shaded Relief Base: ESRI (2014)
 Great Barrier Reef Marine Park boundary: Great Barrier Reef Marine Park Authority (2010)
 Priority Port of Gladstone master planned area boundary: DSD (2016)
 Indicative Reef boundary: GBRMPA (2009)
 Port Curtis reef extent 2015: Vision Environment (2015) and BMT WBM (2014)

0 2,000 4,000 Metres

Date: 20/01/2017 Version: 2 Job No: 253916
 Coordinate system: GDA 1994 MGA Zone 56

Priority Port of Gladstone master planning local expression of OUV of GBRWHA
 Figure 1.1: Extent of Reefs

- It should be noted that GBRMPA (2009) mapping does not identify many of the smaller rocky outcroppings that occur within the Port of Gladstone and which are classified as fringing reefs, including Tide Island, Diamantina Island, Quoin Island, Witt Island and Picnic Island (BMT WBM 2009).
- While Facing Island Reef #6 (Gatcombe Head) is described as a 'steep headland reef' (BMT WBM 2009), the description of fringing reefs in the *Geological and geomorphological features of OUV in the GBRWHA* (Whiteway et al. 2014) would suggest that Gatcombe Head (23-061F) could also be described as a fringing reef within this region.
- Conversely most reefs in the North Passage sector were described as platform reefs by BMT WBM (2009)
- Several reef field surveys have recently been conducted in the region such as those undertaken to inform the GPC Biodiversity Offset Strategy (Jones et al. 2015), the Gladstone Health Harbour Partnership (GHHP) '*Development of coral indicators for the Gladstone Harbour Report 2015*' by the Australian Institute of Marine Science (AIMS), and baseline studies by Vision Environment for the GPC Channel Duplication environmental impact statement (EIS). Based on information recorded in these recent field surveys, the majority of fringing coral reef habitat occurs outside of the PPG master planned area boundary (refer Figure 1.1).

1.2 Contribution of the local attribute to the OUV of the GBRWHA

Fringing reefs have a **minor contribution** to criterion vii (aesthetic values and superlative natural phenomena), criterion viii (ongoing geological processes), criterion ix (ecological and biological processes) and to criterion x (biodiversity conservation) of the OUV of the GBRWHA based on the following information:

Commonwealth or state attribute legislative status

- Fringing reefs are not specifically listed under Commonwealth or state legislation

Local or regional attribute status

- Fringing reefs are not specifically listed under local or regional legislative mechanisms

Notable or iconic attribute value

- Reefs in the region appear to be typical of inshore reefs in the southern GBR region (Ayling et al. 2013)
- More notable examples of fringing reefs occur within the GBRWHA (eg Cairns and the Whitsunday Coast)

Notable or iconic attribute value

- Reefs in the region appear to be typical of inshore reefs in the southern GBR region (Ayling et al. 2013) with coral cover in the Port of Gladstone is consistent with patterns observed at other fringing reefs in the broader region such as Shoalwater Bay, Percy Islands, and Prudhoe Island (BMT WBM 2013)
- More notable examples of fringing reefs are present in the GBRWHA (eg mainland fringing reefs present north of Cairns and along the Whitsunday Coast)

Condition/trend of the attribute

- Reefs within the region have been affected by flood waters and extreme events in recent years (eg 2011 and 2013), with lowered salinities and high turbidity likely to be a major driver in the reduction of coral cover at reef sites (BMT WBM 2014)
- The coral communities in the mid and outer harbour reporting zones were reported as 'very poor' condition when surveyed in 2014 (Thompson, Costello and Davidson 2015)

- Recent analysis of long term datasets shows hard coral cover has significantly declined in the GBR region over the past 30 years up to 2012 (GBRMPA 2014a)
- Recent declines in coral cover are largely the result of a combination of cyclones, crown-of-thorns starfish outbreaks, mass bleaching events, poor water quality from catchments and associated impacts from climate change
- Reef scientists suggest that the long term prospects of all fringing and nearshore reefs on the GBR are poor, as they are subject to a wide range of anthropogenic and natural impacts (Smithers, Hopley and Parnell 2006).

Contribution to attribute sustainability

- Based on bathymetric charts and available remotely sensed imagery it is estimated that there are approximately 900 inshore reefs (Hopley et al. 2007), including both fringing reefs, and nearshore reefs and shoals (ie areas of shallow water, such as those associated with ridges or sandbanks). Of the 2,904 named reefs identified by Hopley et al. (1989), 758 are fringing reefs in the GBR.
- Inshore reef growth in the southern GBR is generally poor, except around the Keppel Islands (Smithers, Hopley and Parnell 2006)

Notable presence of the attribute

- More notable examples of fringing reefs are present in the GBRWHA (eg mainland fringing reefs present north of Cairns and along the Whitsunday Coast)

Significance of attribute to the preservation of the GBRWHA


- The loss of fringing reefs in the PPG master planned area and surrounds would impact the local ecosystem and likely impact other OUV attributes in the area (eg fish species and marine turtles). It is not, however, expected that this would result in the significant decline in the OUV of the GBRWHA.

1.3 Inshore turbid reefs

1.3.1 Presence of local attribute

Inshore turbid reefs have a **minor presence** in the PPG master planned area and surrounds based on the following information:

- Inshore turbid zone reefs include both shore attached (fringing reefs in locations close to the mainland) and non-shore attached shoals (Whiteway et al. 2014). These reefs *'develop under the influence of sediments derived from the mainland or islands, either directly where high levels of terrigenoclastic sediment accumulation or sediment flux occur, or indirectly where turbidity is high because fine-grained sediments are continuously or episodically in suspension'* (Whiteway et al. 2014).
- Several subtidal communities, including reef communities within the Port of Gladstone exist within naturally (and anthropogenically affected) high ambient turbidity conditions and light-limited environments (BMT WBM 2013)
- Recent reef surveys were undertaken in the region to inform the GPC Biodiversity Offset Strategy (Jones et al. 2015) and for the GHHP ('Development of coral indicators for the Gladstone Harbour Report 2015') by the AIMS (Thompson, Costello and Davison 2015).
- Surveys reported in Thompson, Costello and Davison (2015) which recorded inshore turbid reef locations such as Quoin Island, Turtle Island and Diamantina Island (refer Figure 1.1) as containing limited hard substrate and primarily made up of broken rock and occasional small dead coral colonies colonised by a mixed community of macroalgae and small heterotrophic soft corals (Thompson, Costello and Davison 2015).

- 
- Jones et al. (2015) describes reefs west of Quoin Island (eg Turtle Island Reef) as turbid nearshore reefs with low to no living hard coral cover, except for the occasional small Turbinaria colony (Jones et al. 2015)

1.3.2 Contribution of the local attribute to the OUV of the GBRWHA

Inshore turbid reefs have a **minor contribution** to criterion viii (ongoing geological processes), criterion ix (ecological and biological processes) and to criterion x (biodiversity conservation) of the OUV of the GBRWHA based on the following information:

Commonwealth or state attribute legislative status

- Inshore turbid reefs are not specifically listed under Commonwealth or state legislation

Local or regional attribute status

- Inshore turbid reefs are not specifically listed under local or regional legislative mechanisms

Notable or iconic attribute value

- Reefs in the region appear to be typical of inshore reefs in the southern GBR region (Ayling et al. 2013)
- More notable examples of inshore turbid reefs occur within the GBRWHA (eg Paluma Shoals, Halifax Bay) (Browne, Smithers and Perry 2012)

Condition/trend of the attribute

- Ecological studies suggest that turbid zone reefs are more vulnerable to reef degradation than their clear-water mid- and outer-shelf reef counterparts (Cooper and Fabricius 2007, Fabricius et al. 2007, Fabricius et al. 2008).
- While nearshore reefs are poorly represented in the literature, nearshore shoals represent an important reef type and many have high coral cover (>30%) (Browne et al. 2012)

Contribution to attribute sustainability

- Based on bathymetric charts and available remotely sensed imagery it is estimated that there are approximately 900 inshore reefs (Hopley et al. 2007), including both fringing reefs, and nearshore reefs and shoals, representing approximately a third of the reefs on the GBR
- Inshore turbid reefs in the PPG master planned area and surrounds represent a relatively insignificant area in relation to the GBRWHA

Notable presence of the attribute

- More notable examples of inshore turbid reefs are present in the GBRWHA (eg Paluma Shoals, Halifax Bay) (Browne, Smithers and Perry 2012)

Significance of attribute to the preservation of the GBRWHA

- The loss of inshore turbid reefs in the PPG master planned area and surrounds would impact the local ecosystem and likely impact other OUV attributes in the area (eg fish species and marine turtles). It is not, however, expected that this would result in the significant decline in the OUV of the GBRWHA.

1.4 Coral species diversity and extent

1.4.1 Presence of local attribute

Coral species diversity and extent have a **minor presence** in the PPG master planned area and surrounds based on the following information:

- When compared to reefs in the northern GBR, or at mid-shelf or outer-shelf areas, reefs in this region are generally lower in coral species richness, and tend to be made up of corals along with other benthic organisms (eg algae, sponges) growing on rocks or boulders (Ayling et al. 2012, GBRMPA 2007, DeVantier et al. 2006).
- Several desktop and field surveys in the PPG master planned area and surrounds have recorded coral species that are typical of fringing and inshore turbid coral reefs on the southern inshore GBR
- Coral taxa that are tolerant or semi-tolerant to turbid conditions such as faviids, Turbinaria, poritids, Acropora and soft corals are commonly represented in reefs with the PPG master planned area and surrounds
- Inshore reefs on the GBR such as those in the PPG master planned area and surrounds regularly experience high nutrient concentrations and turbidity can often be dominated by macroalgal communities, which grow in place of corals that have died, or out-compete corals for space on reefs (McCook et al. 2001)
- Mapping by GBRMPA (2009) and recent field surveys (refer Figure 1.1) illustrates that the coral reef areas of the PPG master planned area and surrounds are not extensive.

1.4.2 Contribution of the local attribute to the OUV of the GBRWHA

Coral species diversity and extent have a **minor contribution** to criterion vii (aesthetic values and superlative natural phenomena), criterion viii (ongoing geological processes), criterion ix (ecological and biological processes) and to criterion x (biodiversity conservation) of the OUV of the GBRWHA based on the following information:

Commonwealth or state attribute legislative status

- This attribute is not specifically listed under Commonwealth or state legislation

Local or regional attribute status

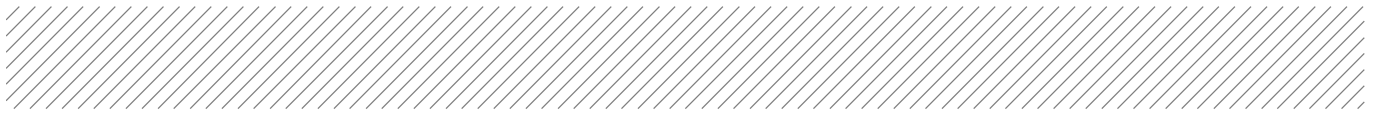
- This attribute is not specifically listed under local or regional legislative mechanisms

Notable or iconic attribute value

- Reefs in the region appear to be typical of inshore reefs in the southern GBR region (Ayling et al. 2013)
- When compared to reefs in the northern GBR, or at mid-shelf or outer-shelf areas, reefs in this region are generally lower in coral species richness

Condition/trend of the attribute

- Reefs within the region have been affected by flood waters and extreme events in recent years (eg 2011 and 2013), with lowered salinities and high turbidity likely to be a major driver in the reduction of coral cover at reef sites (BMT WBM 2014). This has led to a reduction in coral species richness.
- Recent analysis of long term datasets shows hard coral cover has significantly declined in the great barrier reef region over the past 30 years up to 2012 (GBRMPA 2014a)
- Reef scientists suggest that the long term prospects of all fringing and nearshore reefs on the GBR are poor, as they are subject to a wide range of anthropogenic and natural impacts (Smithers, Hopley and Parnell 2006).



Contribution to attribute sustainability

- Coral species in the PPG master planned area and surrounds represent a relatively insignificant area in relation to the GBRWHA
- The species diversity of reefs in this region are generally limited to those coral taxa that are tolerant or semi-tolerant to turbid conditions such as faviids, Turbinaria, poritids, Acropora and soft corals. As such they contribute little to species diversity over the whole GBRWHA.

Significance of attribute to the preservation of the GBRWHA

- The loss of coral diversity and extent in the PPG master planned area and surrounds would impact the local ecosystem and likely impact other OUV attributes in the area (eg fish species). It is not, however, expected that this would result in the significant decline in the OUV of the GBRWHA.

2 Marine water quality

The relevant information from the retrospective statement of OUV and the Outlook Report 2014 relating to marine water quality is summarised in Table 2.1, with respect to the local expression of the OUV of the GBRWHA for the PPG master planned area and surrounds.

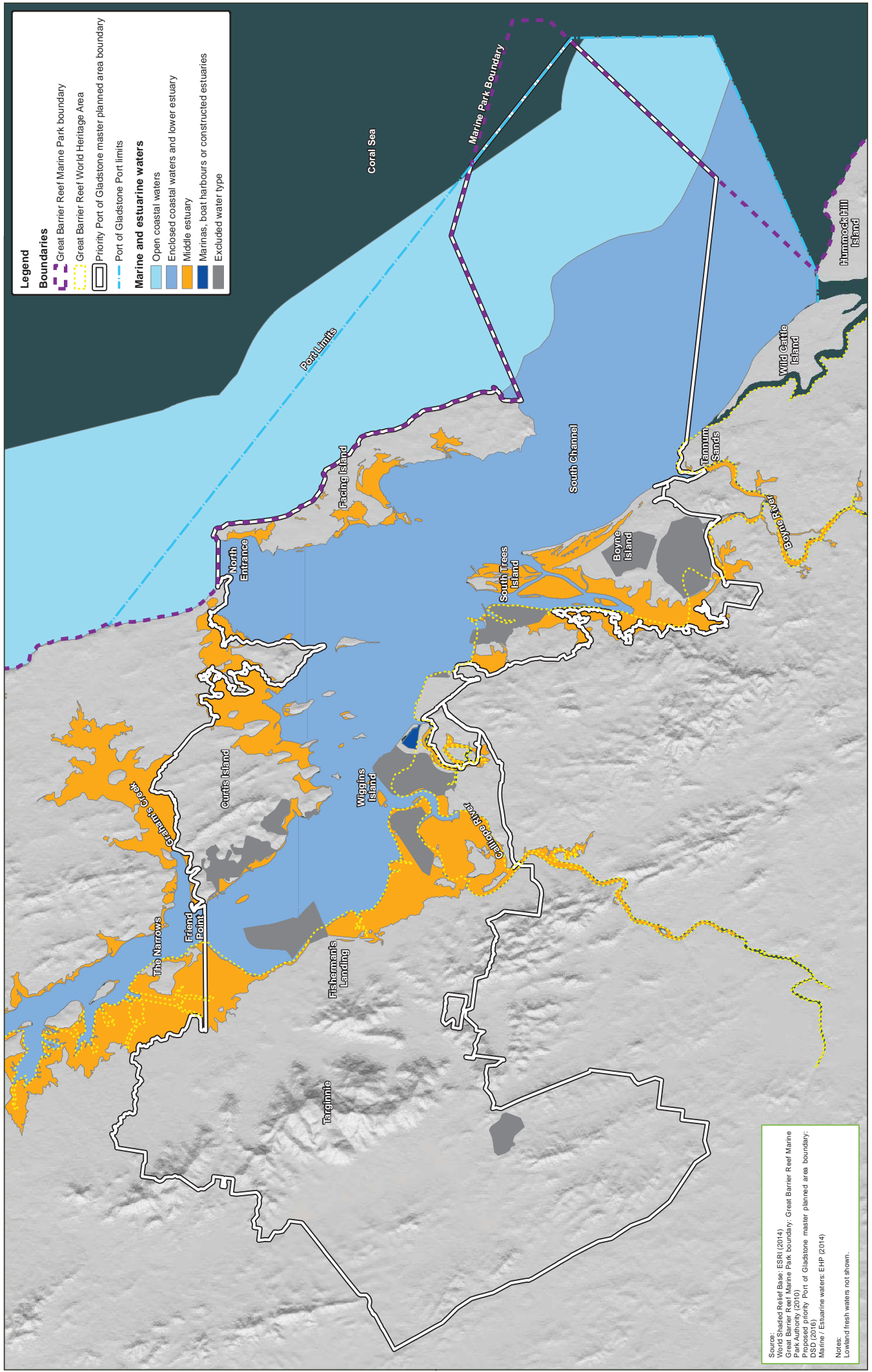
Table 2.1 OUV of the GBRWHA: Marine water quality

Attribute	Statement of OUV	GBR Outlook Report 2014			Relevant OUV criteria			
		GBR wide: Significant contribution to OUV	GBR wide condition	GBR wide trend	vii	viii	ix	x
Marine water quality	<ul style="list-style-type: none"> Water quality is a key matter for the management of the OUV of the GBRWHA 	<ul style="list-style-type: none"> Physical and chemical processes (including factors which influence water quality) contribute to the health of the GBRWHA and are important attributes which contribute to the OUV of the GBRWHA 	<ul style="list-style-type: none"> Good (Physical processes [including sedimentation]) Poor (Chemical processes [including nutrient cycling]) 	<ul style="list-style-type: none"> Deteriorated (Physical processes [including sedimentation]) Deteriorated (Chemical processes [including nutrient cycling]) 	-	-	✓	✓

2.1 Presence of local attribute


Marine water quality has a **significant** presence within the PPG master planned area and surrounds based on the following information:

- The Port of Gladstone has three naturally formed connections with the ocean, including The Narrows, the North Entrance between Curtis Island and Facing Island, and the South Channel between Facing Island and Boyne Island (BMT WBM 2014). Previous hydrodynamic studies undertaken in the area describe Port of Gladstone as having an estimated flushing time with the ocean of 19 days (Herzfeld et al. 2004).
- Water types of the Port of Gladstone have been defined based on the long term monitoring of water quality parameters within the area and in accordance with the Australian Water Quality Guidelines (AWQG) (ANZECC/ARMCANZ 2000) and the Queensland Water Quality Guidelines (QWQG) (EHP 2009). Marine and estuarine water types are described in the *Environmental Protection (Water) Policy 2009* (EPP (Water)) and supporting documentation and include the following types within and surrounding the PPG master planned area (refer Figure 2.1):
 - Enclosed coastal waters and lower estuary
 - Open coastal waters
 - Middle estuary
- Figure 2.1 also shows areas mapped as 'excluded water types' and 'marinas, boat harbours or constructed estuaries', these areas have been excluded from this assessment as they have been modified (eg construction of facilities, reclamation areas, constructed dams) and are not considered to contribute towards the natural heritage criteria of the OUV of the GBRWHA.



Sources:
 World Shaded Relief Base: ESRI (2014)
 Great Barrier Reef Marine Park boundary: Great Barrier Reef Marine Park Authority (2010)
 Proposed priority Port of Gladstone master planned area boundary: PSD (2016)
 Marine / Estuarine waters: EHP (2014)

Notes:
 Lowland fresh waters not shown.

- 
- The boundaries of different water types have been mapped using a variety of attributes such as: geographic coordinates; catchment or subcatchment boundaries; highest/lowest astronomical tide; tidal limiting structure (weirs); maritime mapping conventions; coastline; surveyed terrestrial boundaries; altitude and boundaries based on technical investigations.

2.2 Contribution of the local attribute to the OUV of the GBRWHA

The attribute 'marine water quality' has a **moderate contribution** to criterion ix (ecological and biological processes) and to criterion x (biodiversity conservation) of the OUV of the GBRWHA based on the following information:

Commonwealth or state attribute legislative status

- Queensland waters are protected under the EPP (Water), which is subordinate legislation under the *Environmental Protection Act 1994*
- GBR Marine Park zoning in waters to the north, east and south of the PPG master planned area includes 'general use zone', 'habitat protection zone', 'marine national park zone' and 'conservation park zone'

Local or regional attribute status

- No local or regional legislative mechanisms are afforded to the marine waters within and surrounding the PPG master planned area

Notable or iconic attribute value

- The marine water quality of the PPG master planned area and surrounds is not specifically recognised as a prime example of this attribute in the GBRWHA

Condition/trend of the attribute

- The Great Barrier Reef Outlook Report 2014 states that 'declining marine water quality, influenced by land-based run-off, is recognised as one of the most significant threats to the long-term health and resilience of the Great Barrier Reef' (GBRMPA 2014a)
- In accordance with the AWQG and the QWQG the EPP (Water) describes the marine and estuarine waters of the PPG master planned area and surrounds in terms of management intent/level of protection as 'moderately disturbed' apart from open coastal waters which are 'slightly to moderately disturbed', and The Narrows which are 'high ecological value' (EHP 2014).
- The independent review of the Port of Gladstone states 'continued management of the port as a slightly to moderately disturbed ecosystem (i.e. using the 95 per cent trigger level as per current practice) is consistent with maintaining the OUV of the GBRWHA expressed in the port' (Commonwealth of Australia 2013).

Contribution to attribute sustainability


- The local presence of the attribute contributes to the ongoing sustainability of the attribute more broadly but it is recognised that the waters of the PPG master planned area and surrounds form part of an existing operational port and not a pristine marine water area of high conservation value

Notable presence of the attribute

- More notable, iconic and pristine examples of marine water quality occur in other areas of the GBRWHA (eg Cairns and north to Cape York Peninsula, where the GBRWHA is exposed to fewer freshwater events which can contain pollutants from catchment areas (GBRWHA 2014)).

Significance of attribute to the preservation of the GBRWHA

- Marine water quality is an attribute which underpins the presence of several other OUV attributes in the region. As described in the Independent Review of the Port of Gladstone:



'The water column is the crucial nurturing and linking habitat within marine ecosystems and between terrestrial and marine ecosystems. Inshore waters are a particularly important marine habitat because natural runoff from the land brings nutrients and trace elements that are essential for productivity of phytoplankton in the water column and of algae, seagrasses and corals attached to the seabed. The primary productivity of phytoplankton in the illuminated upper layers of the water column provides the basis of most marine food chains, feeding microscopic planktonic animals in a complex food web with many links to fish and top predators.'

'Water quality and the extent, condition and associated communities of seabed habitat for seagrasses and intertidal and subtidal habitat of mangroves are critical marine habitat matters within and beyond the Port of Gladstone. The sheltered inshore waters that sustain seabed and mangrove habitats are important breeding and nursery feeding areas and provide linkages between inshore nursery areas and offshore populations of some fish and invertebrates.'

'Property-wide, the water column is important in terms of impacts from land and nearshore activity on offshore water quality whether these are chronic operational activities (including maintenance dredging and catchment runoff), catastrophic events resulting from accident or incompetence, or occasional severe weather-related events.' (Commonwealth of Australia 2013).

- A significant decline in water quality locally could result in potential impacts to the local expression of other OUV attributes in the region, including (but not limited to):
 - Coral reefs
 - Fish species, diversity and habitat
 - Marine megafauna species habitat
 - Marine turtle habitat
 - Seabird foraging habitat and migratory shorebird habitat
 - Seagrass and macroalgae
 - *Halimeda* algae beds
 - Total species diversity
- Due to the importance of marine water quality to the local expression of other attributes that contribute to the OUV of the GBRWHA, and that water quality is an identified as a management priority for the GBRWHA, the marine water quality attribute is considered to have a moderate contribution to the OUV of the GBRWHA.

3 Fish

The relevant information from the retrospective statement of OUV and the Outlook Report 2014 relating to fish is summarised in Table 3.1, with respect to the local expression of the OUV of the GBRWHA for the PPG master planned area and surrounds.

Table 3.1 OUV of the GBRWHA: Fish

Attribute	Statement of OUV	GBR Outlook Report 2014			Relevant OUV criteria			
		GBR wide: Significant contribution to OUV	GBR wide condition	GBR wide trend	vii	viii	ix	x
Fish species and diversity	<ul style="list-style-type: none"> ■ Beneath the ocean surface, there is an abundance and diversity of shapes, sizes and colours; including thousands of species of reef fish which provide a myriad of brilliant colours, shapes and sizes ■ Superlative natural phenomena include significant spawning aggregations of many fish species 	<ul style="list-style-type: none"> ■ 1,625 bony fish species have been recorded in the GBR 	<ul style="list-style-type: none"> ■ Good (bony fishes) 	<ul style="list-style-type: none"> ■ Deteriorated (bony fishes) 	✓	-	✓	✓

3.1 Presence of local attribute

Fish have a **minor presence** in the PPG master planned area and surrounds based on the following information:

- Approximately 1,600 species of bony fish have been recorded within the GBR region (GBRMPA 2014a)
- Fish surveys conducted in the PPG master planned area and surrounds have recorded 88 species of estuarine and coastal fish from 2,994 individuals (Currie and Connelly 2004) and 59 species of reef fish from 6,037 individuals (Vision Environment 2015), representing 147 species in total

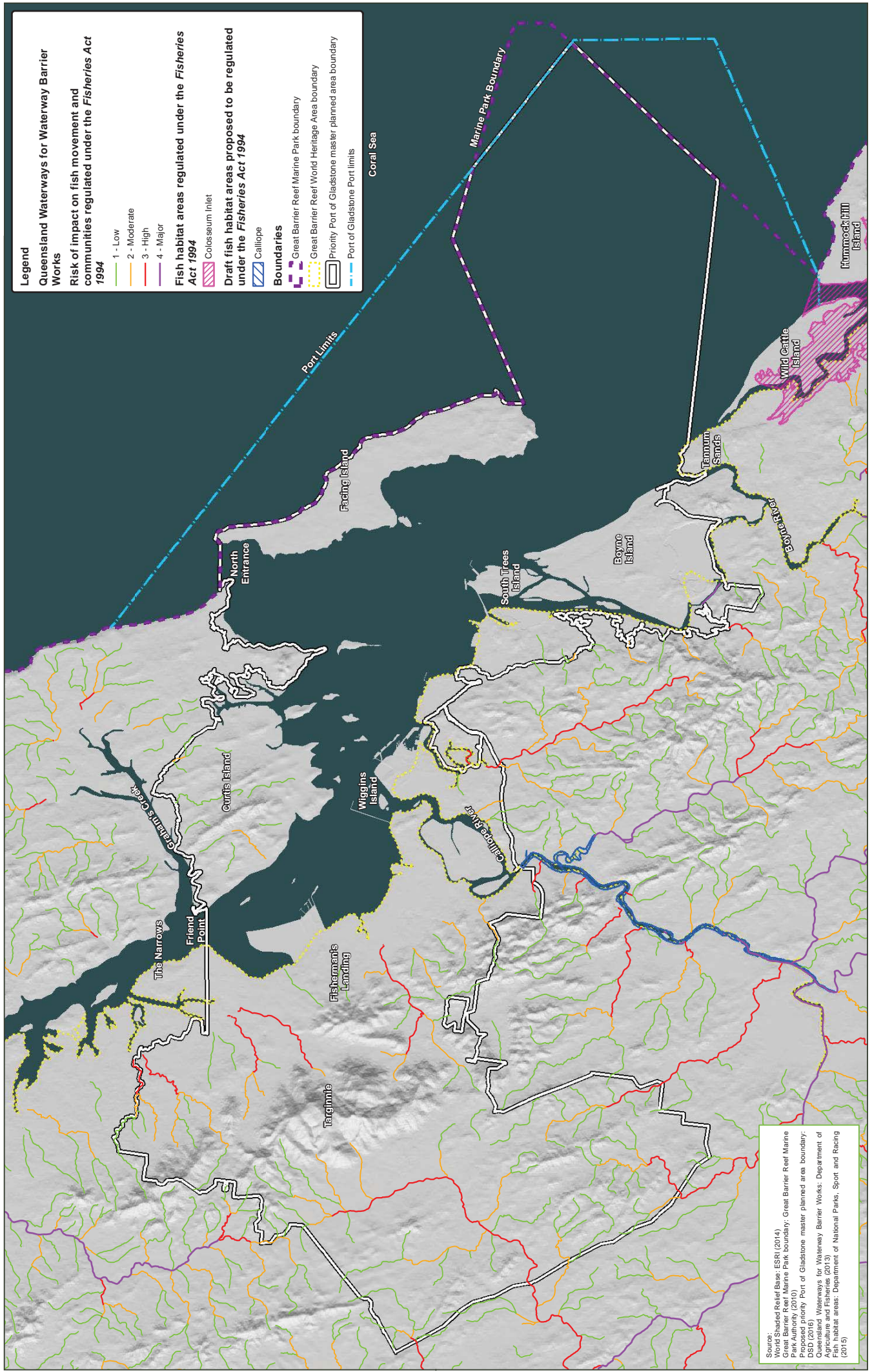
- Bony fish species which are considered to be vulnerable to threats within the GBRWHA include Blue threadfin salmon (*Eleutheronema tetradactylum*), King threadfin salmon (*Polydactylus macrochir*), Grey mackerel (*Scomberomorus semifasciatus*) and Sawfish (including Freshwater sawfish [*Pristis pristis*], Dwarf sawfish [*Pristis clavata*], Green sawfish [*Pristis zijsron*] and Narrow sawfish [*Anoxypristis cuspidate*]) (GBRMPA 2014b)
- In 2009 to 2010, the total harvest of Threadfin salmon in the GBRWHA was approximately 248 tonnes (GBRMPA 2014a). The annual average harvest of Threadfin salmon for the PPG master planned area and surrounds was approximately 20 tonnes (based on approximately 184 tonnes of Threadfin salmon subject to commercial harvest between 2005 to 2014 for the QFish 'S30' Commercial Fishery 30 minute reporting grid, which encompasses the PPG master planned area and surrounds) (DAF 2015).
- The total harvest of Grey mackerel within the GBRWHA between 2003 and 2008 was 297 tonnes, representing an average annual harvest of approximately 60 tonnes (GBRMPA 2014a). The annual average harvest of Mackerel for the PPG master planned area and surrounds was approximately 36 tonnes (based on approximately 325 tonnes of Mackerel subject to commercial harvest between 2005 to 2014 for the QFish 'S30' Commercial Fishery 30 minute reporting grid, which encompasses the PPG master planned area and surrounds) (DAF 2015).
- There is no quantitative data available on the GBRWHA or global population size of sawfish species however it is understood that population numbers have declined drastically along the east coast of Australia (GBRMPA 2014b)
- Declared Fish Habitat Areas (FHAs) and waterways providing for fish passage (showing connection to the FHAs, and the potential for fish movements throughout the PPG master planned area and surrounds) within the PPG master planned area and surrounds are illustrated in Figure 3.1.

3.2 Contribution of the local attribute to the OUV of the GBRWHA

Fish species and diversity is considered to have a **minor contribution** to criterion vii (aesthetic values and superlative natural phenomena), ix (ecological and biological processes) and x (biodiversity conservation) the OUV of the GBRWHA based on the following information:

Commonwealth or state attribute legislative status

- Conservation significant and migratory fish species which have the potential to occur within the PPG master planned area and surrounds (based on database searches, refer Appendix C) include the following species:
 - Dwarf sawfish (*Pristis clavata*): vulnerable (EPBC Act), listed migratory (EPBC Act [Bonn convention]), listed marine (EPBC Act), listed as endangered at a global scale by the IUCN
 - Freshwater sawfish (*Pristis pristis*): vulnerable (EPBC Act), listed migratory (EPBC Act [Bonn convention]), listed marine (EPBC Act), listed as critically endangered at a global scale by the IUCN
 - Green sawfish (*Pristis zijsron*): vulnerable (EPBC Act), listed migratory (EPBC Act [Bonn convention]), listed marine (EPBC Act), listed as critically endangered at a global scale by the IUCN
 - Narrow sawfish (*Anoxypristis cuspidate*): Listed migratory (EPBC Act [Bonn convention]), listed as endangered at a global scale by the IUCN
- The PPG master planned area and surrounds are not listed as an area of habitat critical to the survival of threatened fish species, as per applicable recovery plans or conservation advice statements available
- The PPG master planned area and surrounds provides potential habitat for EPBC Act listed marine species (ie species of pipefish and seahorse)



Priority Port of Gladstone master planning local expression of OUV of GBRWHA
Figure 3.1: Fish habitat areas and waterways providing for fish passage

Source:
 World Shaded Relief Base: ESRI (2014)
 Great Barrier Reef Marine Park boundary: Great Barrier Reef Marine Park Authority (2010)
 Priority Port of Gladstone master planned area boundary: DSD (2016)
 Queensland Waterways for Waterway Barrier Works: Department of Agriculture and Fisheries (2013)
 Fish habitat areas: Department of National Parks, Sport and Racing (2015)



Local or regional attribute status

- Declared FHA present within the PPG master planned area and surrounds include the Colosseum Inlet FHA and the proposed Calliope River FHA (refer Figure 3.1).
- All sawfish species are listed as 'no-take species' under the *Fisheries Regulation 2008* (Qld)
- Fish species are protected within the GBR Marine Park (GBRMP) through permit requirements and activity restrictions in zoned areas of the GBRMP. GBRMP zoning surrounding the PPG master planned area includes 'general use zone', 'habitat protection zone', 'marine national park zone' and 'conservation park zone'

Notable or iconic attribute value

- Fish species assemblages in the PPG master planned area and surrounds are not specifically recognised as a prime example or value of the region in key publications (ie retrospective statement of OUV, Outlook Report 2014, Lucas et al. 1997)

Condition/trend of the attribute

- The Great Barrier Reef Outlook Report 2014 (GBRMPA 2014a) records the attribute conditions in the wider GBR to be good for bony fishes. The attribute condition trend in the wider GBR was recorded as deteriorated for bony fishes.

Contribution to attribute sustainability

- Diversity of available habitat contributes to the diversity of fish species (Lucas et al. 1997). The PPG master planned area and surrounds provide habitat for juvenile, sub-adult and adult fish species in the form of nursery grounds and food sources. Habitat areas within the PPG master planned area and surrounds are associated with coral reefs, seagrass meadows, mangrove communities, hard and soft benthic substrates, beach habitats, estuaries, creeks and rivers. Habitat areas for fish species within the PPG master planned area and surrounds are not considered to be unique to the area and are available throughout the GBRWHA.
- Currie and Connelly (2004) identified 147 species of fish within the PPG master planned area and surrounds, representing approximately 9% of the known fish species diversity within the GBRWHA. The PPG master planned area is not considered to represent a large portion of the known fish diversity of the GBRWHA.
- The PPG master planned area and surrounds is not considered likely to have a significant contribution to the Blue threadfin salmon, King threadfin salmon or Grey mackerel, vulnerable fish species within the GBRWHA. Based on commercial fisher harvest data (note with data comparisons made between varying sources and assessment periods), approximately 8% and 20% of the annual catch data for the Threadfin salmon and Mackerel, respectively is sourced from the PPG master planned area and surrounds when compared to the GBRWHA. Note that the approximate estimate of 20% of Mackerel provides a conservative estimate for the Grey mackerel, as the data set contains a variety of Mackerel species

Notable presence of the attribute

- Fish are mobile species with the potential to travel large distances. The fish species present within the PPG master planned area and surrounds are not considered to be unique to the PPG master planned area and surrounds

Significance of attribute to the preservation of the GBRWHA

- The loss of fish habitat areas within the PPG master planned area and surrounds (ie coral reefs, seagrass meadows and mangrove communities) has the potential to have an impact on the species diversity of local fish populations. It is not, however, expected that this would result in the significant decline in the OUV of the GBRWHA.

4 Marine megafauna

The relevant information from the retrospective statement of OUV and the Outlook Report 2014 relating to marine megafauna is summarised in Table 4.1, with respect to the local expression of the OUV of the GBRWHA for the PPG master planned area and surrounds.

Table 4.1 OUV of the GBRWHA: Marine megafauna

Attribute	Statement of OUV	GBR Outlook Report 2014			Relevant OUV criteria			
		GBR wide: Significant contribution to OUV	GBR wide condition	GBR wide trend	vii	viii	ix	x
Dugong	<ul style="list-style-type: none"> The GBRWHA provides major feeding grounds for one of the world's largest populations of the threatened Dugong 	<ul style="list-style-type: none"> The GBR Dugong population is recognised as contributing to the region's OUV The GBR is home to a globally significant population of dugongs and provides essential habitat and connectivity between populations in the Torres Strait and the waters off south-east Queensland 	Poor	Deteriorated	-	-	-	✓
Species of whales	<ul style="list-style-type: none"> At least 30 species of whales and dolphins occur in the GBRWHA 	<ul style="list-style-type: none"> Approximately 15 species of whales inhabit the GBR 	Good	Improved	-	-	-	✓
Migrating whales	<ul style="list-style-type: none"> The GBRWHA is a significant area for Humpback whale calving 	<ul style="list-style-type: none"> Migrating whales are a contributing attribute to the superlative natural phenomena of the GBR 	-	-	✓	-	-	-

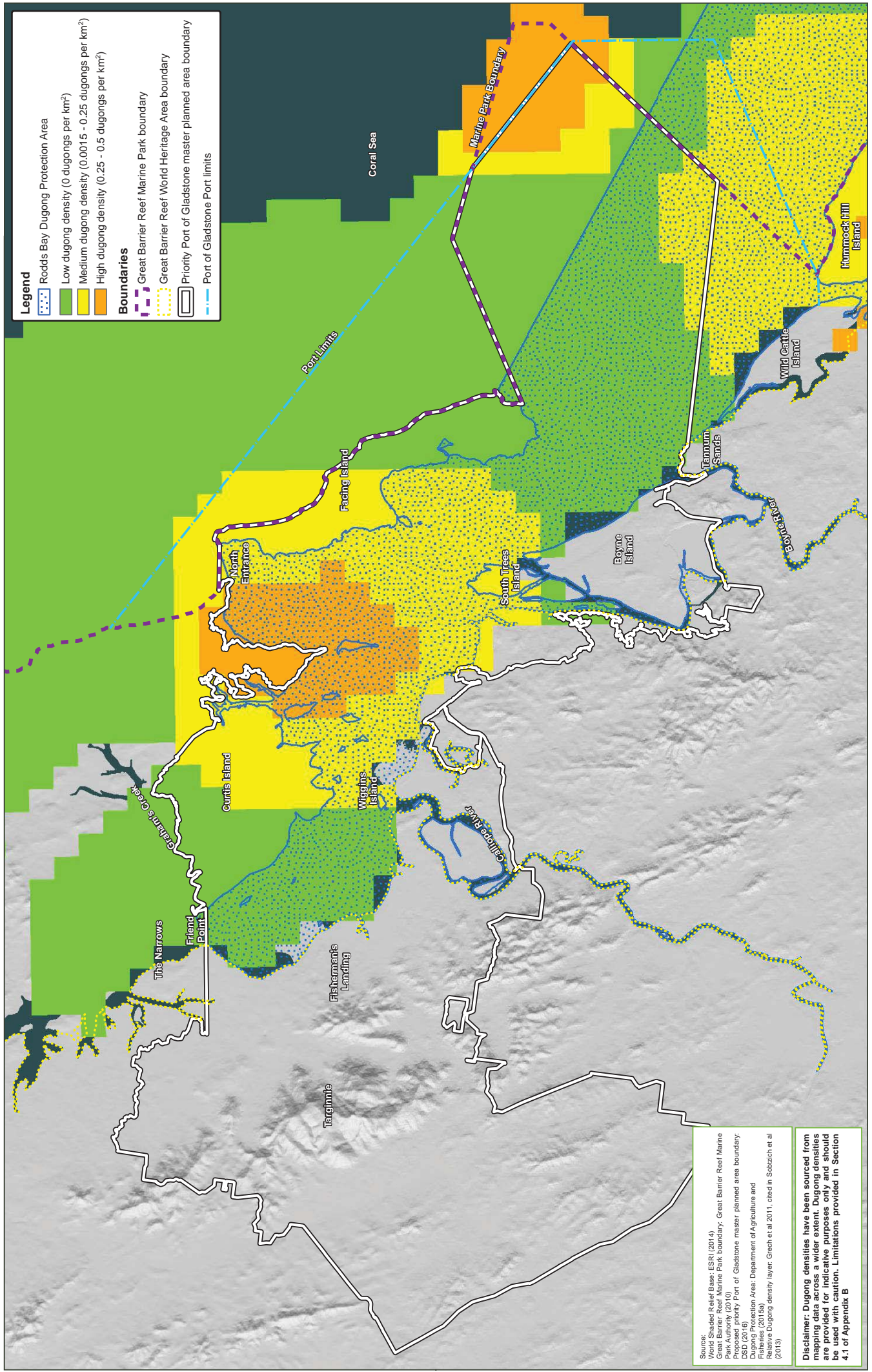
Attribute	Statement of OUV	GBR Outlook Report 2014			Relevant OUV criteria			
		GBR wide: Significant contribution to OUV	GBR wide condition	GBR wide trend	vii	viii	ix	x
Species of dolphins	<ul style="list-style-type: none"> At least 30 species of whales and dolphins occur in the GBRWHA 	<ul style="list-style-type: none"> Approximately 18 species of dolphins inhabit the GBR The Australian snubfin dolphin and the Australian humpback dolphin are considered the highest priority dolphin species for management in the GBR region because of their small, localised populations, exposure to high levels of human activity, and suspected population declines 	Good	Deteriorated	✓	-	-	✓

4.1 Dugong

4.1.1 Presence of local attribute

Dugong have a **minor presence** in the PPG master planned area and surrounds based on the following information:

- The seagrass meadows within the PPG master planned area and surrounds provide important connectivity habitat between larger Dugong habitat areas at Shoalwater Bay to the north and Hervey Bay to the south (Sobtzick et al. 2013). The seagrass meadows within the PPG master planned area and surrounds are the only known major areas of seagrass between Shoalwater Bay and Hervey Bay (Blair 2012, Sheppard et al. 2006, Sobtzick et al. 2013).
- The density of Dugong within the PPG master planned area and surrounds has been mapped based on the results of aerial surveys and is shown in Figure 4.1 (relative dugong density based on aerial surveys from 1986 to 2005 conducted by James Cook University, modelled by Grech et al. 2011, as cited in Sobtzick et al. 2013).
- As shown in Figure 4.1, the modelling of relative Dugong density (Grech et al. 2011) indicates that the PPG master planned area and surrounds support a range of low (0 Dugongs per km²), medium (0.0015 - 0.25 Dugongs per km²) and high (0.25 - 0.5 Dugongs per km²) dugong density areas based on aerial surveys from 1986 to 2005.
- Based on the review of dugong density modelling by Grech et al. (2011), Sobtzick et al. (2013) estimates that the Gladstone region supports a Dugong population in the low hundreds at most
- The PPG master planned area and surrounds support a relatively small Dugong population, although the area is considered to be regionally significant to the south Queensland Dugong population. The Port of Gladstone area located between Rodds Bay and The Narrows was declared a Dugong Protection Area Zone B (restricted use) in 1997 to recognise the importance of the seagrass habitats available for Dugong populations (Sobtzick et al. 2013).



Legend

- Rodds Bay Dugong Protection Area
- Low dugong density (0 dugongs per km²)
- Medium dugong density (0.0015 - 0.25 dugongs per km²)
- High dugong density (0.25 - 0.5 dugongs per km²)

Boundaries

- Great Barrier Reef Marine Park boundary
- Great Barrier Reef World Heritage Area boundary
- Priority Port of Gladstone master planned area boundary
- Port of Gladstone Port limits

Source:
 World Shoreline Base: ESR (2014)
 Great Barrier Reef Marine Park Authority (2010)
 Proposed priority Port of Gladstone master planned area boundary:
 PSD (2016)
 Dugong Protection Area: Department of Agriculture and
 Fisheries (2013)
 Relative Dugong density layer: Grech et al 2011, cited in Sabatton et al
 (2013)

Disclaimer: Dugong densities have been sourced from mapping data across a wider extent. Dugong densities are provided for indicative purposes only and should be used with caution. Limitations provided in Section 4.1 of Appendix B



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Priority Port of Gladstone master planning local expression of OUV of GBRWHA
Figure 4.1: Rodds Bay Dugong Protection Area and relative Dugong density based on aerial surveys (1986 to 2005)

- It is acknowledged that there are limitations to the Dugong density data (as per Sobotzick et al. 2013) that is to be considered in assessing the presence and contribution of the local attribute:
 - Dugong density data presented in Figure 4.1 has been sourced from mapping data across a broader extent than the PPG master planned area. Dugong density data is provided for indicative purposes only, and should be interpreted in consideration of these limitations.
 - The modelling conducted by Grech et al. (2011) illustrates Dugong density data occurring over land, however this is an artefact of the broad-scale nature of the data set. Dugong density should only be interpreted for marine environments.
 - Population size estimates are confounded by large scale animal movements (ie hundreds of kilometres in a few days) (Sobotzick et al. 2013), and as such, aerial surveys are consequently not designed to investigate relative abundance at local spatial scales (ie PPG master planned area and surrounds). It is generally accepted that the results of such surveys underestimate true population sizes, and provide only a standardised minimum estimation (Sobotzick et al. 2013).
 - Dugong distribution patterns and behaviours are recognised to demonstrate seasonal variation, (typically driven by sea surface temperature changes) (Sobotzick et al. 2013). Aerial survey results presented in Figure 4.1 do not account for seasonal variation (ie surveys were conducted in November of each year, during high tide where possible), partially due to logistical constraints associated with the large-scale surveys (Sobotzick et al. 2013).
 - Adequate survey methods for monitoring changes in the size and habitat use of small dugong populations at local scales (eg within the PPG master planned area) are yet to be developed and should be a priority for future research projects (Sobotzick et al. 2013).

4.1.2 Contribution of the local attribute to the OUV of the GBRWHA

Dugong have a **moderate contribution** to the OUV of the GBRWHA based on the following information:

Commonwealth or state attribute legislative status

- Dugong are not listed as threatened under the EPBC Act, however they are listed under the EPBC Act as marine and migratory, and are subject to the Bonn Convention
- Dugong are listed as vulnerable under the provisions of the *Nature Conservation Act 1992* (Qld) (NC Act)
- Dugong are listed as vulnerable to extinction at a global scale by the International Union for the Conservation of Nature (IUCN)
- There is limited information on the population biology and demographics of Dugong on the east coast of Australia (Blair 2012, Sobotzick et al. 2013). Blair (2012) identified a marked genetic difference between Dugong from the Moreton Bay to Shoalwater region to those from north of the Shoalwater region, suggesting that Moreton Bay to Shoalwater to Moreton Bay may need to be managed separately to the areas to the north.
- Due to the relatively low numbers of Dugong recorded within the PPG master planned area and surrounds, it is not considered that this area represents an important population in isolation, or contributes significantly to the number of Dugong within the GBRWHA. The population is recognised as being regionally important (Sobotzick et al. 2013).
- The PPG master planned area and surrounds are not identified as one of the important Dugong habitat areas within the Queensland Urban Coast (ie extending from Cooktown to the Queensland/New South Wales border), with the most important habitat areas situated within the Moreton Bay and Hervey Bay regions (DoEE 2016a)



Local or regional attribute legislative status

- The Rodds Bay Dugong Protection Area is situated within the PPG master planned area (refer Figure 4.1). The Dugong Protection Area is designed under the provisions of the *Great Barrier Reef Marine Park Regulations 1983* (Cth), *Fisheries Act 1994* (Qld) and the NC Act.

Notable or iconic attribute value

- The Dugong population in the PPG master planned area and surrounds is not specifically recognised as a prime example or value of the region in key publications (ie retrospective statement of OUV, Outlook Report 2014, Lucas et al. 1997)

Condition/trend of the attribute

- The condition is poor and the GBR wide trend is that this attribute is deteriorating

Contribution to attribute sustainability

- As discussed in Section 4.1.1, estimating Dugong population density (resident and/or transient) at a small scale is difficult, with the resultant survey data subject to limitations, such as large scale animal movements and potential count errors, and limited inclusion of seasonal variation which influences the behaviour and movements of Dugong. There is no established survey methodology suitable for investigating relative abundance at local spatial scales (eg Port Curtis/Rodds Bay) (Sobtzick et al. 2013). As a result of these limitations, it is generally accepted that the results of density surveys underestimate true population sizes, and provide only a standardised minimum estimation (Sobtzick et al. 2013).
- Dugong population sizes fluctuate due to animal movements (Marsh and Lawler 2007), therefore it is acknowledged that the number of Dugong present within the PPG master planned area and surrounds will fluctuate over time. As the population is in flux, it is difficult to define the contribution of individual Dugong in the PPG master planned area to the broader population.
- The Outlook Report 2014 reports that in 2011 the estimated number of Dugong between the Daintree River and the southern boundary of the GBRWHA was approximately 600 animals, compared to an estimate of around 2,000 from the previous surveys in 2005 (GBRMPA 2014a)
- On the basis that aerial surveys generally underestimate Dugong population size, Sobtzick et al. (2013) suggest that the Port of Gladstone and Rodds Bay supports a Dugong population in the low hundreds of individuals at the most
- Sobtzick et al. (2013) suggest that the Gladstone region provides important habitat for a relatively small number of Dugong (ie low hundreds at most). However, Sobtzick et al. (2013) recognises that the seagrass meadows in Gladstone are considered to provide an important connective function for Dugong movement and genetic variability.
- As discussed in Section 4.1.1, the seagrass meadows in the Gladstone area are of regional significance as they are the only known major areas of seagrass between Shoalwater Bay and Hervey Bay (Blair 2012, Sheppard et al. 2006, Sobtzick et al. 2013). As such the seagrass meadows within the PPG master planned area and surrounds likely represent important connecting habitat between larger Dugong habitat areas to the north and south.
- Given the significant decline in the number of Dugong in the southern section of the GBRWHA in 2011 (GBRMPA 2014a), there is potential risk that the loss of habitat (ie connective seagrass meadows) within the PPG master planned area and surrounds could contribute to the loss or decline of the population of Dugongs in the southern section of the GBRWHA.

Notable presence of the attribute

- More notable examples of Dugong habitat and numbers of animals occur in Shoalwater Bay, Hervey Bay and Moreton Bay (Blair 2012).



Significance of attribute to the preservation of the GBRWHA

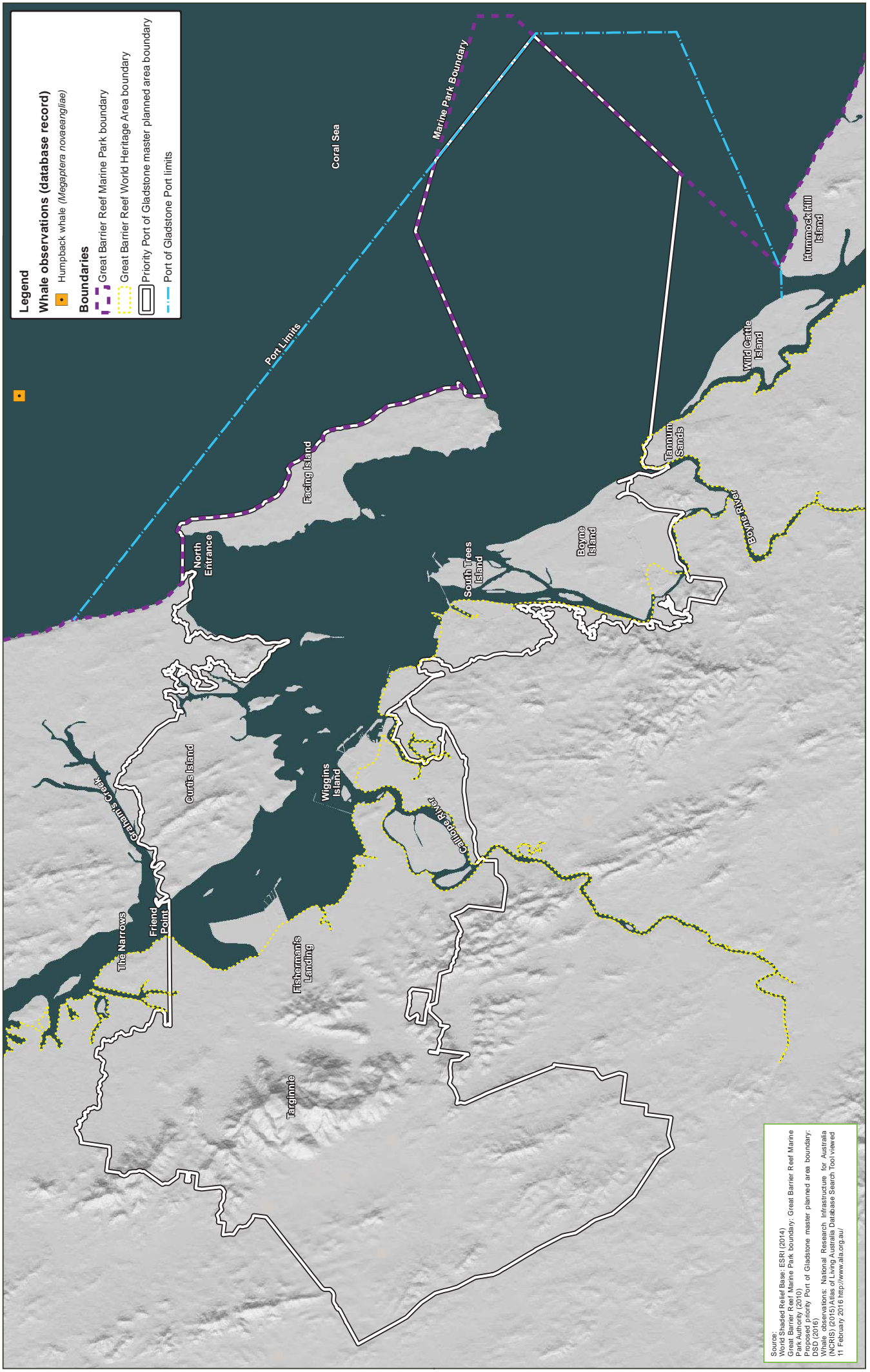
- Loss of habitat within and surrounding the PPG master planned area may impact on the southern population of Dugong. It is not, however, expected that this would result in the significant decline in the OUV of the GBRWHA.

4.2 Species of whales and migrating whales

4.2.1 Presence of local attribute

Whales have a **minor presence** in the PPG master planned area and surrounds based on the following information:

- Whale species which have the potential to occur within the PPG master planned area and surrounds include:
 - Blue whale (*Balaenoptera musculus*)
 - Bryde's whale (*Balaenoptera edeni*)
 - Humpback whale (*Megaptera novaeangliae*)
 - Killer whale (*Orcinus orca*)
 - Minke whale (*Balaenoptera acutorostrata*)
 - Southern right whale (*Eubalaena australis*)
 - Sperm whale (*Physeter macrocephalus*) (GPC 2012)
- Dominant whale species present within the PPG master planned area and surrounds, as recorded between 1980 and 2012 (NCRIS 2015), include:
 - Minke whale (*Balaenoptera acutorostrata*): four individuals
 - Humpback whale (*Megaptera novaeangliae*): 73 individuals
 - Sperm whale (*Physeter macrocephalus*): two individuals
 - One migrating whale species has been recorded on the wildlife databases within the PPG master planned area surrounds as illustrated in . However, this is not considered to be an accurate reflection of the seasonal presence of migrating whales in the region, though it does confirm a recorded sighting on the existing wildlife databases (refer Appendix C).
 - Waters adjacent to the PPG master planned area are known to support Humpback whales on a seasonal basis as part of their migratory movements to core calving habitat (refer Figure 4.3)



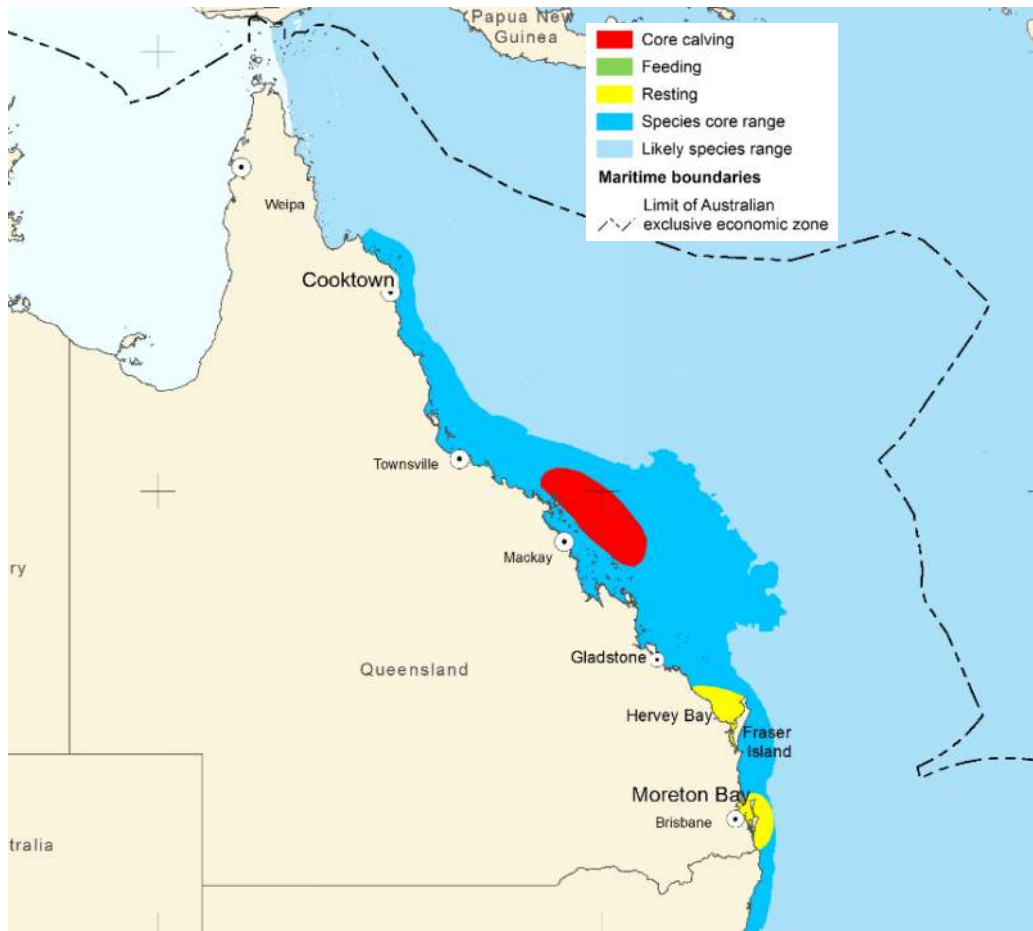
Map by: RB
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Source:
 World Shaded Relief Base: ESRI (2014)
 Great Barrier Reef Marine Park boundary: Great Barrier Reef Marine Park Authority (2010)
 Proposed priority Port of Gladstone master planned area boundary: DSD (2016)
 Whale observations: National Research Infrastructure for Australia (NCRIS) (2015) Atlas of Living Australia Database Search Tool Viewed 11 February 2016 <http://www.ala.org.au/>



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Priority Port of Gladstone master planning local expression of OUV of GBRWHA
 Figure 4.2: Migrating whales



Core calving	Area where the majority of humpback whale calving occurs
Feeding	Area where humpback whales are regularly observed feeding around Australia (excluding Antarctic waters)
Resting	Sheltered area where humpback whales are known to rest during the southern migration
Species core range	Humpback whales travel through this area on a seasonal basis as part of their migratory movements
Likely species range	Humpback whales may be present on a seasonal basis
Notes: While these described areas are indicative of these behaviours, these behaviours are not restricted to these areas and may occur elsewhere	

Figure 4.3 Humpback whale distribution and indicative habitat types

Source: TSSC (2015)

4.2.2 Contribution of the local attribute to the OUV of the GBRWHA

Whales have a **minor contribution** to the OUV of the GBRWHA based on the following information:

Commonwealth or state attribute legislative status

- Of the whale species with the potential to occur in the PPG master planned area and surrounds, two are listed as endangered under the EPBC Act (Blue and Southern right whales), and one is listed as vulnerable under the EPBC Act (Humpback whale). All species are listed as migratory under the EPBC Act, with the exception of the Minke whale.
- The whales observed within the PPG master planned area and surrounds are considered to be seasonally present within the offshore waters in the vicinity of the Port of Gladstone (GHD 2011a, GHD 2011b). Areas within the PPG master planned area and surrounds are mapped as 'species core range' (refer Figure 4.3) (ie Humpback whales travel through this area during seasonal migrations). The low number of recorded sightings for all species are not expected to represent a significant proportion of the overall species populations known to utilise the GBRWHA.
- Critical habitat has not been defined for many whale species such as the Blue whale (DoE 2015). This is due to the limited knowledge on the distribution and abundance of such species, and to date, the best information relates to biologically important areas where foraging occurs (DoE 2015). There is no foraging habitat within the PPG master planned area or surrounds.

Local or regional attribute status

- No areas in the PPG master planned areas, and surrounds, are specifically protected areas for whales

Notable or iconic attribute value

- The PPG master planned area and surrounds are not specifically recognised within key publications regarding the GBRWHA (ie retrospective statement of OUV, Outlook Report 2014, independent review, Lucas et al. 1997)
- The whales observed within the PPG master planned area and surrounds are considered to be seasonally present within the offshore waters in the vicinity of the Port of Gladstone (GHD 2011a, GHD 2011b)

Condition/trend of the attribute

- Whale populations are rated as being in good condition with a GBR wide trend of improvement. However it is noted that there is a lack of information on the condition of most whale population, however Humpback whale populations are recovering strongly.

Contribution to attribute sustainability

- The whales observed within the PPG master planned area and surrounds are considered to be seasonally present within the offshore waters in the vicinity of the Port of Gladstone (GHD 2011a, GHD 2011b), and based on the low recorded numbers of whales within the area, it is not expected that the area contributes significantly to the ongoing sustainability of whale populations within the GBRWHA. For example, there are 73 records on the wildlife databases for the Humpback whale in the PPG master planned area and surrounds between 1980 and 2012 (refer Appendix C, noting that this may not represent 73 different individuals), whereas the estimated east Australian population for this species is estimated by GBRMPA (2014) to be approximately 14,500. There is limited available population information for the GBRWHA for other whale species.
- Although the PPG master planned area and surrounds are mapped as the species core range, which is mapped extensively throughout the GBRWHA (refer Figure 4.3).

Notable presence of the attribute

- The seasonal presence of whales in the offshore waters surrounding the PPG master planned area are not considered to represent unique or notable examples of habitat for whales
- There are no known core calving, resting or foraging areas mapped in close proximity to the PPG master planned area and surrounds. The nearest aggregation area is located approximately 250 km south east, near Hervey Bay and Fraser Island (a resting area for the species) (refer Figure 4.3).

Significance of attribute to the preservation of the GBRWHA

- The local expression of whales in the PPG master planned area and surrounds does not represent a significant contribution to the OUV of the GBRWHA. It is highly unlikely that the loss of the local expression of this attribute would result in a significant decline in the OUV of the GBRWHA.

4.3 Species of dolphins

4.3.1 Presence of local attribute

Dolphins have a **moderate presence** in the PPG master planned area and surrounds based on the following information:

- Dolphin species which have the potential to occur within the PPG master planned area and surrounds include:
 - Australian humpback dolphin (*Sousa sahalensis*)
 - Australian snubfin dolphin (*Orcaella heinsohni*)
 - Coastal bottlenose dolphin (*Tursiops truncatus s. str.*)
 - Common dolphin (*Delphinus delphis*)
 - Indian ocean bottlenose dolphin (*Tursiops aduncus*)
 - Risso's dolphin (*Grampus griseus*)
 - Spotted dolphin (*Stenella attenuata*)
- Dolphin species which are frequently encountered within the PPG master planned area and surrounds include Australian humpback dolphin, Coastal bottlenose dolphin and the Indian-ocean bottlenose dolphin (Cagnazzi 2013, Cagnazzi 2015).
- Dolphin surveys conducted by Cagnazzi (2015) between 30 April and 4 September 2014 identified the Australian humpback dolphin within the PPG master planned area and surrounds (refer Figure 4.4). The Australian humpback dolphin is considered likely to occur as one population within Australian waters (DoEE 2016).
- The Australian snubfin dolphin was not identified within the PPG master planned area and surrounds during the surveys conducted by Cagnazzi (2015), however was recorded around Port Alma approximately 35 km north of the PPG master planned area and geographically separated by The Narrows and Curtis Island (refer Figure 4.5). The Australian snubfin dolphin is considered unlikely to inhabit the PPG master planned area and surrounds (Cagnazzi 2013, Cagnazzi 2015). The closest species occurrence record recorded in the Atlas of Living Australia for the Australian snubfin dolphin to the PPG master planned area and surrounds is a single individual recorded in 1997, situated on the north coast of Camp Island. Isolated species occurrence recordings have been collected near Bundaberg (recorded in 1994) and Yeppoon (recorded in 1999) (NCRIS 2016). Recent studies suggest that the Australian snubfin dolphin is unlikely to occur in substantial numbers in waters south of The Narrows (Cagnazzi 2013).

- There have been population estimates for the Australian humpback dolphins in Cleveland Bay (50 or less); the Capricorn coast (about 64); Keppel Bay (about 107); and the Port of Gladstone (about 85, denoted as Port Curtis in the Outlook Report 2014) (GBRMPA 2014a). This is approximately 306 individuals, of which approximately 28% are estimated to occur in the Port of Gladstone. Populations of this species are also known to occur south of the region in Great Sandy Strait and Moreton Bay (refer to Figure 4.6). There is almost no understanding of population structures of the Australian humpback dolphin occurring elsewhere in the GBRWHA and surrounding region, although there have been sightings (GBRMPA 2014a).
- The Outlook Report 2014 (GBRMPA 2014a) identifies that changes in population size of the Australian humpback dolphins will not be detectable over a short time period, unless declines are in the order of 20 per cent per year or greater. Therefore, population declines less than 20 per cent per year may result in the population size decreasing to very low levels before a decline is detected (GBRMPA 2014a).
- The other dolphin species generally occur offshore and generally display low site fidelity, instead foraging where large prey aggregations occur (GBRMPA 2014a). There is limited information on the estimated populations of these other species within the GBRWHA and in the PPG master planned area and surrounds.

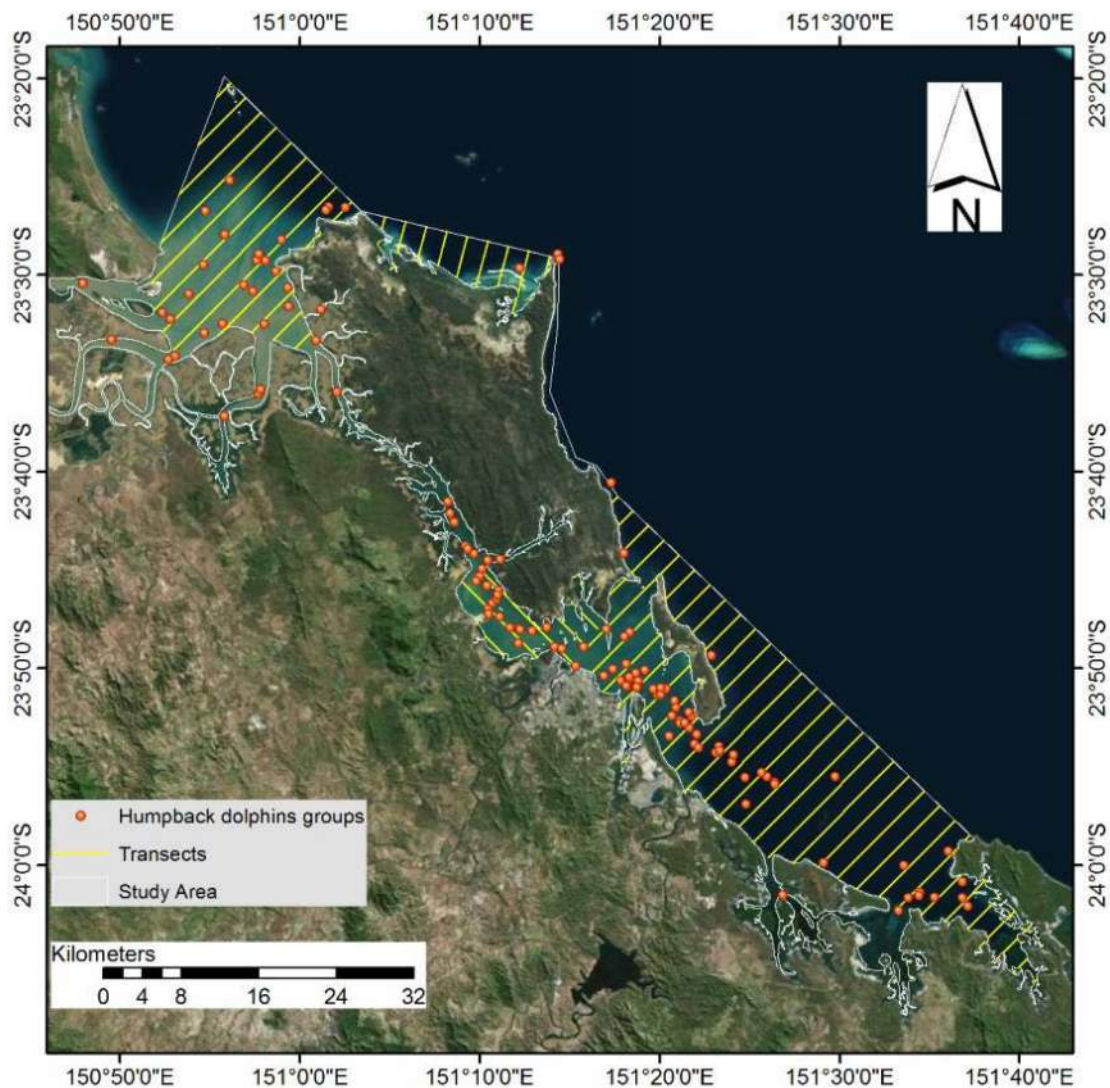


Figure 4.4 Distribution of groups of Australian humpback dolphins during 2014 surveys

Source: Cagnazzi (2015)

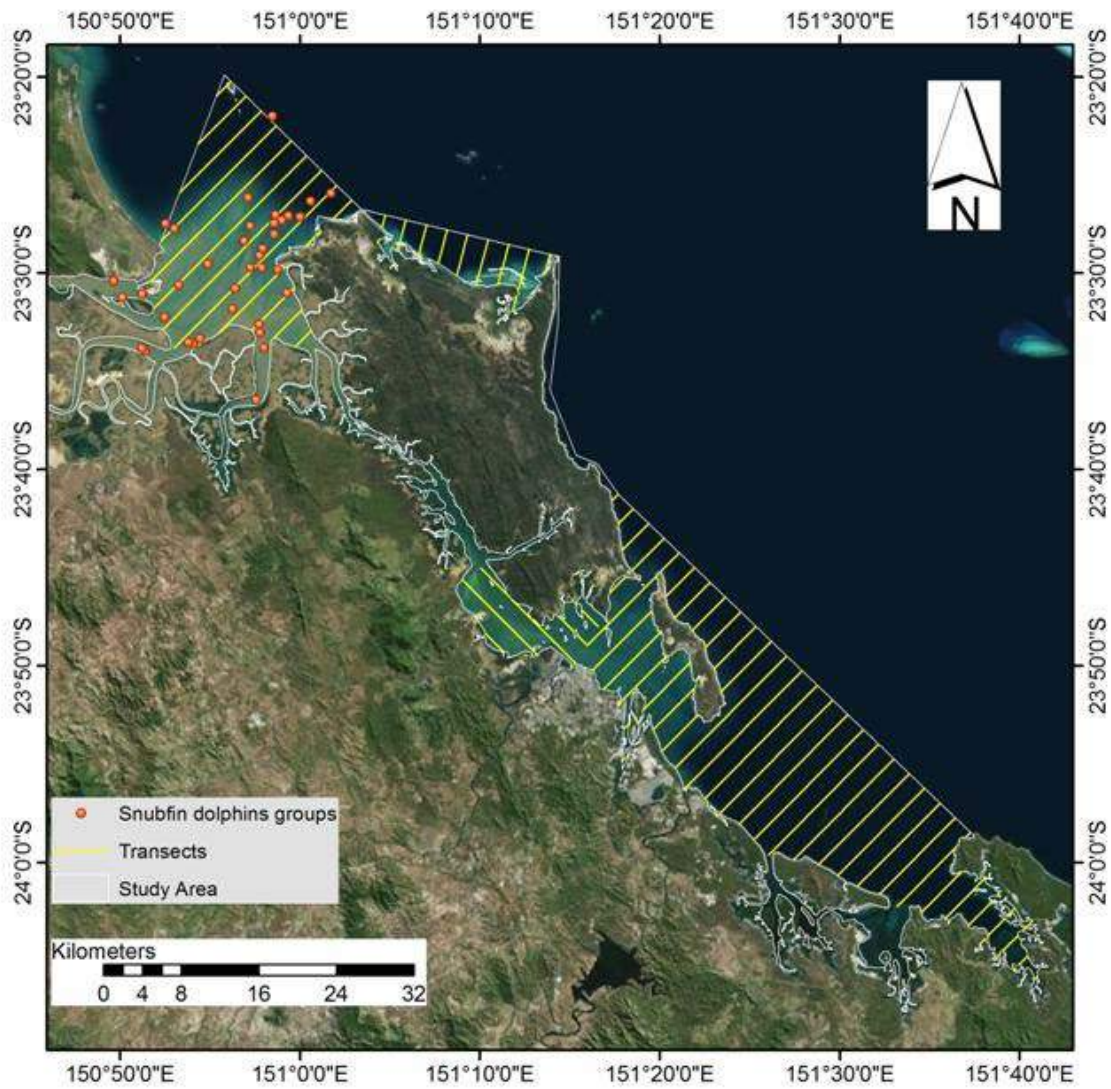


Figure 4.5 Distribution of groups of Australian snubfin dolphins during 2014 surveys

Source: Cagnazzi (2015)

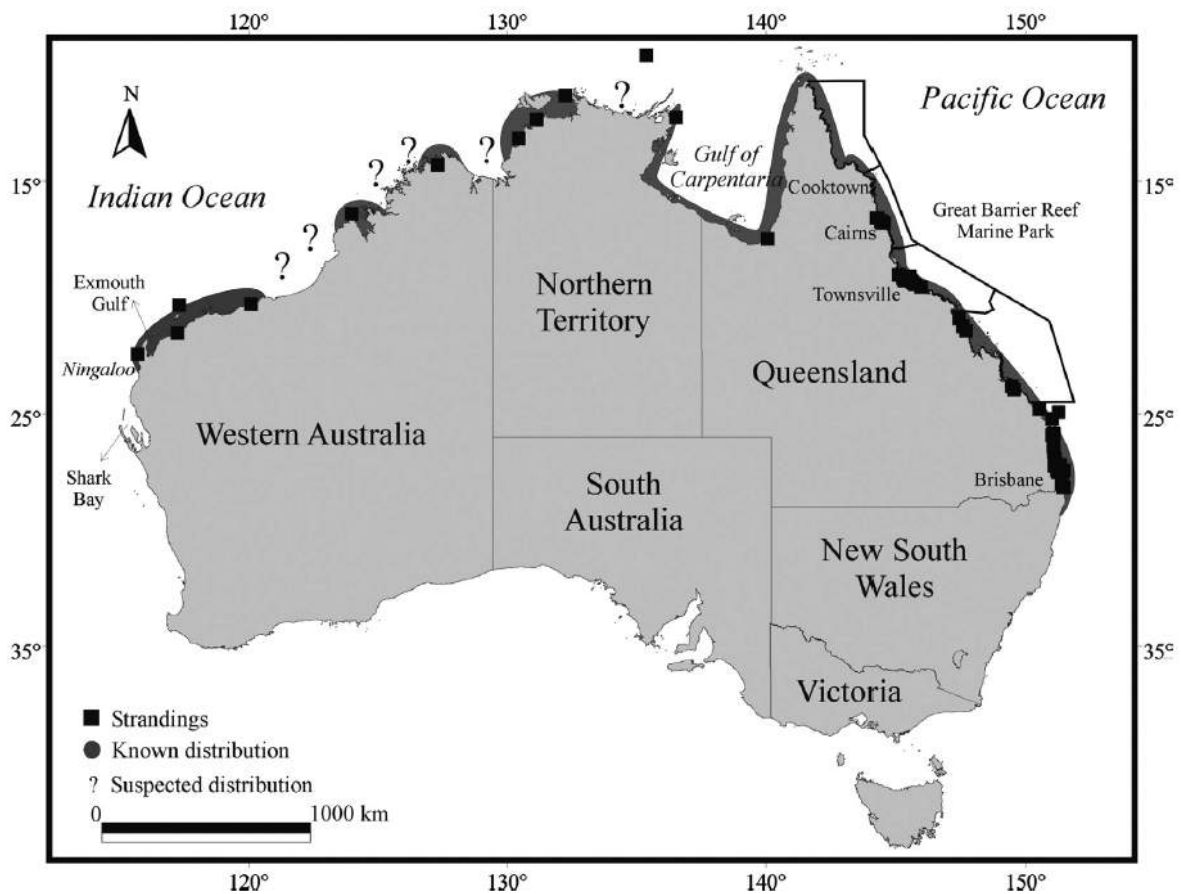


Figure 4.6 Distribution of Australian humpback dolphins in Australian water. The known distribution is based on stranding records and published literature.

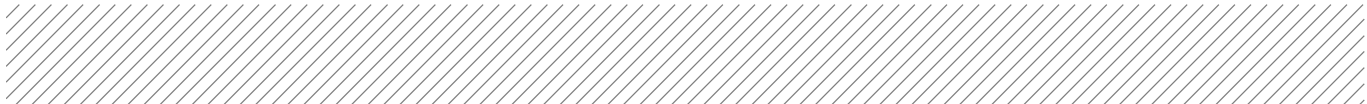
Source: Parra et al. (2004).

4.3.2 Contribution of the local attribute to the OUV of the GBRWHA

Dolphins have a **minor contribution** to criterion vii (aesthetic values and superlative natural phenomena) of the OUV of the GBRWHA, and a **significant contribution** to criterion x (biodiversity conservation) of the OUV of the GBRWHA based on the following information:

Commonwealth or state attribute legislative status

- Of the dolphin species likely to occur within the PPG master planned area and surrounds, none are listed as threatened under the EPBC Act, however, the Australian humpback dolphin is listed as migratory (Bonn Convention) and is listed as vulnerable under the NC Act.
- The western section of Moreton Bay and the lower reaches of the Brisbane River have been identified as potential key habitats for the Australian humpback dolphin (DoEE 2016). No critical habitat has been identified within the PPG master planned area or surrounds.
- There are no overall population estimates for the Australian humpback dolphin in the GBRWHA, however, populations for the Port of Gladstone indicate that the PPG master planned area and surrounds may contain approximately 85 individuals (GBRMPA 2014a).
- Distribution of the Australian humpback dolphin within the GBRWHA occurs in several key locations, including the following areas: Cairns; Cleveland Bay in Townsville; areas near Hamilton Island; and areas in the PPG master planned area and surrounds; Rodds Bay; and Port Alma (refer Figure 4.4 and Figure 4.6).

- 
- Based on the sparse information on population structure of this species (Para et al. 2004), the Port of Gladstone (including the PPG master planned area and surrounds) is considered to be an important location within the GBRWHA for the population of Australian humpback dolphins based on the known distribution of the species.

Local or regional attribute status

- There are no specific dolphin protection areas in the PPG master planned area or surrounds.

Notable or iconic attribute value

- The Outlook Report 2014 recognises the distribution of Australian humpback dolphins in the Port of Gladstone (specifically reported as Port Curtis, however this terminology is no longer widely used). Other published articles, as referenced throughout this section, also recognise the importance of the Port of Gladstone (including the PPG master planned area and surrounds) as being an important location for this species' distribution within the context of the GBRWHA.
- No publications specifically reference the PPG master planned area or surrounds as being a prime example of an area important for the dolphin species known to occur in the GBRWHA.

Condition/trend of the attribute

- The GBR wide condition for dolphins is listed as good in the Outlook Report 2014, with the GBR wide trend listed as deteriorating.
- The Outlook Report specifically identifies the Australian snubfin and Australian humpback dolphins as being the highest priority for management in the GBRWHA due to their 'small, localised populations, exposure to high levels of human activity, and suspected population declines.' (GBRWHA 2014).
- The Australian humpback dolphin is at risk of population declines that may not be detectable if less than a 20 per cent decline in one year, therefore this species requires a particular focus in terms of the OUV of the GBRWHA.

Contribution to attribute sustainability

- The PPG master planned area and surrounds is considered to contribute to the sustainability of the Australian humpback dolphin in the GBRWHA, and its loss may potentially affect the overall population viability, though this is not expected to lead to an immediate and significant population decline.

Notable presence of the attribute

- Refer to above information.

Significance of attribute to the preservation of the GBRWHA

- It is unlikely that the loss of the Australian humpback dolphin from the PPG master planned area and surrounds, would result in a serious decline in the species overall population (ie Australian population), however the loss may potentially affect population viability (though there is limited evidence to support this). There are other centres of distribution for this species outside of the GBRWHA that contribute to the total species population.
- Therefore, it is unlikely that the loss of the Australian humpback dolphin from the PPG master planned area and surrounds would result in a significant decline in the OUV of the GBRWHA.

5 Marine turtles

The relevant information from the retrospective statement of OUV and the Outlook Report 2014 relating to marine turtles is summarised in Table 5.1, with respect to the local expression of the OUV of the GBRWHA for the PPG master planned area and surrounds.

For this section, a rookery is defined as a colony of breeding animals and a nesting beach is defined as a suitable location for nesting for marine turtles (eg may include a rookery, or may only contain scattered nesting sites).

Table 5.1 OUV of the GBRWHA: Marine turtles

Attribute	Statement of OUV	GBR Outlook Report 2014			Relevant OUV criteria			
		GBR wide: Significant contribution to OUV	GBR wide condition	GBR wide trend	vii	viii	ix	x
Breeding colonies of marine turtles	<ul style="list-style-type: none"> ■ Cays of the GBRWHA support globally important breeding colonies of marine turtles 	<ul style="list-style-type: none"> ■ Breeding colonies of marine turtles on islands and cays, with 38 islands identified as being important nesting sites, including: <ul style="list-style-type: none"> – Raine Island (Green turtle) – Milman Island (Hawksbill and Green turtles) – Moulter Cay (Green turtle) – Wild Duck Island (Flatback turtle) – Peak Island (Flatback turtle) – Cays of the Capricorn Bunker Group (Loggerhead and Green turtles) 	Poor	No consistent trend	✓	-	-	✓
Green turtle breeding	<ul style="list-style-type: none"> ■ Raine Island is the world's largest green turtle breeding area 	<ul style="list-style-type: none"> ■ Raine Island supports the world's largest aggregation of nesting green turtles 	Poor	No consistent trend	✓	-	-	✓

Attribute	Statement of OUV	GBR Outlook Report 2014			Relevant OUV criteria			
		GBR wide: Significant contribution to OUV	GBR wide condition	GBR wide trend	vii	viii	ix	x
Marine turtle rookeries	<ul style="list-style-type: none"> Six of the world's seven species of marine turtle occur in the GBR GBRWHA includes many regionally important marine turtle rookeries 	<ul style="list-style-type: none"> Globally significant nesting areas occur in the GBR for four species, including Loggerhead turtle, Green turtle, Hawksbill turtle and the Flatback turtle 	Poor	No consistent trend	✓	-	-	✓
Nesting turtles	<ul style="list-style-type: none"> Nesting turtles are a contributing attribute to the superlative natural phenomena of the GBR 	<ul style="list-style-type: none"> The GBR includes many regionally important marine turtle rookeries 	Poor	No consistent trend	✓	-	-	-

5.1 Presence of local attribute

Breeding colonies of marine turtles, Green turtle breeding, marine turtle rookeries, and nesting turtles have a **moderate** presence within the PPG master planned area and surrounds based on the following information:

- Marine turtles which have been recorded to nest within the PPG master planned area and surrounds include:
 - Flatback turtle (*Natator depressus*)
 - Green turtle (*Chelonia mydas*)
 - Loggerhead turtle (*Caretta caretta*)
- Flatback turtles are the dominant nesting marine turtle species in the PPG master planned area and surrounds, with approximately 20% of Queensland's Flatback turtle population recorded to nest on inshore islands of the Gladstone region (EPA 2003). During the 2014 to 2015 breeding season a moderate sized population with 40 nesting females was recorded on Curtis Island during peak nesting in late November to early December 2014 (Limpus et al. 2015). The southern section of Curtis Island is an index beach for monitoring (Limpus 1971) and consistently records approximately 50 breeding females nesting each season (Hodge et al. 2006). Nesting also occurs in lower numbers at the eastern side of Facing Island, Hummock Hill Island and at Tannum Sands (Limpus 2007).
- Green turtles are the most common species of marine turtle found in the PPG master planned area and surrounds (Limpus 2008a, Limpus et al. 2013). Aerial and boat-based surveys for marine turtles undertaken in the Port of Gladstone in 2008/2009 and 2011 to assess habitat utilisation, recorded a total of 522 turtles with the most commonly observed species being Green turtles (GHD 2009).

- The Green turtle has been recorded nesting within the PPG master planned area and surrounds, nesting on the beaches of Curtis Island and Facing Island (Limpus et al. 2000, Limpus et al. 2006, Limpus 2008b)
- Loggerhead turtles are known to nest occasionally on the beaches of Curtis and Facing Islands, but not on an annual basis (Limpus et al. 2013)
- The Hawksbill turtle is not considered to have a significant population within the PPG master planned area and surrounds. One recording of a nesting Hawksbill turtle has been recorded for the GBRWHA over a recording period of more than 70 years (GBRMPA 2014b).
- Olive ridley and Leatherback turtles are known to occur in the PPG master planned area and surrounds but are rarely encountered (Limpus et al. 2013). There are no records of Olive ridley turtles nesting in the GBRWHA (GBRMPA 2014a). There is limited census data availability for the Leatherback turtle in Australia and are considered to have low nesting numbers in Australia (GBRMPA 2014a).
- Within the PPG master planned area and surrounds, marine turtle nesting beaches are present on the seaward side of Facing Island, Curtis Island, Tannum Sands and Wild Cattle Island. Marine turtle nesting areas within the PPG master planned area and surrounds are illustrated in Figure 5.1.
- Foraging resources for marine turtles are mapped in Figure 6.1 (Extent of seagrass meadows), Figure 6.2 (Benthic macroalgae) and Figure 1.1 (Reefs).

5.2 Contribution of the local attribute to the OUV of the GBRWHA

Breeding colonies of marine turtles and marine turtle rookeries are considered to have a **moderate contribution** to criterion vii (aesthetic values and superlative natural phenomena) and a **moderate contribution** to criterion x (biodiversity conservation) based on the information below.

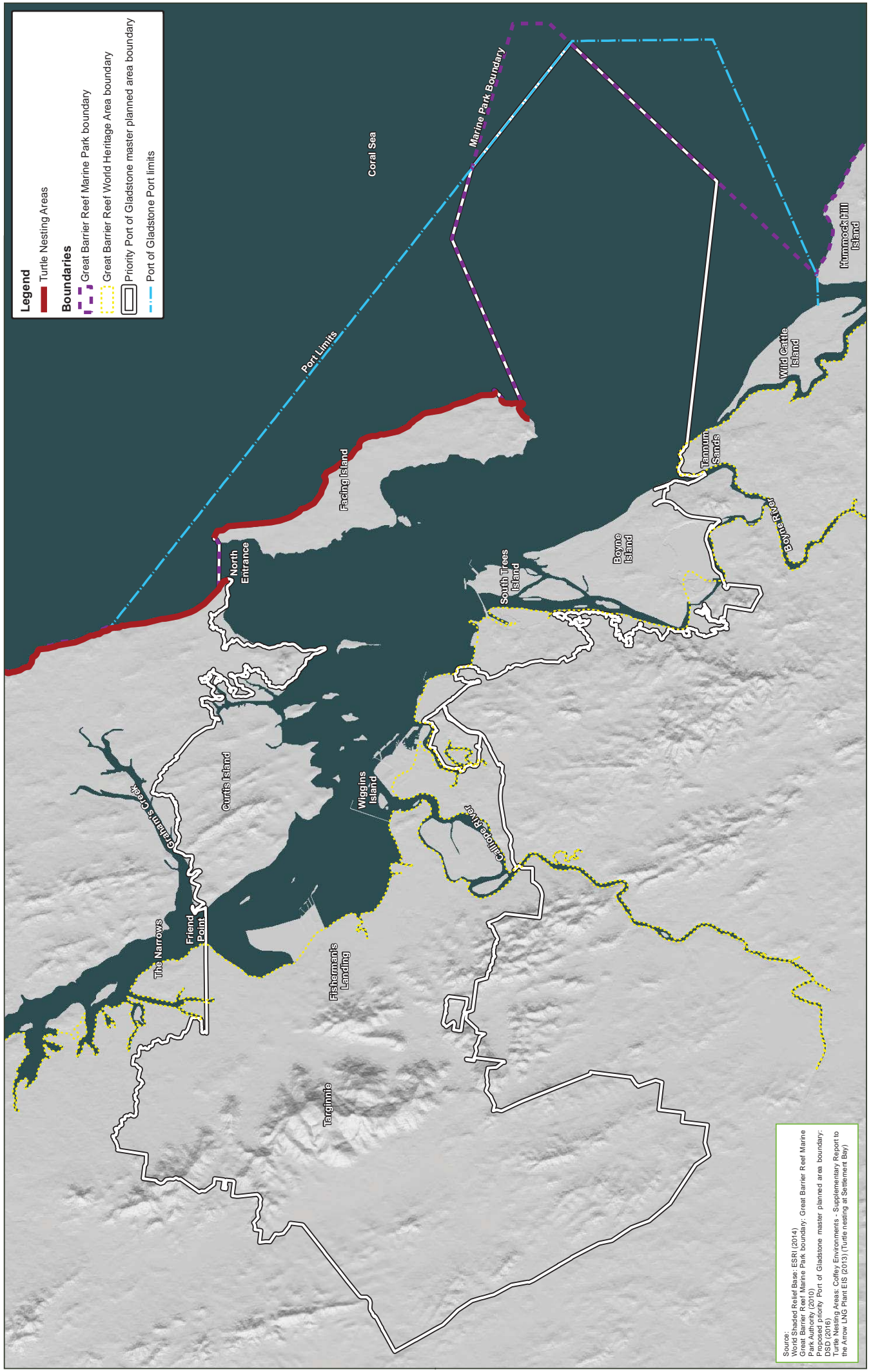
Green turtle breeding and nesting turtles are considered to have a **minor contribution** to criterion vii (aesthetic values and superlative natural phenomena) and a **minor contribution** to criterion x (biodiversity conservation) based on the following information:

Commonwealth or state attribute legislative status

- Marine turtles which nest within the PPG master planned area and surrounds are listed as threatened, migratory species and include:
 - Flatback turtle (*Natator depressus*): vulnerable (EPBC Act, NC Act), listed migratory (EPBC Act [Bonn convention]), listed marine (EPBC Act), listed as data deficient at a global scale by the IUCN
 - Green turtle (*Chelonia mydas*): vulnerable (EPBC Act, NC Act), listed migratory (EPBC Act [Bonn convention]), listed marine (EPBC Act), listed as endangered at a global scale by the IUCN
 - Loggerhead turtle (*Caretta caretta*): endangered (EPBC Act, NC Act), listed migratory (EPBC Act [Bonn convention]), listed marine (EPBC Act), listed as vulnerable at a global scale by the IUCN
- The PPG master planned area and surrounds are not listed as an area of identified habitat critical to the survival of marine turtles species (Environment Australia 2003).

Local or regional attribute status

- There are no specific marine turtle protection areas in the PPG master planned area or surrounds
- Marine turtles are protected within the GBR Marine Park through permit requirements and activity restrictions in zoned areas of the GBR Marine Park. GBR Marine Park zoning surrounding the PPG master planned area includes 'general use zone', 'habitat protection zone', 'marine national park zone' and 'conservation park zone'.



Legend

- Turtle Nesting Areas

Boundaries

- Great Barrier Reef Marine Park boundary
- Great Barrier Reef World Heritage Area boundary
- Priority Port of Gladstone master planned area boundary
- Port of Gladstone Port limits

Source:
 World Shaded Relief Base: ESRI (2014)
 Great Barrier Reef Marine Park boundary: Great Barrier Reef Marine Park Authority (2014)
 Priority Port of Gladstone master planned area boundary: DSD (2016)
 Turtle Nesting Areas: Coffey Environments - Supplementary Report to the Arrow LNG Plant EIS (2013) (Turtle nesting at Settlement Bay)



0 2,000 4,000 Metres

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Priority Port of Gladstone master planning local expression of OUV of GBRWHA
Figure 5.1: Turtle nesting areas



Notable or iconic attribute value


- The marine turtle populations within the PPG master planned area and surrounds are not recognised as a prime example or value of the region in key publications (ie retrospective statement of OUV, Outlook Report 2014 and Lucas et al. 1997). However, there are recent publications identifying Curtis Island as one of four key rookeries for the Flatback turtle which is the only marine turtle endemic to Australia (refer below information).

Condition/trend of the attribute

- The Great Barrier Reef Outlook Report 2014 (GBRMPA 2014a) records the attribute condition in the wider GBR to be poor for marine turtles. No consistent trend was recorded for marine turtles.

Contribution to attribute sustainability

- Important nesting sites for marine turtles within the GBRWHA include:
 - Raine Island and nearby cays (supports the world’s largest aggregation of nesting Green turtles)
 - Milman Island (supports Hawksbill turtles and Green turtles)
 - Bouydong Island (supports Hawksbill turtles)
 - Moulter Cay (supports Green turtles)
 - Wild Duck Island (supports Flatback turtles)
 - Peak Island (supports Flatback turtles)
 - Avoid Island (supports Flatback turtles)
 - Curtis Island (supports Flatback turtles)
 - Cays of the Capricorn Bunker Group (supports Loggerhead turtles and Green turtles) (GBRMPA 2014a)
- Loggerhead turtles and Green turtles are supported by the foraging resources present in the GBRWHA, including the following resources within PPG master planned area and surrounds:
 - The inshore region of the Port of Gladstone provides foraging resources for Green turtles in the form of seagrass meadows, including species *Zostera muelleri*, *Halodule* and *Halophila*, mangroves and macroalgae (Limpus 2008a). The seagrass habitat and species types found in the coastal areas of Port of Gladstone are abundant in the wider Fitzroy Natural Resource Management region at Shoalwater Bay, Keppel Islands, Rodds Bay and Hervey Bay (McKenzie et al. 2014) which suggests there remains foraging habitat for Green turtles in the wider GBR region
 - The Loggerhead turtle is a carnivorous species with a diet that includes soft corals, jellyfish, cuttlefish, sea-pens, sea-cucumbers and invertebrates such as gastropods and bivalve molluscs (Chatto 1998). Foraging resources for the Loggerhead turtle are considered to be widespread and readily available across the GBR region
- Marine turtle species which have been recorded to nest within the PPG master planned area and surrounds include:
 - Flatback turtles: Approximately 20% of Queensland’s Flatback turtle population are recorded to nest on inshore islands of the Gladstone region (EPA 2003). Limpus et al. (2013) includes South End beach on Curtis Island as one of four key Flatback turtle rookery for eastern Australia
 - Green turtles: Recorded nesting within the PPG master planned area and surrounds, nesting on the beaches of Curtis Island and Facing Island (Limpus et al. 2000, Limpus et. al. 2006, Limpus 2008b)
 - Loggerhead turtles: Recorded to nest occasionally on the beaches of Curtis and Facing Islands (EPA 2003)

- 
- The potential loss of nesting sites for the Flatback turtle within the PPG master planned area and surrounds has the potential to impact on the Flatback turtle populations of the GBRWHA, as approximately 20% of Queensland's Flatback turtle population are recorded to nest on inshore islands of the Gladstone region (EPA 2003)
 - Given that the Loggerhead turtle breeding area for eastern Australia is concentrated in the Capricorn-Bunker Group, the Swain Reefs, and the Bundaberg to Wreck Rock area (Lucas et al. 1997), there is potential risk that the loss of foraging habitat within the PPG master planned area and surrounds could contribute to the loss or decline of the population of Loggerhead turtles in the southern section of the GBRWHA.

Notable presence of the attribute

- Curtis Island provides an important nesting beach for the Flatback turtle, which is endemic to the east Australian continental shelf (Limpus et al. 2013). South End beach is listed as one of four key rookeries for this species (Limpus et al. 2013).
- More notable examples of Green turtle nesting within the GBRWHA occur at Raine Island and Moulter Cay (GBRMPA 2014a)
- More notable examples of Flatback turtle nesting within the GBRWHA occur at Peak Island, Wild Duck Island and Avoid Island (GBRMPA 2014a)
- More notable examples of Loggerhead turtle nesting within the GBRWHA occur at the islands and cays of the Capricorn-Bunker group and Swains Reefs (GBRMPA 2014a).

Significance of attribute to the preservation of the GBRWHA

- The loss of nesting habitat on Curtis Island, and in particular the South End beach nesting habitat, would likely have an impact on populations of the Flatback turtle, as it is one of four major rookeries for the species. The loss of nesting sites for this species within the PPG master planned area and surrounds has the potential to result in a significant impact on the OUV of the GBRWHA (ie loss of biodiversity and aesthetic values).
- The loss of nesting sites for marine turtles within the PPG master planned area and surrounds is considered likely to impact on populations of the Flatback turtle and has the potential to impact local populations of the Green turtle and the Loggerhead turtle (ie which form part of the southern GBRWHA population). However, the loss of nesting sites within the PPG master planned area and surrounds is not considered to have a significant impact on the OUV of the GBRWHA.

6 Seagrass and macroalgae

The relevant information from the retrospective statement of OUV and the Outlook Report 2014 relating to seagrass and macroalgae is summarised in Table 6.1, with respect to the local expression of the OUV of the GBRWHA for the PPG master planned area and surrounds.

Table 6.1 OUV of the GBRWHA: Seagrass and macroalgae

Attribute	Statement of OUV	GBR Outlook Report 2014			Relevant OUV criteria			
		GBR wide: Significant contribution to OUV	GBR wide condition	GBR wide trend	v ii	viii	ix	x
Seagrass	<ul style="list-style-type: none"> The shallower marine areas of the GBRWHA support many seagrass species 	<ul style="list-style-type: none"> 15 species of seagrass occur within the GBRWHA 	Poor	Deteriorated	✓	✓	✓	✓
Beds of <i>Halimeda</i> algae	<ul style="list-style-type: none"> Extensive beds of <i>Halimeda</i> algae represent active calcification and accretion over thousands of years 	<ul style="list-style-type: none"> <i>Halimeda</i> banks comprise large areas of the northern Great Barrier Reef, inshore of the Ribbon Reefs, and are also found further south 	Very good	Stable	-	-	✓	-

6.1 Seagrass

6.1.1 Presence of local attribute

The attribute 'seagrass' has a **moderate presence** in the PPG master planned area and surrounds based on the following information:

- Seagrass surveys in the Port of Gladstone and surrounds conducted since 1988 have found that the area contains a diverse array of seagrass meadows
- Seagrass meadows are present (or have previously been identified in) the PPG master planned area and surrounds in both intertidal and subtidal deep water from the Western Basin, Inner harbour, mid harbour and outer harbour, and into the deeper coastal water of the Great Barrier Reef Marine Park (GBRMP). Fifteen species of seagrass occur within the GBRWHA and seven of these have been recorded within the Port of Gladstone (GPC 2012) being:
 - Cymodocea rotundata*
 - Halodule uninervis*
 - Halophila decipiens*
 - Halophila ovalis*
 - Halophila spinulosa*
 - Halophila minor*
 - Zostera mulleri* subsp. *capricorni*

- Seagrass meadows in the region are ephemeral and changes in seagrass abundance, species composition and biomass will occur over different seasons. Seagrass seasonal cycles are defined according to the climate-induced pattern of growth and senescence (McKenzie 1994, Chartrand et al. 2011). The growing season is defined as July to January, which typifies seagrass' natural increase in biomass and distribution as ideal growth conditions provide a period of opportunistic expansion. The senescent season, from February to June, is typically when seagrasses retract and rely on stores or seeds to get through wet season conditions, including flooding and reduced water quality (Chartrand et al. 2012).
- The total area (composite) of seagrass meadows recorded from previous fine-scale surveys (ie 2002, 2009, 2013 and 2014) are illustrated in Figure 6.1.

6.1.2 Contribution of the local attribute to the OUV of the GBRWHA

The attribute 'seagrass' has a **minor contribution** to criterion vii (aesthetic values and superlative natural phenomena) and to criterion viii (ongoing geological processes), and a **moderate contribution** to criterion ix (ecological and biological processes) and to criterion x (biodiversity conservation) of the OUV of the GBRWHA based on the following information:

Commonwealth or state attribute legislative status

- All seagrass meadows in Queensland, dormant and alive, are protected under the *Fisheries Act 1994*

Local or regional attribute status

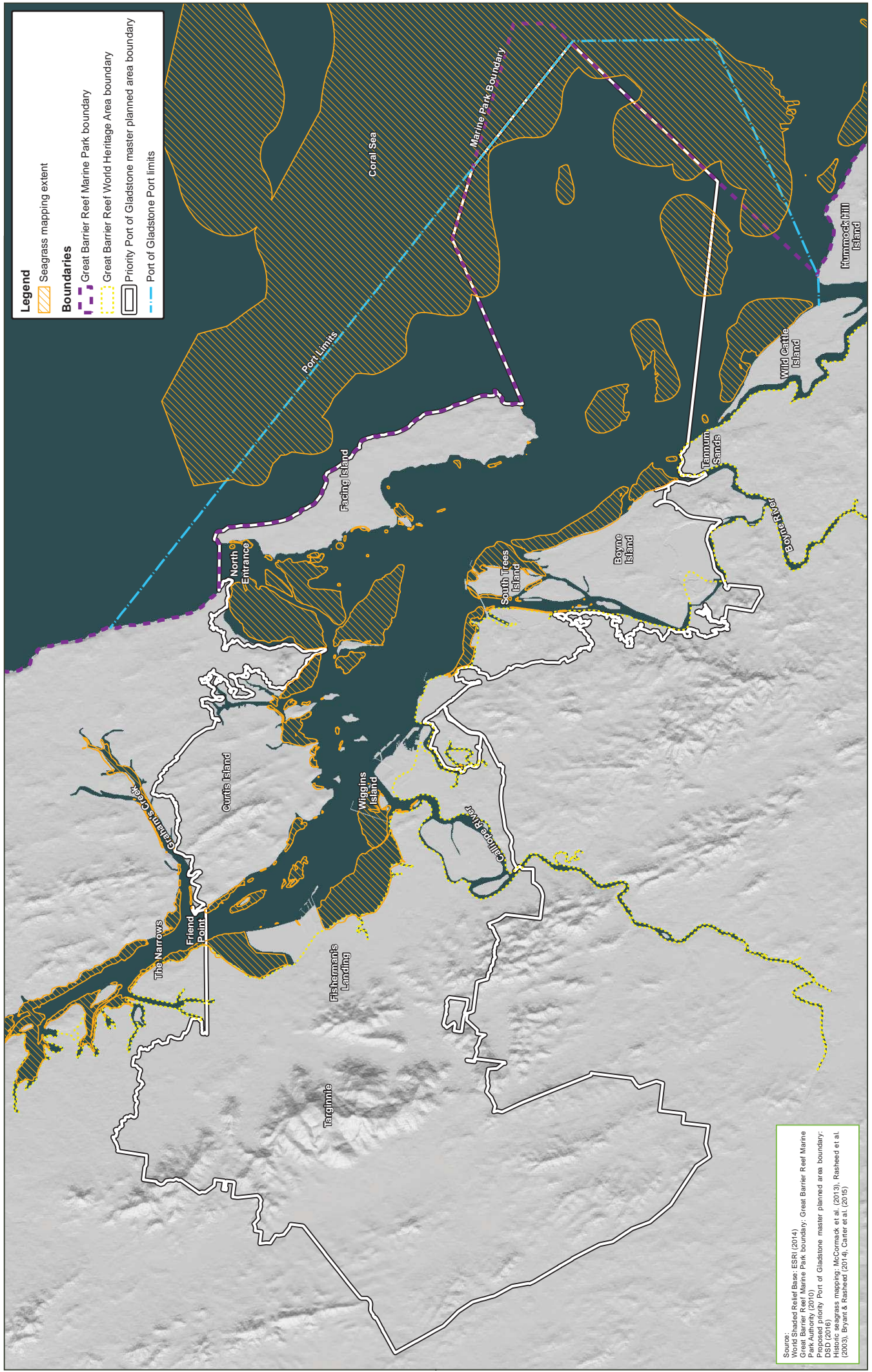
- The seagrass meadows in the waters of the Port of Gladstone are subject to protections under the *Fisheries Act 1994*
- The seagrass communities of the Port of Gladstone and Rodds Bay are the largest major areas of seagrass located between Shoalwater Bay to the north and Hervey Bay to the south. The seagrass species types found in intertidal areas of the PPG master planned area and surrounds are well represented in the wider natural resource management (NRM) region of 'Fitzroy' under the Queensland Government's Reef Water Quality Protection Plan at Shoalwater Bay, Keppel Islands, Rodds Bay and Hervey Bay (McKenzie et al. 2014).
- Seagrasses in the Port of Gladstone region are of particular value as a food source to Dugong, recognised by the declaration of the Rodds Bay Dugong Protection Area (Carter et al. 2015).

Notable or iconic attribute value

- Seagrass meadows occur in moderate abundance within the PPG master planned area and surrounds. More notable and iconic examples of seagrass meadows occur in other areas of the GBRWHA (eg Shoalwater Bay area).
- The seagrass meadows are of value to the region and play a major role in supporting other local OUV attributes in the PPG master planned area and surrounds (eg Dugong, dolphins, marine turtles, fish species and diversity).

Condition/trend of the attribute

- Seagrass abundance and distribution have been declining globally at an ever increasing rate, attributable to both natural and anthropogenic pressures (Waycott et al. 2009). There appears to be a good link between seagrass condition in the Port of Gladstone and major climate events, especially high rainfall and flow events of the Calliope River (McCormack et al. 2013). Above average rainfall and flow from the Calliope River was recorded in 2010, 2011 and 2013, often coinciding with tropical cyclones in the region. These years were characterised by significant declines in seagrass biomass and meadow area and a shift in species composition, and generally being classified as in 'poor' condition. The overall condition of seagrass meadows in the region has improved since 2013.




Source:
 World Shaded Relief Base: ESRI (2014)
 Great Barrier Reef Marine Park boundary: Great Barrier Reef Marine Park Authority (2010)
 Proposed priority Port of Gladstone master planned area boundary: DSD (2016)
 Historic seagrass mapping: McCormick et al. (2013); Rasheed et al. (2003); Bryant & Rasheed (2014); Cairn et al. (2015)



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Priority Port of Gladstone master planning local expression of OUV of GBRWHA
Figure 6.1: Extent of seagrass meadows

- 
- The Great Barrier Reef Outlook Report 2014 (GBRMPA 2014a) records the attribute condition in the wider GBR to be poor for seagrass. The attribute condition trend was recorded as deteriorated for seagrass.

Contribution to attribute sustainability

- Seagrass contribute to coastal protection by restricting water movement, support of fisheries production, nutrient cycling and particle trapping (Costanza et al. 2014, Hemminga and Duarte 2000)
- As benthic primary producer habitat, seagrasses have important economic value in terms of nursery and feeding habitats for commercial and recreational fisheries species (Watson et al. 1993, Unsworth and Cullen 2010) as well as providing food sources for marine megafauna, including turtles and Dugongs.
- Seagrass meadows display measurable responses to changes in water quality, which make them ideal indicators for measuring the health of ecosystems and the impacts of developments and industries along coastlines (Rasheed et al. 2008).

Notable presence of the attribute

- Seagrass meadows occur in moderate abundance within the PPG master planned area and surrounds. More notable and iconic examples of seagrass meadows occur in other areas of the GBRWHA (eg Shoalwater Bay area).

Significance of attribute to the preservation of the GBRWHA

- The role that seagrass meadows play in supporting a range of other local OUV attributes (eg Dugong, marine turtles, fish species) in the PPG master planned area and surrounds suggests that seagrass meadows have a minor to moderate contribution to the OUV of the GBRWHA.

6.2 *Halimeda* algae

6.2.1 Presence of local attribute

The attribute 'beds of *Halimeda* algae' has a **minor presence** in the PPG master planned area and surrounds based on the following information:

- Broad-scale baseline assessments of benthic communities in the Port of Gladstone (McKenna et al. 2014) have recorded the presence of the erect calcareous algae *Halimeda* in low to low/medium density cover macroalgae regions
- The presence of *Halimeda* was associated with benthic communities of mostly open substrate dominated by sand/shell with low densities of erect macrophytic, erect calcareous and filamentous algae located around three areas on the offshore side of Facing Island (McKenna et al. 2014). It was also recorded in small benthic community around Rodds Peninsula where it was the dominant algae in this region (refer Figure 6.2).

6.2.2 Contribution of the local attribute to the OUV of the GBRWHA

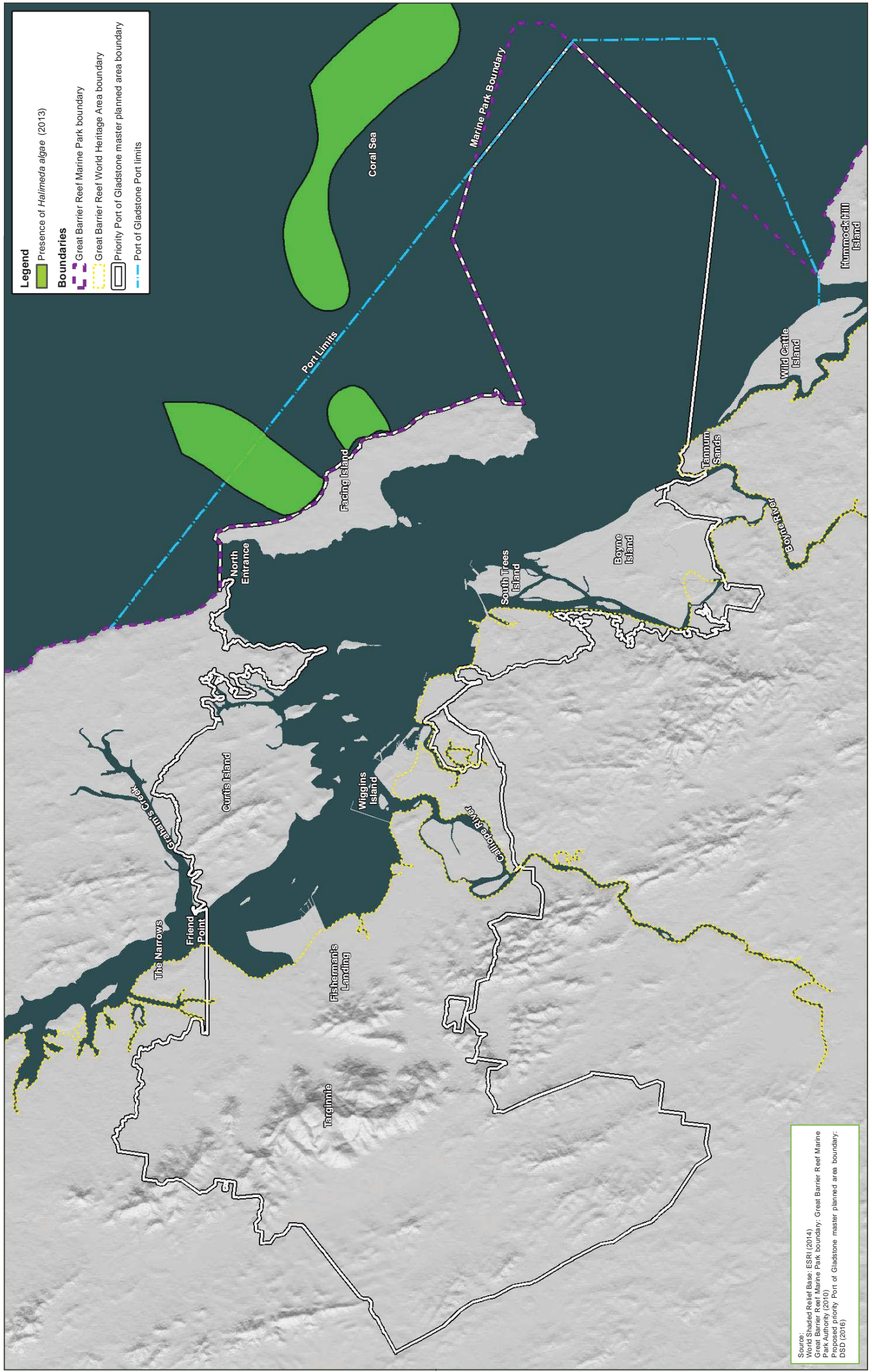
The attribute 'beds of *Halimeda* algae' has a **minor contribution** to criterion ix (ecological and biological processes) of the OUV of the GBRWHA based on the following information:

Commonwealth or state attribute legislative status

- Macroalgae genus *Halimeda* is not specifically listed under Commonwealth or state legislation

Local or regional attribute status

- Macroalgae genus *Halimeda* is not specifically listed under local or regional legislative mechanisms



Source:
 World Shaded Relief Base: ESRI (2014)
 Great Barrier Reef Marine Park boundary: Great Barrier Reef Marine Park Authority (2010)
 Proposed priority Port of Gladstone master planned area boundary: DSD (2016)



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Priority Port of Gladstone master planning local expression of OUV of GBRWHA
 Figure 6.2: Presence of *Halimeda* algae

Notable or iconic attribute value

- *Halimeda* in the PPG master planned area and surrounds is not specifically recognised as a prime example or value of the region in key publications (ie retrospective statement of OUV, Outlook Report 2014 and Lucas et al. 1997). *Halimeda* banks in the GBRWHA are generally associated with remote areas and deep water.

Condition/trend of the attribute

- The Great Barrier Reef Outlook Report 2014 (GBRMPA 2014a) records the attribute condition in the wider GBR to be very good for *Halimeda* algae. The attribute condition trend for *Halimeda* algae was recorded as stable for *Halimeda* algae.

Contribution to attribute sustainability

- The areas where *Halimeda* has been recorded in the PPG master planned area and surrounds are unlikely to contribute significantly to the sustainability of *Halimeda* as a habitat area across the GBRWHA.

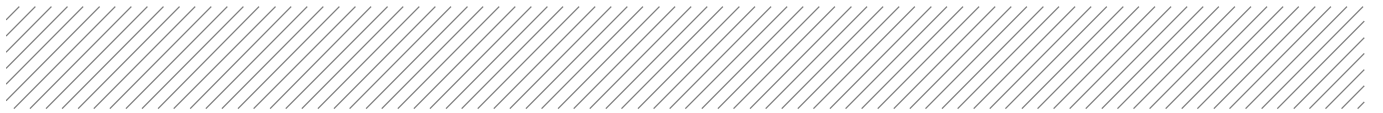
Notable presence of the attribute

- The presence of *Halimeda* in the PPG master planned area and surrounds (in 2013) was associated with benthic communities of mostly open substrate dominated by sand/shell with low densities of erect macrophytic, erect calcareous and filamentous algae. *Halimeda* banks in the GBRWHA are generally associated with remote offshore areas and deep water in the northern areas of the GBRWHA (refer Figure 6.3).



Figure 6.3 Locations of *Halimeda* banks

Source: GBRMPA (2014)



Significance of attribute to the preservation of the GBRWHA

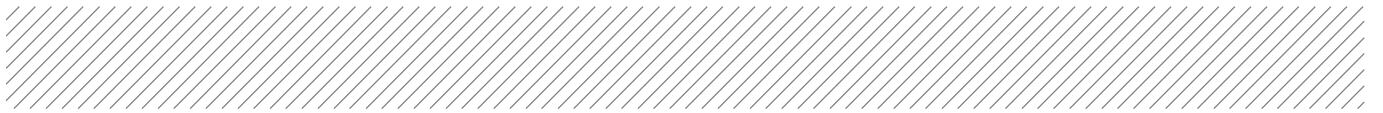
- Loss of *Halimeda* algae within and surrounding the PPG master planned area may impact on the local reef communities. It is not, however, expected that this would result in the significant decline in the OUV of the GBRWHA.

7 Seabirds and migratory shorebirds

The relevant information from the retrospective statement of OUV and the Outlook Report 2014 relating to seabirds and shorebirds is summarised in Table 7.1, with respect to the local expression of the OUV of the GBRWHA for the PPG master planned area and surrounds.

Table 7.1 OUV of the GBRWHA: Seabirds and migratory shorebirds

Attribute	Statement of OUV	GBR Outlook Report 2014			Relevant OUV criteria			
		GBR wide: Significant contribution to OUV	GBR wide condition	GBR wide trend	vii	viii	ix	x
Seabirds	<ul style="list-style-type: none"> Twenty-two seabird species breed on cays and some continental islands, and some of these breeding sites are globally significant; other seabird species also utilise the area. On many of the cays there are 	<ul style="list-style-type: none"> Breeding colonies of seabirds at the following islands and cays supporting breeding populations. Important seabird areas include Raine Island, Michaelmas Cay, islands of the Capricorn-Bunker Group and the cays of the Swain Reefs. 	Poor	No consistent trend	✓	-	-	-
		<ul style="list-style-type: none"> 22 seabird species breeding (cays and some continental islands have globally significant breeding sites) 	-	-	-	-	-	✓



Attribute	Statement of OUV	GBR Outlook Report 2014			Relevant OUV criteria			
		GBR wide: Significant contribution to OUV	GBR wide condition	GBR wide trend	vii	viii	ix	x
	spectacular and globally important breeding colonies of seabirds	<ul style="list-style-type: none"> ■ Islands and cays within the GBR support breeding populations of 20 seabird species. It is estimated that between 1.4 and 1.7 million seabirds breed throughout the GBR each year. This represents more than 25 per cent of Australia's tropical seabirds, more than 50 per cent of offshore – foraging black noddies and approximately 25 per cent of Wedge-tailed shearwaters, Brown booby, Masked booby and Red-tailed tropic birds. The number of non-breeding birds (birds which use the region for feeding but breed elsewhere) is estimated to be about 425,000, giving a total seabird population that may exceed two million. ■ Key locations include wetlands, shorelines, offshore islands and coral cays. 	Poor	-	-	-	✓	-

Attribute	Statement of OUV	GBR Outlook Report 2014			Relevant OUV criteria			
		GBR wide: Significant contribution to OUV	GBR wide condition	GBR wide trend	vii	viii	ix	x
Shorebirds and migratory birds	<ul style="list-style-type: none"> ■ 242 species of birds ■ The establishment of vegetation on the cays and continental islands exemplifies the important role of birds, such as the Pied Imperial Pigeon, in processes such as seed dispersal and plant colonisation. 	<ul style="list-style-type: none"> ■ 242 species of birds 	Poor	-	-	-	-	✓

7.1 Seabirds

7.1.1 Presence of local attribute

For the purposes of this attribute, the assessment of local expression of the seabird attribute was limited to seabirds known to breed in the GBRWHA. This is consistent with the description of the attribute in the Statement of OUV (DoE 2015a), the Outlook Report 2014 (GBRMPA 2014a) and other supporting reports (eg Lucas et al. 1997).

Although there is no breeding habitat within the PPG master planned area and surrounds for the seabird species considered here, there is potential foraging habitat within the master planned area.

Seabirds have a **minor presence** in the PPG master planned area and surrounds based on the following information:

- The offshore and pelagic foraging seabirds known to breed in the Mackay/Capricorn region (refer Figure 7.1) of the GBRWHA include (GBRMPA 2012, GBRMPA 2014a):
 - Wedge-tailed shearwater (*Ardenna pacifica*)
 - Brown booby (*Sula leucogaster*)
 - Masked booby (*Sula dactylatra*)
 - Lesser frigatebird (*Fregata ariel*)
 - Red-tailed tropic bird (*Phaethon rubricauda*)
 - Black noddy (*Anous minutus*)

- The nearest known seabird breeding colonies to the PPG master planned area and surrounds are situated in the Capricorn-Bunker Group of coral cays and islands (refer Figure 7.1) (GBRMPA 2012, GBRMPA 2014a). The 13 islands and cays in the Capricorn-Bunker Group host breeding colonies for approximately 65.6 per cent of the biomass of breeding seabirds in the GBR (Dyer et al. 2005, GBRMPA 2012, Hulsman et al. 1997).
- These breeding colonies are situated approximately 45 km north east of the PPG master planned area
- Wedge-tailed shearwaters have been recorded travelling between 300 km to 1100 km from breeding colonies to foraging sites (McDuie et al. 2015). Other seabird species, such as the Brown booby, will generally forage in shallow inshore reef waters (Bunce 2015).
- These breeding seabirds may utilise the PPG master planned area and surrounds as foraging habitat, particularly waters from the seaward side of Boyn Island and out toward the GBRMP boundary and the Capricorn-Bunker Group (refer Figure 7.1)
- Of the seabirds listed above, the following species have been recorded as occurring in the PPG master planned area and surrounds on species databases (refer Appendix C):
 - Wedge-tailed shearwater – 1 record
 - Brown booby – 3 records (1 specimen backed)
 - Masked booby – not recorded
 - Lesser frigatebird – 1 record
 - Red-tailed tropic bird – not recorded
 - Black noddy – 2 records

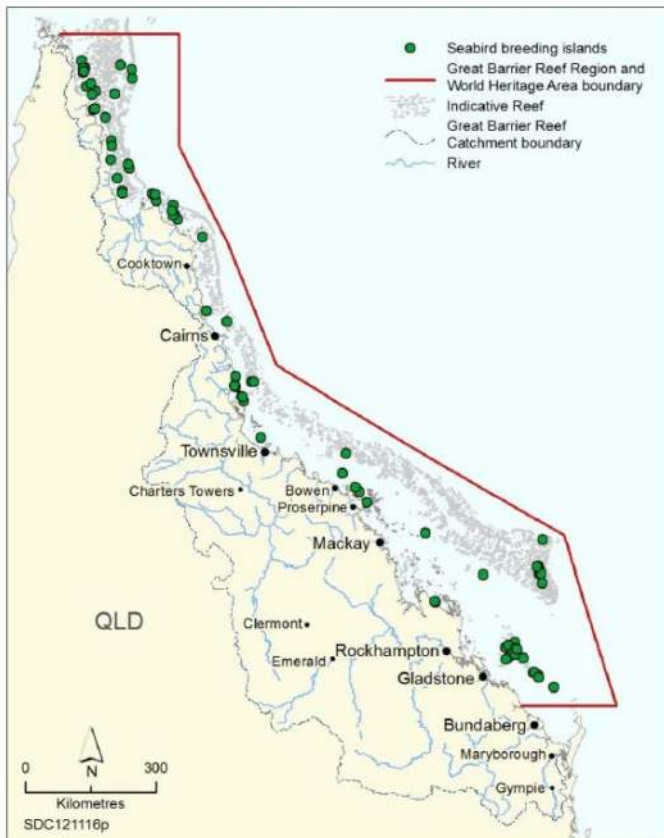


Figure 7.1 Principal seabird breeding islands within the GBRWHA

Source: GBRMPA (2014a)

7.1.2 Contribution of the local attribute to the OUV of the GBRWHA

The seabird attribute is considered to have a **minor contribution** to criterion vii (aesthetic values and superlative natural phenomena), ix (ecological and biological processes) and x (biodiversity conservation) of the OUV of the GBRWHA based on the following information:

Commonwealth or state attribute legislative status

- The majority of the seabird species that breed in the GBRWHA are listed on international conventions and agreements for the coordination of conservation efforts for migratory species. None of these species are listed under Commonwealth or state legislation as threatened species, however, they are all listed under the EPBC Act as marine species and/or migratory species.
 - Wedge-tailed shearwater – listed on the Japan-Australia Migratory Bird Agreement (JAMBA), EPBC Act Migratory/Marine species
 - Brown booby – listed on JAMBA, Chinese-Australia Migratory Bird Agreement (CAMBA), Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA), and EPBC Act Migratory/Marine species
 - Masked booby – listed on JAMBA, ROKAMBA, and EPBC Act Migratory/Marine species
 - Lesser frigatebird – listed on JAMBA, CAMBA, ROKAMBA, and EPBC Act Migratory/Marine species
 - Red-tailed tropic bird – listed on JAMBA, CAMBA, ROKAMBA, and EPBC Act Migratory/Marine species
 - Black noddy – EPBC Act Marine species
- The potential foraging habitat present within and surrounding the PPG master planned area is not considered critical habitat and low numbers of the species have been recorded within the area. Critical habitat is considered to be the islands and cays supporting breeding colonies which are situated outside of the PPG master planned area and surrounds.

Local or regional attribute status

- The potential foraging habitat for the relevant seabirds is not specifically protected

Notable or iconic attribute value


- The potential foraging habitat and presence of seabirds within the PPG master planned area and surrounds is not specifically recognised in available publications as a prime example of value

Condition/trend of the attribute

- Seabirds are reported as being in 'poor' condition with no consistent trend in the Outlook Report 2014 (GBRMPA 2014a). This report indicates that seabird populations are highly variable between species and there is a lack of long term monitoring data.
- The presence of seabirds within the PPG master planned area is low, and does not allow analysis of the condition/trend of seabirds or the potential foraging habitat within the PPG master planned area and surrounds

Contribution to attribute sustainability

- The potential foraging areas are not considered to be critical/important to sustaining seabird populations due to the potential for seabirds to forage over large distances, combined with the low number or confirmed records for these species in the PPG master planned area and surrounds
- The local presence of seabirds and potential foraging habitat in the PPG master planned area and surrounds does not represent a key aggregation, breeding, feeding or recruitment location

- 
- It is unlikely that the loss or decline of potential foraging habitat would affect the conservation status of these seabirds

Notable presence of the attribute

- The potential foraging habitat within the PPG master planned area and surrounds is not unique, unusual or notable

Significance of attribute to the preservation of the GBRWHA

- It is highly unlikely that the loss of potential seabird foraging habitat from the master planned area and surrounds would result in a significant decline in the OUV of the GBRWHA.

7.2 Shorebirds and migratory birds

7.2.1 Assessment approach

It is acknowledged that migratory shorebirds are generally highly mobile, and may use multiple sites within the PPG master planned area and surrounds during their seasonal migration to the region. As such, it is important to note that the important roost sites discussed experience fluctuations in the number of shorebirds over time. It is therefore important to consider roost sites and potential foraging habitat as a system, rather than in isolation, as roost sites are likely to be utilised where they occur in proximity to suitable foraging habitat.

For the purposes of this assessment, migratory shorebirds survey data has been utilised, however there are a number of resident shorebirds within the PPG master planned area and surrounds.

One of the key information sources referenced for this assessment was a migratory shorebird monitoring review report prepared for GPC by IMEMS (2013). This review summarised results of a series of shorebird surveys in the Curtis Coast region (IMEMS 2013). These surveys targeted five key localities, including the Fitzroy Delta, North Curtis Island, Port Curtis, Colosseum inlet/Mundoolin Rock and Rodds Peninsula. This report reviewed survey data collected and records from the Queensland Wader Study Group (QWSG) from 1993 to 2013, from approximately 188 survey sites throughout the Curtis Coast region.

Annual shorebird monitoring event reports prepared for GPC have also been utilised. This includes data collected from the Port of Gladstone and surrounds from 2013 to 2016 (Wildlife Unlimited 2013, 2014, 2015 and 2016).

For the purposes of this assessment, the definitions for important habitat for migratory shorebirds in the EPBC Act Policy Statement 3.21 Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species (DoE 2015b) have been adopted, including:

- Internationally important habitat:
 - Regularly supports 1% of the individuals in a population of one species/subspecies of waterbird, or a total abundance of at least 20,000 waterbirds
- Nationally important habitat:
 - Regularly supports 0.1% of the flyway population of a single species of migratory shorebird, or 2,000 migratory shorebirds, or 15 migratory shorebird species

The above definitions include the term 'regularly support' in their threshold levels for important habitat. The information below is based on habitat that has been recorded on more than one occasion to exceed a particular threshold. It is the summation of these important roost sites that contribute to the overall habitat value of the PPG master planned area and surrounds.

7.2.2 Presence of local attribute

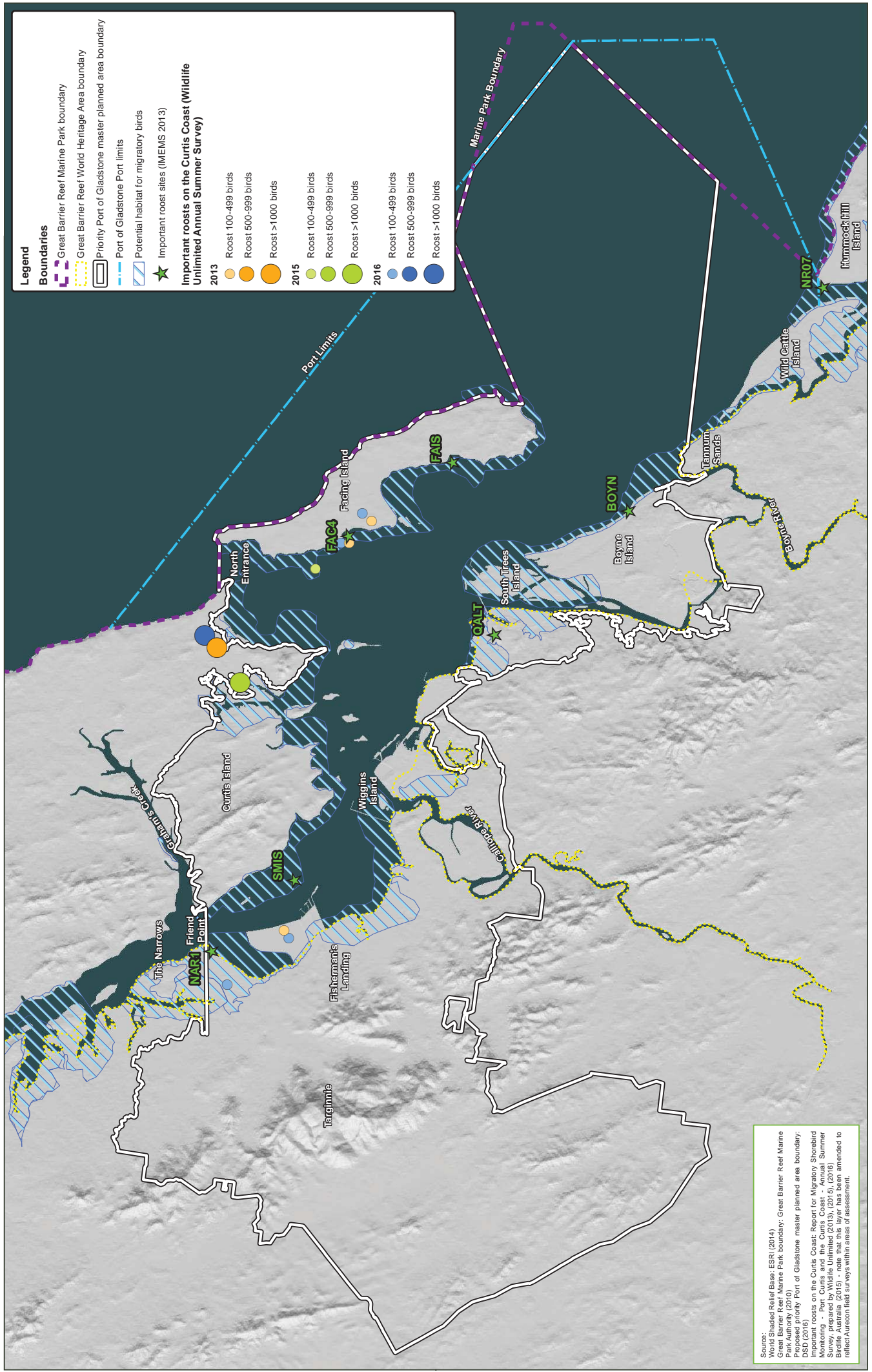
Shorebirds and migratory birds have a **significant presence** in the PPG master planned area and surrounds based on the following information:

- Approximately 11% of the PPG master planned area is mapped as potential shorebird habitat (refer Figure 7.2) (Birdlife Australia 2015). Of the total area of potential shorebird habitat mapped in the GBRWHA, approximately 2.8% is located within the PPG master planned area (Birdlife Australia 2015).
- Shorebird populations which have exceeded 0.1% of total East Asian-Australasian Flyway (EAAF) population within the PPG master planned area for five migratory shorebird species (refer locations of important roost sites as shown in Figure 7.2), as outlined in Table 7.2.

Table 7.2 Important roost sites within the PPG master planned area and surrounds identified in IMEMS (2013) as supporting at least 0.1% of a flyway population

Location of important roost sites with > 0.1% of a EAAF population	Species for which counts of birds on at least one occasion exceed > 0.1% of the EAAF population
■ NAR1 (1% to 2%) located on the shoreline at Friend Point on Kangaroo Island	■ Eastern curlew (<i>Numenius madagascariensis</i>)
■ SMIS (1% to 2%) located on Six Mile Island in The Narrows	■ Eastern curlew
■ QALT (3% to 6%) (QALT is composed of 10 subareas)	■ Eastern curlew ■ Grey-tailed tattler (<i>Tringa brevipes</i>) ■ Terek sandpiper (<i>Xenus cinereus</i>)
■ FAC4 (7% to 10%) located on Facing Island	■ Eastern curlew ■ Grey-tailed tattler ■ Lesser sand plover (<i>Charadrius mongolus</i>) ■ Terek sandpiper
■ FAIS (1% to 2%) located on Facing Island	■ Terek sandpiper
■ BOYN (1% to 2%) located on Boyne Island Beach	■ Lesser sand plover
■ NR07 (1% to 2%) located at Tiber Point at the entrance to Colosseum Inlet	■ Ruddy turnstone (<i>Arenaria interpres</i>)

- Roost sites within the PPG master planned area at the following locations identified through Gladstone monitoring programs as important habitat, including:
 - Friend Point on Kangaroo Island
 - North Passage and South Passage Islands
 - Habitat within the vicinity of Port Central and surrounds (ie refer QALT site on Figure 7.2)
 - Boyne Island Beach
 - Facing Island, on the harbour facing side (refer Figure 7.2)
- Tiber Point at the entrance to Colosseum Inlet within the Curtis Coast region, including the PPG master planned area, contributes approximately 8% of the total population of migratory shorebirds in Queensland with an average population size during monitoring events in excess of 29,500 birds (population size calculated as a sum of the average counts over time for each species) (IMEMS 2013).
- A diverse range of habitat types occur within and surrounding the PPG master planned area, providing foraging and roosting habitat for a range of migratory bird species (refer Figure 7.2)



Legend

Boundaries

- Great Barrier Reef Marine Park boundary
- Great Barrier Reef World Heritage Area boundary
- Priority Port of Gladstone master planned area boundary
- Port of Gladstone Port limits
- Potential habitat for migratory birds
- Important roost sites (MEMS 2013)

Important roosts on the Curtis Coast (Wildlife Unlimited Annual Summer Survey)

Year	Roost 100-499 birds	Roost 500-999 birds	Roost >1000 birds
2013	(Light Blue Circle)	(Medium Blue Circle)	(Dark Blue Circle)
2015	(Light Green Circle)	(Medium Green Circle)	(Dark Green Circle)
2016	(Light Orange Circle)	(Medium Orange Circle)	(Dark Orange Circle)

Sources:
 Great Barrier Reef (2014)
 Great Barrier Reef Marine Park Authority (2010)
 Proposed priority Port of Gladstone master planned area boundary:
 DSD (2016)
 Important roosts on the Curtis Coast: Report for Migratory Shorebird
 Survey, prepared by Wildlife Unlimited (2013), (2015), (2016)
 Birdlife Australia (2015) - note that this layer has been amended to
 reflect Aurecon field surveys within areas of assessment.

Map by: RB

Scale: 0, 2,000, 4,000 Metres

Date: 19/01/2017 Version: 1 Job No: 253916
 Coordinate system: GDA 1994 MGA Zone 56

Priority Port of Gladstone master planning local expression of OUV of GBRWHA
Figure 7.2: Shorebird habitat and important roosting sites

- One roost site within the Port Curtis region on North Curtis Island (Yellow Patch Estuary, approximately 25 km north of the PPG master planned area) has been recorded to hold more than 1% of the flyway population of Whimbrels (*Numenius phaeopus*) and is therefore considered important habitat (meets the threshold for internationally important habitat, though it is unknown if this site supports this proportion of Whimbrels on a regular basis). Although this site is not within the PPG master planned area and surrounds, species utilising this habitat could potentially utilise roosting/foraging resources in the PPG master planned area and surrounds due to their highly mobile nature.
- There are important shorebird habitats within the PPG master planned area and the surrounds. Shorebirds are likely to utilise habitat throughout these areas and population counts of shorebirds in the PPG master planned area are therefore likely to fluctuate over time (ie birds will not always return to the same roost, and may utilise multiple roosts in one season, refer IMEMS 2013).
- The peak period for migratory shorebirds arriving in Central Queensland for most species recorded from the PPG master planned area and surrounds is from October through to February, however it is noted that many species will be present outside of these peak period. Wildlife Unlimited (2016) presents an indication of peak migration periods and flux periods for migratory shorebirds relevant to the PPG master planned area, for information.

7.2.3 Contribution of the local attribute to the OUV of the GBRWHA

Shorebirds and migratory birds have a **significant contribution** to criterion x (biodiversity conservation) of the OUV of the GBRWHA based on the following information:

Commonwealth or state attribute legislative status

Species for which important habitat is known to occur within the PPG master planned area and surrounds are listed below, however, other threatened migratory shorebird species are known to occur within the area (refer Appendix C).

- All of these species are listed as migratory/marine under the provisions of the EPBC Act. All are listed on CAMBA and ROKAMBA, and all are listed on JAMBA with the exception of the Grey-tailed tattler
- Eastern curlew – listed as critically endangered under the EPBC Act and vulnerable under the NC Act
- Grey-tailed tattler – not listed as a threatened species under Commonwealth or state legislation
- Terek sandpiper – not listed as a threatened species under Commonwealth or state legislation
- Lesser sand plover – listed as endangered under the EPBC Act
- Ruddy turnstone – not listed as a threatened species under Commonwealth or state legislation
- The Beach-stone curlew (*Esacus magnirostris*), a resident shorebird (ie non-migratory) occurring within the PPG master planned area and surrounds (IMEMS 2013), is listed as vulnerable under the NC Act

Local or regional attribute status

- There are no internationally recognised protection areas established for shorebirds within the PPG master planned area or surrounds (ie Ramsar wetlands)
- As stated above, many migratory shorebirds are protected under international agreements such as CAMBA, JAMBA and ROKAMBA

Notable or iconic attribute value

- No locations within the PPG master planned area or surrounds are specifically noted within key documents (ie retrospective statement of OUV, Outlook Report 2014 and Lucas et al. 1997)

Condition/trend of the attribute

- There are currently no population estimates for shorebirds in the GBRWHA, though it is noted that there are substantial population declines Australia-wide (GBRWHA 2014)

Contribution to attribute sustainability

- As there are currently no shorebird population estimates for the GBRWHA, shorebirds within the Gladstone region and surrounding areas has been assessed relative to the Queensland population estimates (refer Table 7.3 and IMEMS [2013]).
- This indicates that the Gladstone region and surrounds supports more than 10% of the Queensland population for six migratory shorebird species, including 10.9% of the Queensland population of the endangered Lesser sand plover. Approximately 8.6% of Queensland population of the critically endangered Eastern curlew occurs within the Gladstone region and surrounds.
- Figure 7.3 shows the distribution of sighting records of Eastern Curlew species submitted to eBird in the last 10 years. Though there are other areas in the GBRWHA with a higher proportion of records (eg locations near Cairns, Townsville and Airlie Beach), the PPG master planned area and surrounds is considered to make an important contribution to the population within Queensland.

Table 7.3 Percentage of migratory shorebird species State population occurring in the Gladstone region and surrounds

Migratory shorebird species	Percentage of state population within the Gladstone region and surrounds
Bar-tailed godwit	5.5%
Black-tailed godwit	1.4%
Common greenshank	10.3%
Curlew sandpiper	15.6%
Eastern curlew (Critically endangered, EPBC Act)	8.6%
Great knot	2.8%
Greater sand plover	4.4%
Grey-tailed tattler	7.6%
Lesser sand plover (Endangered, EPBC Act)	10.9%
Red-necked stint	11.0%
Ruddy turnstone	12.4%
Sanderling	9.1%
Sharp-tailed sandpiper	4.1%
Terek sandpiper	13.7%
Whimbrel	8.9%

Source: IMEMS (2013)

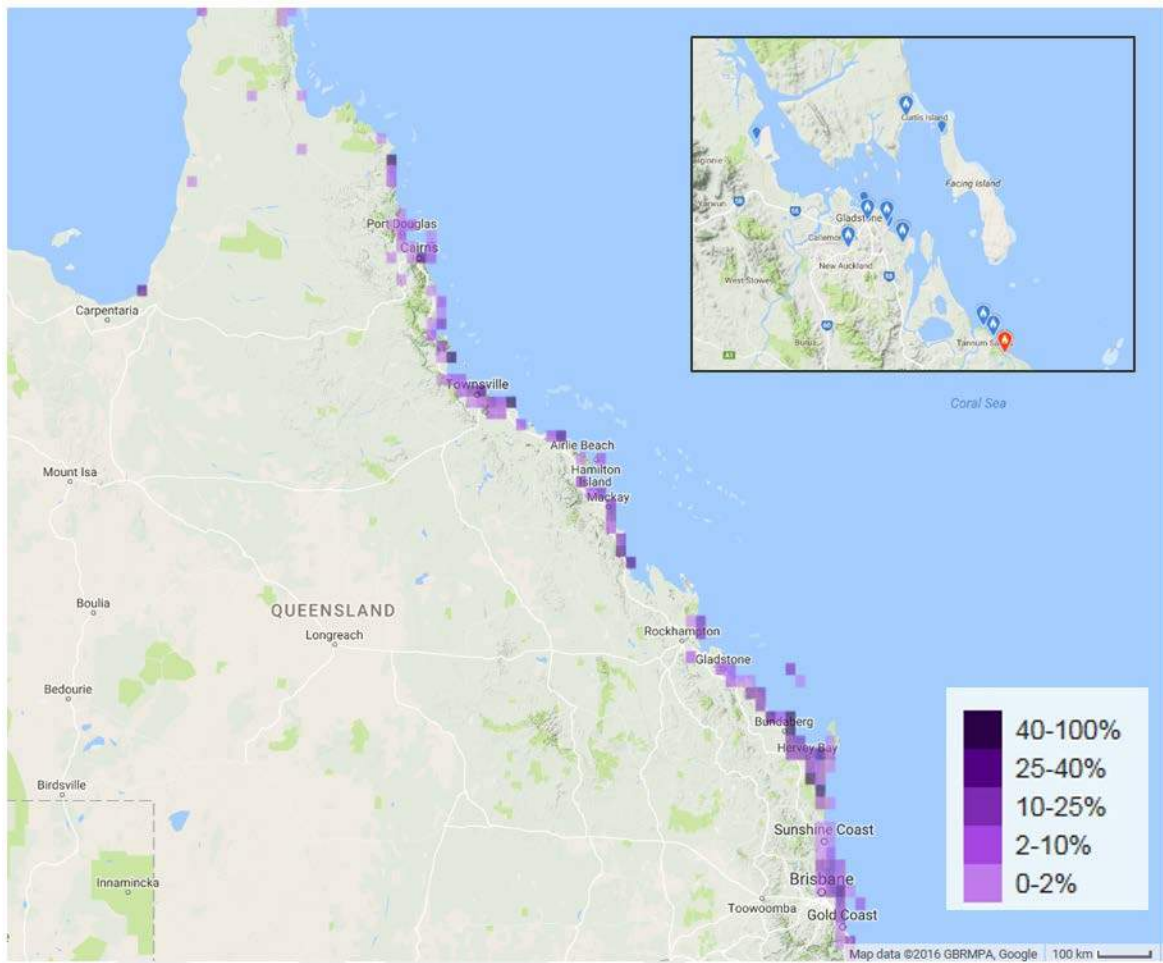


Figure 7.3 Distribution of records of the Eastern curlew submitted to eBird from 2006 to 2016 in Queensland

Source: eBird Australia (2016)

Notable presence of the attribute

- The PPG master planned area and surrounds is not reported as a notable, unique or unusual example of shorebird habitat.
- Although more important shorebird habitat exists within the GBRWHA (ie Ramsar wetlands at Bowling Green Bay and Shoalwater and Corio Bays Area as shown in Figure 7.4), the PPG master planned area and surrounds provides important habitat for a number of migratory shorebirds including threatened shorebirds.

Significance of attribute to the preservation of the GBRWHA

- There is uncertainty around the estimated population numbers of migratory shorebirds and shorebirds within the GBRWHA (GBRMPA 2014a). However it is considered that due to the presence of important habitat and the proportion of the Queensland populations of migratory shorebirds (refer Table 7.3), the PPG master planned area and surrounds contributes significantly to the shorebird attribute of the OUV of the GBRWHA.

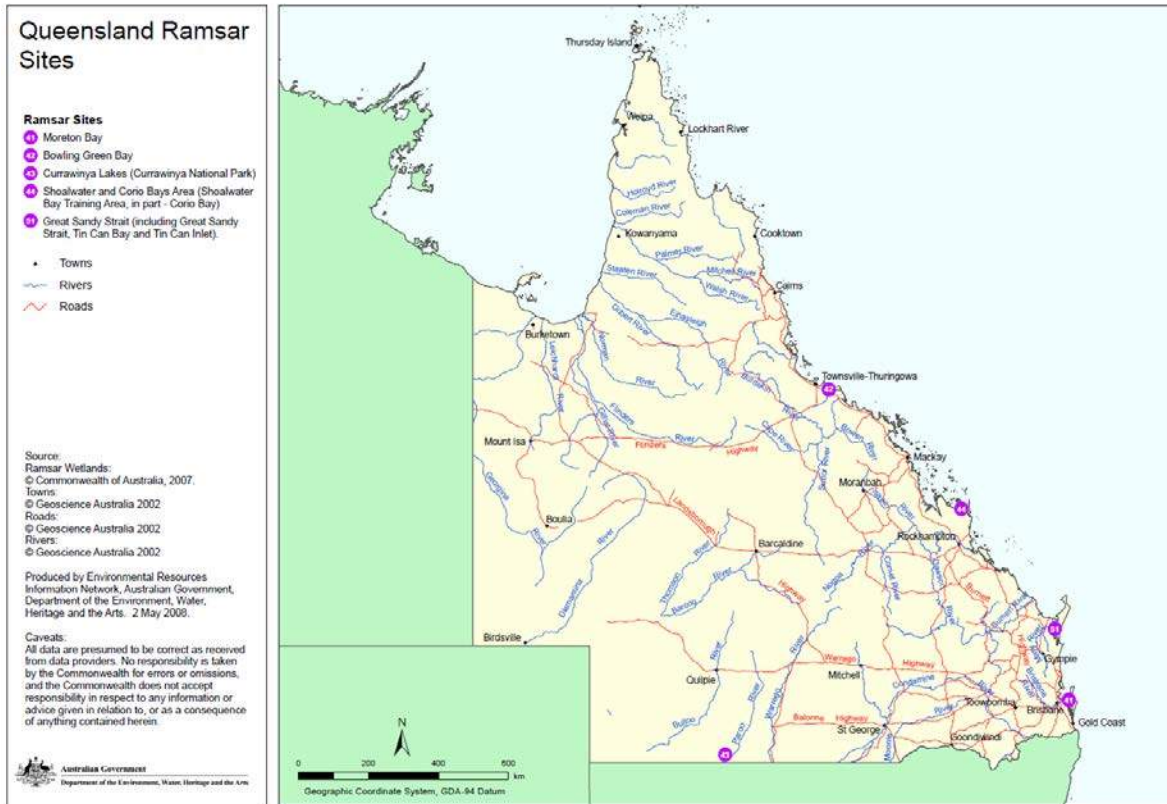


Figure 7.4 Queensland Ramsar wetlands

Source: DEWHA (2008)

8 Flora, fauna and ecological communities

The relevant information from the retrospective statement of OUV and the Outlook Report 2014 relating to flora, fauna and ecological communities is summarised in Table 8.1, with respect to the local expression of the OUV of the GBRWHA for the PPG master planned area and surrounds.

Table 8.1 OUV of the GBRWHA: Flora, fauna and ecological communities

Attribute	Statement of OUV	GBR Outlook Report 2014			Relevant OUV criteria			
		GBR wide: Significant contribution to OUV	GBR wide condition	GBR wide trend	vii	viii	ix	x
Threatened and endangered flora and fauna species (including threatened ecological communities)	<ul style="list-style-type: none"> GBRWHA contains a significant number of threatened species 	<ul style="list-style-type: none"> Habitats to support species is highly variable with some well-known. Habitats in the southern portion of the GBRWHA have deteriorated, particularly seagrass meadows and reefs 	Good	Deteriorated	-	-	-	✓
Vegetated mountains	<ul style="list-style-type: none"> The rugged vegetated mountains on Hinchinbrook Island contribute to the vast mosaic patterns of the GBRWHA 	<ul style="list-style-type: none"> Rugged vegetated mountains and lush rainforest gullies of Hinchinbrook Channel and Island 	-	-	✓	-	-	-
Mangroves	<ul style="list-style-type: none"> The shallower marine areas of the GBRWHA support half the world's diversity of mangroves species 	<ul style="list-style-type: none"> Approximately 2,070 km² of mangrove habitat within and adjacent to the GBRWHA 	Very good	Stable	✓	✓	✓	✓
Mangrove species diversity		<ul style="list-style-type: none"> 39 mangrove species and hybrids have been recorded in the GBRWHA 	Good	Stable	-	-	-	✓

Attribute	Statement of OUV	GBR Outlook Report 2014			Relevant OUV criteria			
		GBR wide: Significant contribution to OUV	GBR wide condition	GBR wide trend	vii	viii	ix	x
Vast mangrove forests	<ul style="list-style-type: none"> The vast mangrove forests in Hinchinbrook Channel contribute to the vast mosaic patterns of the GBRWHA 	<ul style="list-style-type: none"> Vast mangrove forests at The Narrows considered a notable example of mangrove sequences in the GBRWHA 	Good	Stable	✓	-	-	-

8.1 Threatened and endangered flora and fauna species


For the purposes of this attribute, threatened and endangered flora and fauna species attribute were defined by the key threatened species identified within the GBR coastal zone strategic assessment (DSD 2014). The methodology for the selection of this species in the GBR coastal zone strategic assessment is outlined in Section 3.4 of the assessment report ('Methodology for selecting key MNES values'), and included species listed under the EPBC Act that were predicted to occur in the coastal zone assessment area and were likely to be impacted as a result of proposed developments (ie based on development applications and EBPC Act controlled action project referrals).

The mapping from the GBR coastal zone strategic assessment for these key threatened species was reviewed and where species habitat was predicted to occur in the PPG master planned area, the species were included within the contribution assessment for this attribute (ie this report).

Threatened flora and fauna species which have been recorded within the PPG master planned area and surrounds on the Wildlife Online database and the EPBC protected matters search tool are also included within this attribute (DEHP 2017, DoEE 2016b) (refer Appendix C).

Threatened species mapping is provided in the master planning risk assessment (refer Appendix A and B of the master planning risk assessment), based on the best available information. It is acknowledged that the currently available information is 'low precision data' (due to sensitivity of data), includes areas that have been previously cleared/significantly disturbed, or does not contain mapping data for all of the threatened species with potential to occur in the PPG master planned area and surrounds. Table 2.1 in the master planning risk assessment provides a detailed overview of the available environmental value mapping sources, figure references and a description of the limitations of the data sources and mapping provided. This mapping has therefore not been reproduced for the purposes of this report.

Detailed attribute assessments for a number of threatened and endangered flora and fauna species components are presented in other sections of this document (ie fish species are assessed in Section 3, marine megafauna are assessed in Section 4, seabirds and migratory shorebirds are assessed in Section 7, globally significant marine species are assessed in Section 12).

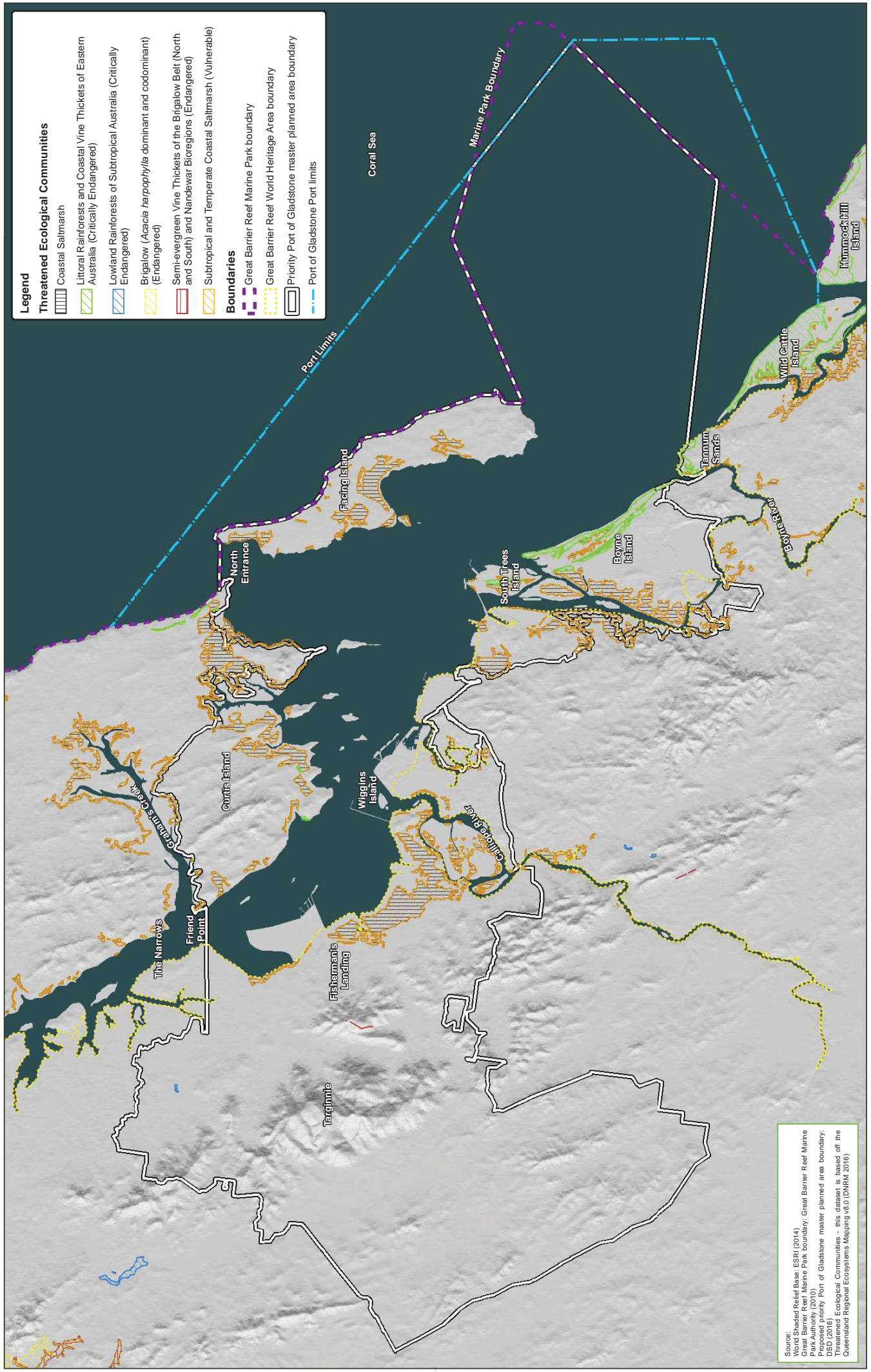


The assessment of the local expression of the threatened and endangered flora and fauna species attribute includes assessment of the local expression of threatened marine, intertidal and terrestrial flora and fauna species, threatened ecological communities (TEC) and vegetated mountains. The assessment of the local expression of vegetated mountains for this attribute considers mainland environments, with vegetated on islands considered with the continental islands attribute (refer Section 9).

8.1.1 Presence of local attribute

Threatened and endangered flora and fauna species, and TECs have an **moderate presence** and vegetated mountains have a **minor presence** within the PPG master planned area and surrounds based on the following information:

- Key threatened species were identified for the GBR coastal zone as part of the GBR coastal zone strategic assessment (DSD 2014). Potential habitat for four of the key threatened species is mapped within the PPG master planned area and surrounds, including:
 - Water mouse (*Xeromys myoides*). The Water mouse has been recorded within the PPG master planned area and surrounds (DEHP 2017)
 - Yellow chat (*Epthianura crocea macgregori*) (refer master planning risk assessment Appendix B, Figure B.63 for predictive habitat map)
 - Cassowary (*Casuarius casuarius johnsonii*), note that the species is considered unlikely to occur within the PPG master planned area and surrounds, with the PPG master planned area situated approximately 660 km south of the species southern most distribution (Latch 2007)
 - *Samadera bidwillii* (Quassia) (refer master planning risk assessment Appendix B, Figure B.63 for predictive habitat map)
- 18 globally significant marine species have the potential to occur within the PPG master planned area and surrounds
- 20 threatened intertidal and terrestrial flora and fauna species were identified in the Wildlife Online database as occurring within the PPG master planned area and surrounds (EHP 2017). An additional 37 threatened intertidal and terrestrial flora and fauna species were identified in the EPBC Act protected matters search tool as potentially occurring within the PPG master planned area and surrounds (DoEE 2016b) (note that the EPBC Act protected matters search tool results are generated based on predictive habitat mapping, whereas the Wildlife Online database is based on species observation records).
- TECs which are present within the PPG master planned area and surrounds are illustrated in Figure 8.1, and include:
 - 22.82 km² of the ‘Subtropical and Temperate Coastal Saltmarsh’ TEC is mapped within the PPG master planned area and surrounds
 - 0.02 km² of the TEC ‘Lowland Rainforest of Subtropical Australia’ is mapped within the PPG master planned area and surrounds
 - 2.13 km² of the TEC ‘Littoral Rainforests and Coastal Vine Thickets of Eastern Australia’ is mapped within the PPG master planned area and surrounds
- Mount Larcom is a vegetated mountain that is considered to contribute to the vista of the GBRWHA, particularly when viewed from coastal/marine areas.



Priority Port of Gladstone master planning local expression of OUV of GBRWHA
 Figure 8.1: Threatened ecological communities

8.1.2 Contribution of the local attribute to the OUV of the GBRWHA

Threatened and endangered species (including TECs) are considered to have a **moderate contribution** to criterion x (biodiversity conservation) and vegetated mountains are considered to have a **minor contribution** to criterion vii (aesthetic values and superlative natural phenomena) based on the following:

Commonwealth or state attribute legislative status

- Potential habitat for four of the key threatened species identified as part of the GBR coastal zone strategic assessment (DSD 2014) is mapped within the PPG master planned area and surrounds, including:
 - Water mouse (*Xeromys myoides*): vulnerable (EPBC Act, NC Act), listed as vulnerable at a global scale by the IUCN
 - Yellow chat (*Epthianura crocea macgregori*): critically endangered (EPBC Act), endangered (NC Act)
 - Cassowary (*Casuaris casuaris johnsonii*): endangered (EPBC Act, NC Act), listed as vulnerable at a global scale by the IUCN
 - *Samadera bidwillii* (Quassia): vulnerable (EPBC Act, NC Act)
- The PPG master planned area and surrounds are not listed as an area of habitat critical to the survival of the key threatened species listed above, as per applicable recovery plans or conservation advice statements available
- The 20 threatened intertidal and terrestrial flora and fauna species identified in the Wildlife Online database as occurring within the PPG master planned area and surrounds include:
 - 10 flora species
 - 5 bird species
 - 3 mammal species
 - 1 reptile species (DEHP 2017)
- The additional 37 threatened intertidal and terrestrial flora and fauna species identified in the EPBC Act protected matters search tool as potentially occurring within the PPG master planned area and surrounds include:
 - 19 bird species
 - 6 mammal species
 - 7 plant species
 - 5 reptile species (DoEE 2016b)
- 18 globally threatened marine species, listed by the IUCN, have the potential to occur within the PPG master planned area and surrounds (refer Section 12)
- TECs are protected under the provisions of the EPBC Act. The EPBC Act status for the TECs mapped within the PPG master planned area and surrounds includes:
 - Subtropical and Temperate Coastal Saltmarsh TEC: vulnerable
 - Lowland Rainforest of Subtropical Australia TEC: critically endangered
 - Littoral Rainforests and Coastal Vine Thickets of Eastern Australia TEC: critically endangered
- TECs present within the PPG master planned area and surrounds is largely defined by remnant vegetation. Remnant vegetation is protected under the provisions of the VM Act
- Mount Larcom is not currently protected under Commonwealth or state legislation.



Local or regional attribute status

- The PPG master planned area and surrounds include National Parks and Conservation Parks which are protected under the provisions of the NC Act. Areas designated as National Parks or Conservation Park provide protection to any areas of potential threatened species habitat which may be present.
- Essential habitat provides protection for areas of threatened species habitat under the provisions of the VM Act. Essential habitat has been mapped for the following threatened species within the PPG master planned area and surrounds, however the GIS layer that is currently publically accessible does not identify the species for which the habitat was recorded.
- Threatened marine species are protected within the GBRMP through permit requirements and activity restrictions in zoned areas of the GBRMP. GBRMP zoning surrounding the PPG master planned area includes 'general use zone', 'habitat protection zone', 'marine national park zone' and 'conservation park zone'.
- There are no specific TEC protection areas in the PPG master planned area or surrounds
- Mount Larcom is not protected under specific local or regional protection areas.

Notable or iconic attribute value

- The PPG master planned area and surrounds are not specifically recognised as a prime example of potential habitat for the key threatened species or TECs subject to this assessment in key publications (ie retrospective statement of OUV, Outlook Report 2014 and Lucas et al. 1997)
- Mount Larcom is not specifically recognised as a prime example or value of the region in key publications (ie retrospective statement of OUV, Outlook Report 2014 and Lucas et al. 1997).

Condition/trend of the attribute

- The Outlook Report 2014 records the attribute conditions in the wider GBR to be good for populations of species and groups of species. The attribute condition trend in the wider GBR was recorded as deteriorated for populations of species and groups of species.
- The attribute condition and trend was not assessed in the Outlook Report 2014 for terrestrial vegetation communities or for vegetated mountains.

Contribution to attribute sustainability

- 11 key threatened species have been identified within the GBR coastal zone as part of the GBR coastal zone strategic assessment (DSD 2014). Potential habitat has been identified within the PPG master planned area and surrounds for four of the key threatened species (DSD 2014). One of these species, the Southern Cassowary, is considered unlikely to occur within the PPG master planned area and surrounds, with the PPG master planned area situated approximately 660 km south of the species southernmost distribution (Latch 2007).
- 18 globally significant marine species which have the potential to occur within the PPG master planned area (refer Section 12).
- The contribution of the local expression of marine species attributes, including threatened species, within the PPG master planned area and surrounds to the GBRWHA is presented in further detail in other sections of this report, including:
 - Fish: Minor contribution discussed in Section 3
 - Dugong: Moderate contribution discussed in Section 4.1
 - Whales: Minor contribution discussed in Section 4.2
 - Dolphin: Significant contribution (criterion x) discussed in Section 4.3
 - Marine turtles (breeding colonies): Minor to moderate contribution discussed in Section 5

– Marine species diversity (of globally significant species): Moderate contribution discussed in Section 12)

- Diversity of available habitat types contribute to the diversity of species, including threatened species, within an area (Lucas et al. 1997). Vegetation communities and habitats of the Curtis Coast are similar to the major vegetation types in other parts of Central Queensland (GPC 2012). Marine, intertidal and terrestrial habitats within the PPG master planned area and surrounds are not considered to be unique to the area and are available throughout the GBRWHA.
- The GBRWHA supports approximately 111.97 km² of Subtropical and Temperate Coastal Saltmarsh TEC. Approximately 22.82 km² of subtropical and Temperate Coastal Saltmarsh TEC is present within the PPG master planned area, representing approximately 20% of the TEC within the GBRWHA.
- The GBRWHA supports approximately 129.79 km² of Lowland Rainforest of Subtropical Australia TEC. Approximately 0.02 km² of Lowland Rainforest of Subtropical Australia TEC is present within the PPG master planned area, representing approximately 0.01% of the TEC within the GBRWHA.
- The GBRWHA supports approximately 22.05 km² of Littoral Rainforests and Coastal Vine Thickets of Eastern Australia TEC. Approximately 2.13 km² of the Littoral Rainforests and Coastal Vine Thickets of Eastern Australia TEC is present within the PPG master planned area, representing approximately 9.65% of the TEC within the GBRWHA.
- Mount Larcom is not considered to significantly contribute to the OUV of the GBRWHA.

Notable presence of the attribute

- Potential habitat has been mapped in the wider GBRWHA for the threatened species identified as potentially occurring within the PPG master planned area and surrounds (DSD 2014)
- The Subtropical and Temperate Coastal Saltmarsh TEC occurs on the coastal zone south of the northern boundary of the South East Queensland IBRA bioregion (ie areas south of Gladstone) (TSSC 2013). As such, the occurrence of the TEC within the master planned area presents a notable occurrence of the TEC for the GBR region.
- Mount Larcom is not a notable or prime example of a vegetated mountain area within the GBRWHA. A prime example of vegetated mountains in the GBRWHA include the mountainous areas on Hinchinbrook Island.

Significance of attribute to the preservation of the GBRWHA

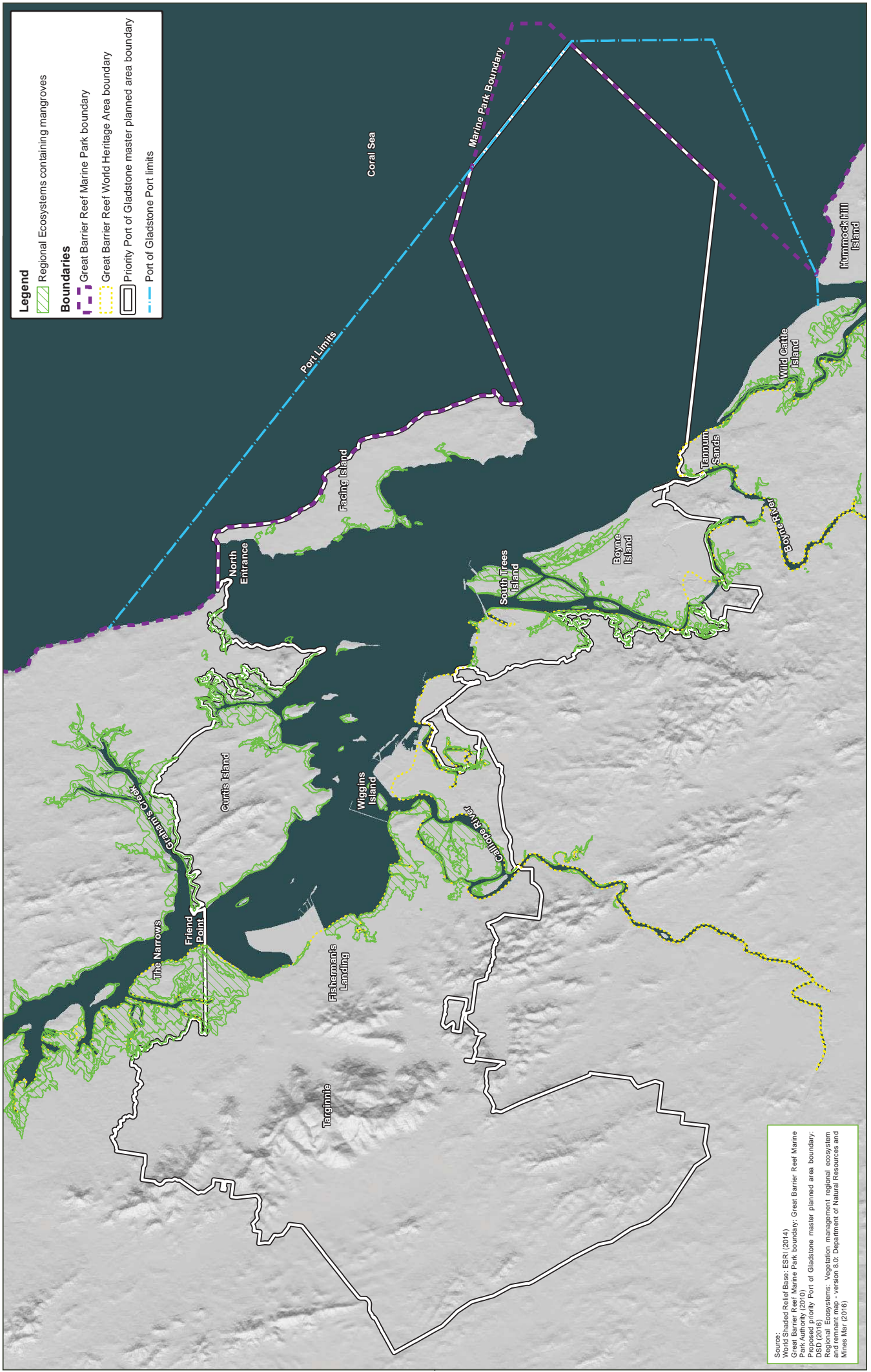
- This assessment of the significance is based on the best available information. It is acknowledged that there are limitations to the current threatened species mapping data sets available for the PPG master planned area and surrounds (eg incomplete data sets, low precision data).
- The threatened species of the GBR coastal zone strategic assessment which have been mapped as potentially occurring within the PPG master planned area and surrounds are not endemic to the PPG master planned area, with areas of potential species habitat mapped in the wider GBRWHA (DSD 2014). The loss of potential threatened species habitat within the PPG master planned area and surrounds is considered likely to impact on local assemblages of the species, however is not considered to result in a significant decline in the OUV of the GBRWHA.
- The Gladstone region represents the northern extent of the Subtropical and Temperate Coastal Saltmarsh TEC, and it is not represented in other areas of the GBRWHA. Potential loss of the TEC within the PPG master planned area and surrounds has the potential to result in a significant decline of the TEC value within the GBRWHA.
- It is unlikely that the loss of values associated with Mount Larcom would result in a significant decline in the OUV of the GBRWHA.

8.2 Mangroves

8.2.1 Presence of local attribute

Mangroves, including mangrove species diversity and vast mangrove forests, have a **minor presence** in the PPG master planned area and surrounds based on the following information:

- Intact, remnant mangrove forests are present within the PPG master planned area and surrounds, associated with:
 - Curtis Island, Facing Island and other inshore islands
 - The Narrows
 - Coastline situated between Fisherman’s Landing and Wiggins Island
 - Boyne Island Beach and coastal dunes
 - South Trees Inlet
- Approximately 31.11 km² of remnant mangrove forests are present within the PPG master planned area
- 13 mangrove species have been recorded within the PPG master planned area and surrounds (GPC 2012), including:
 - Holly leaf mangrove (*Acanthus ilifolius*)
 - Club mangrove (*Aegialitis annulata*)
 - River mangrove (*Aegiceras corniculatum*)
 - Grey mangrove (*Avicennia marina*)
 - Orange mangrove (*Bruguiera exaristata*)
 - Large-leafed orange mangrove (*Bruguiera gymnorhiza*)
 - Yellow mangrove (*Ceriops tagal*)
 - Milky mangrove (*Excoecaria agallocha*)
 - Black mangrove (*Lumnitzera racemosa*)
 - Myrtle mangrove (*Osbornia octodonta*)
 - Red mangrove (*Rhizophora stylosa*)
 - Cannonball mangrove (*Xylocarpus granatum*)
 - Cedar mangrove (*Xylocarpus maoluccensis*)
- Remnant mangrove forests present within the PPG master planned area and surrounds are illustrated in Figure 8.2. This includes remnant vegetation communities containing the following REs:
 - RE 11.1.2 – Samphire forbland on marine clay plains
 - RE 11.1.4 – Mangrove low open forest and/or woodland on marine clay plains
 - RE 12.1.2 – Saltpan vegetation including grassland, herbland and sedgeland on marine clay plains
 - RE 12.1.3 – Mangrove shrubland to low closed forest on marine clay plains and estuaries
 - RE 12.1.1 – Swamp She-oak (*Casuarina glauca*) woodland on margins of marine clay plains



- Legend**
- Regional Ecosystems containing mangroves
- Boundaries**
- Great Barrier Reef Marine Park boundary
 - Great Barrier Reef World Heritage Area boundary
 - Priority Port of Gladstone master planned area boundary
 - Port of Gladstone Port limits

Sources:
 World Shaded Relief Base: ESRI (2014)
 Great Barrier Reef Marine Park boundary: Great Barrier Reef Marine Park Authority (2010)
 Priority Port of Gladstone master planned area boundary: DSD (2016)
 Regional Ecosystems: Vegetation management regional ecosystem and remnant map - version 8.0; Department of Natural Resources and Mines Mar (2016)



0 2,000 4,000 Metres

Date: 19/01/2017 Version: 1 Job No: 253916
 Coordinate system: GDA 1994 MGA Zone 56

Priority Port of Gladstone master planning local expression of OUV of GBRWHA
Figure 8.2: Regional Ecosystems containing mangrove communities

8.2.2 Contribution of the local attribute to the OUV of the GBRWHA

Mangroves are considered to have a **minor contribution** to vii (aesthetic values and superlative natural phenomena), viii (ongoing geological processes), ix (ecological and biological processes) and x (biodiversity conservation), with mangrove species diversity considered to have a **minor contribution** to x (biodiversity conservation) and vast mangrove forests considered to have a **moderate contribution** to vii (aesthetic values and superlative natural phenomena).

Commonwealth or state attribute legislative status

- Marine plants, including mangroves, are protected under the provisions of the *Fisheries Act 1994*
- Mangrove forests which classify as remnant vegetation are protected under the provisions of the *Vegetation Management Act 1999* (Qld) (VM Act)

Local or regional attribute status

- Mangrove vegetation is not specifically protected under local or regional legislative mechanisms

Notable or iconic attribute value

- The vast mangrove forests at The Narrows are noted by Lucas et al. (2007) as a notable example of mangrove sequences in the GBRWHA

Condition/trend of the attribute

- The Outlook Report 2014 records the attribute conditions in the wider GBR to be very good for mangrove species diversity and abundance and good for mangrove forest habitats
- The attribute condition trend in the wider GBR is recorded as stable for mangrove species diversity and abundance and mangrove forest habitats (GBRMPA 2014a)

Contribution to attribute sustainability

- The remnant mangrove forests present within the PPG master planned area and surrounds do not include Endangered or Of concern Regional Ecosystems. The mangrove communities are well represented in areas outside of the PPG master planned area
- The GBRWHA supports approximately 2069 km² of mangrove forests (Lucas et al. 1997). Approximately 31.11 km² of remnant mangrove forests are present within the PPG master planned area, representing approximately 1.50% of the GBRWHA mangrove areas
- 39 mangrove species and hybrids have been recorded in the GBRWHA. 14 species of mangrove have been recorded within the PPG master planned area and surrounds (GPC 2012), representing 39% of the known mangrove species within the GBRWHA.

Notable presence of the attribute

- The remnant mangrove vegetation communities present within the PPG master planned area and surrounds are not listed as Endangered or Of concern REs and are considered to be well represented in areas elsewhere within the GBR region
- There are no mangrove species present within the PPG master planned area and surrounds which are at the northern extent of their distribution (GPC 2012). As such, the mangrove species within the PPG master planned area and surrounds are considered to be represented in the GBRWHA

Significance of attribute to the preservation of the GBRWHA

- Loss of mangrove vegetation within and surrounding the PPG master planned area may impact on local mangrove assemblages. It is not, however, expected that this would result in the significant decline in the OUV of the GBRWHA.

9 Continental islands

The relevant information from the retrospective statement of OUV and the Outlook Report 2014 relating to the continental islands is summarised in Table 9.1, with respect to the local expression of the OUV of the GBRWHA for the PPG master planned area and surrounds.

Threatened flora species and ecological communities are discussed in Section 8.1.

Table 9.1 OUV of the GBRWHA: Continental islands

Attribute	Statement of OUV	GBR Outlook Report 2014			Relevant OUV criteria			
		GBR wide: Significant contribution to OUV	GBR wide condition	GBR wide trend	vii	viii	ix	x
Continental islands and green vegetated islands	<ul style="list-style-type: none"> On some continental islands, large aggregations of over-wintering butterflies periodically occur. The processes of geological and geomorphological evolution are well represented, linking continental islands, coral cays and reefs. Ongoing erosion and accretion of coral reefs, sand banks and coral cays combine with similar processes along the coast and around continental islands. 	<ul style="list-style-type: none"> Islands that are geologically related to the Australian mainland and were typically formed when rising seas (for example, at the end of an ice age) cut off part of the land from the continent. Inshore islands such as Curtis Island and Magnetic Island and offshore groups such as the Brampton and Lindeman island groups. Pristine and good condition natural environments are considered significant contributions to the OUV include continental islands with vegetation coverage and sandy beaches 	<p>Mosaic patterns of reefs, islands and coral cays: Good</p> <p>Green vegetated islands: Good</p>	<p>Mosaic patterns of reefs, islands and coral cays: -</p> <p>Green vegetated islands: Deteriorated</p>	✓	✓	-	-
Vegetation of the continental islands		<ul style="list-style-type: none"> Coral reefs are the cornerstone of the GBR ecosystem and its evolutionary history. Their species diversity, habitat value and natural beauty are major contributors to the Reef's outstanding 	<p>Plant species and diversity: Good</p>	<p>Plant species and diversity: Decline</p>	-	-	✓	✓
Plant species diversity and endemism (species being unique to a defined geographic location)	<ul style="list-style-type: none"> Breeding habitat for some seabird species and support 				-	-	-	✓

Attribute	Statement of OUV	GBR Outlook Report 2014			Relevant OUV criteria			
		GBR wide: Significant contribution to OUV	GBR wide condition	GBR wide trend	vii	viii	ix	x
Green vegetated islands	distinct flora and fauna.	<p>universal value as a world heritage area. The GBR is the world's largest coral reef ecosystem; ranging over 14 degrees in latitude and comprising more than 2900 separate coral reefs.</p> <ul style="list-style-type: none"> ■ Large and intact areas of coral reefs and cays. ■ The islands and reefs of the Capricorn and Bunker Island group provide an example of an ecosystem that has evolved over millennia, has all stages of reef development and almost all geomorphological evolutionary processes remain intact. ■ The region supports 1000s of species of plants, many of which are endemic to the region. Notable are the vast and diverse mainland mangrove forests and, in places, unique island vegetation. 	Mosaic patterns of reefs, islands and coral cays: Good	-	✓	-	-	-

9.1 Presence of local attribute

Continental islands have a **significant presence** in the PPG master planned area and surrounds based on the following information:

- There are a number of continental islands within the PPG master planned area and surrounds (refer Figure 9.1), including:
 - Curtis Island
 - Facing Island
 - Other smaller inshore, vegetated islands such as Quoin Island, Compigne Island, Turtle Island, Diamantina Island, Witt Island, Tide Island, Picnic Island, She Oak Island, Bushy Islet, Rat Island and Garden Island.

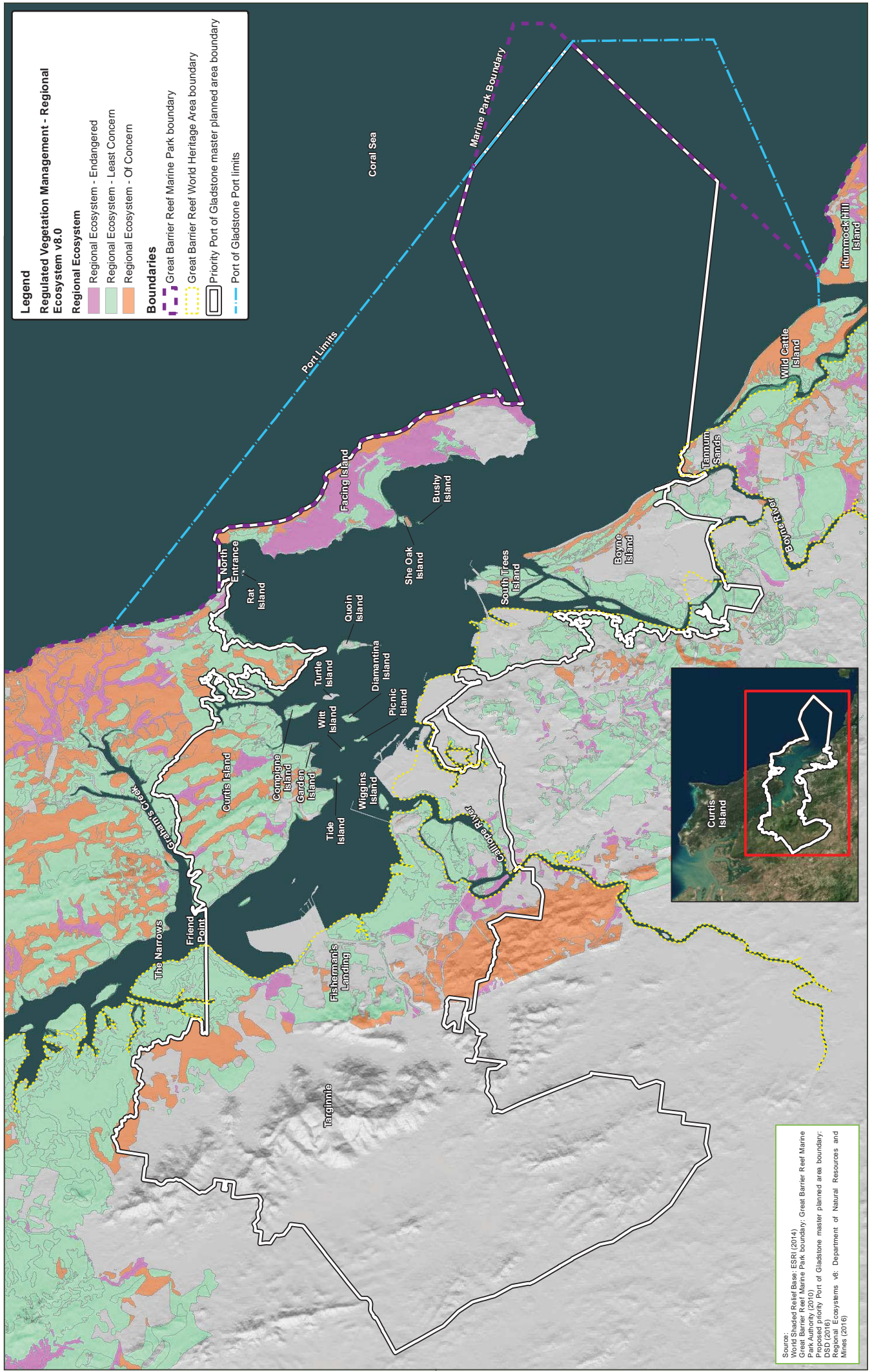


Figure 9.1: Continental islands and associated RE mapping

Scale: 0 2,000 4,000 Metres

Source: World Shaded Relief Base: ESRI (2014)
 Great Barrier Reef Marine Park Authority (2010)
 Proposed priority Port of Gladstone master planned area boundary: DSD (2016)
 Regional Ecosystems v8: Department of Natural Resources and Mines (2016)

- Curtis Island is the largest continental island within the GBRWHA (by land area).
- The Regional Ecosystem (RE) mapping for the continental islands in Figure 9.1, indicates that there is remnant vegetation communities on many of the islands, including large areas of Endangered RE on Facing Island and moderate extents of Of concern RE on both Facing and Curtis Islands. Interrogation of the DNRM RE data (version 8, 2016) indicates that the vegetation communities represented on the smaller inshore continental islands (eg Quoin Island, Diamantina Island, She Oak Island) are also represented on Curtis and Facing Islands. On this basis, it is considered that these islands are likely to contain habitat for similar types of island flora species and communities.

9.2 Contribution of the local attribute to the OUV of the GBRWHA

The contribution of the local expression of continental islands and vegetated islands to the OUV of the GBRWHA are outlined for each criteria below.

- **Moderate contribution** to criterion vii (aesthetic values and superlative natural phenomena) of the OUV of the GBRWHA
- **Moderate contribution** to criterion viii (ongoing geological processes) of the OUV of the GBRWHA
- **Significant contribution** to criterion ix (ecological and biological processes) of the OUV of the GBRWHA
- **Significant contribution** to criterion x (biodiversity conservation) of the OUV of the GBRWHA.

These contribution ratings are based on the following information:

Commonwealth or state attribute legislative status

- Garden Island is protected as a Regional Park under the NC Act
- Curtis Island is protected as the following categories under the NC Act:
 - National Park – 17.76% of the total area of Curtis Island
 - Regional Park – 12.87% of the total area of Curtis Island

Local or regional attribute status

- Refer above.

Notable or iconic attribute value

- Hinchinbrook and Curtis Islands are identified as having the most diverse terrestrial flora in the GBRWHA (Lucas et al. 1997):
 - Hinchinbrook Island with 600 flora species (approximately 800 km north of the PPG master planned area)
 - Curtis Island with 590 flora species.
- None of the other continental islands in the PPG master planned area and surrounds are reported in key reference documents as being notable or iconic. However this does not discount their local contribution to the continental islands attribute for the PPG master planned area.
- With the exception of Curtis Island, there is limited available information on the flora species diversity on the continental islands in the PPG master planned area and surrounds.

Condition/trend of the attribute

- The Outlook Report 2014 records the attribute conditions in the wider GBR to be good for islands. The attribute condition trend in the wider GBR is recorded as deteriorated for continental islands.



Contribution to attribute sustainability

- As outlined above, Curtis Island is important as it contains a high level of flora species diversity, and represents a key example of the unique island vegetation communities on islands in the GBRWHA. Lucas et al. (1997) reported that 2,195 species of plants, totalling 25% of the total flora for Queensland, had been recorded from the continental islands of the GBRWHA. Other Islands in the PPG master planned area and surrounds are likely to support the similar species (based on the RE mapping), however there is limited available and relevant information for these islands.
- The Curtis Island cliff and shoreline platforms in the southeast of Curtis Island are considered important as they provide information on past geological processes, such as sedimentation during the Carboniferous period (350 to 300 million years ago) (QDEH 1994). Other important geomorphological features of the continental islands in the PPG master planned area and surrounds include:
 - Beach ridge and swale systems on Curtis Island
 - Curtis Island parabolic dunes
 - Facing Island raised coral reef platform (QDEH 1994)
- The above features all contribute to the dynamic coastal processes of erosion, sedimentation and redistribution of sediments. In particular, the erosion of the Curtis Island coastal cliffs are important for the ongoing supply of sediment to the surrounding coast (QDEH 1994).
- The sandy beaches of Curtis and Facing Islands (refer Section 5).

Notable presence of the attribute

- Refer above information.
- Though there are approximately 600 continental islands within the GBRWHA (Lucas et al. 1997), Curtis Island represents a significant and notable example and with commensurate flora species value to Hinchinbrook Island.

Significance of attribute to the preservation of the GBRWHA

- It is considered that Curtis Island significantly contributes to the OUV of the GBRWHA for the values outlined in the above information. The other continental islands in the PPG master planned area and surrounds further support the expression of this attribute at a smaller scale (ie based on small land area).
- In a report to the GBRMPA in 1995 on the floristic diversity of the continental islands within the GBRMPA, Batianoff and Dillewaard (1995) report a total of 590 flora species occurring on Curtis Island. This equates to approximately 57.39% of the total continental island flora species diversity reported by Batianoff and Dillewaard (1995) for the whole of the GBRMP.
- The loss of the OUV attributes on Curtis Island would result in the potential loss of endemic continental island flora species from the southern area of the GBRWHA, which is reported to be dissimilar to other floristic regions within the GBRPM (Batianoff and Dillewaard 1995).

10 Geomorphology

The relevant information from the retrospective statement of OUV and the Outlook Report 2014 relating to the geomorphological attributes is summarised in Table 10.1, with respect to the local expression for the PPG master planned area and surrounds. Presence of local attribute

Table 10.1 OUV of the GBRWHA: Geomorphology

Attribute	Statement of OUV	GBR Outlook Report 2014			Relevant OUV criteria			
		GBR wide: Significant contribution to OUV	GBR wide condition	GBR wide trend	vii	viii	ix	x
Beaches	<ul style="list-style-type: none"> The processes of geological and geomorphological evolution are well represented in the GBRWHA, linking continental islands, coral cays and reefs The varied seascapes and landscapes of the GBRWHA have been moulded by changing climates and sea levels, and the erosive 	<ul style="list-style-type: none"> Pristine and good condition, natural environments are considered significant contributions to the OUV and would include the continental islands with vegetation coverage and sandy beaches Spectacular white sandy beaches 	Good	Stable	✓	-	-	-
Dune systems			Good	Stable	✓	✓	-	-
River deltas		<ul style="list-style-type: none"> Landscapes including continental islands with vegetation cover, mainland coastal mountains, wetlands and mangroves. Sandy beaches and river systems. 	Poor	-	✓	✓	✓	✓

Attribute	Statement of OUV	GBR Outlook Report 2014			Relevant OUV criteria			
		GBR wide: Significant contribution to OUV	GBR wide condition	GBR wide trend	vii	viii	ix	x
Connectivity: cross-shelf, longshore and vertical	<p>power of wind and water, over long time periods.</p> <ul style="list-style-type: none"> The globally significant diversity of reef and island morphologies reflects ongoing geomorphic, oceanographic and environmental processes. 	<ul style="list-style-type: none"> The region has a total water volume of around 7,200 cubic kilometres. This open water habitat is critical to the healthy functioning of the whole GBR ecosystem. It provides connectivity between other habitats, from the coast to beyond the continental slope. Open water is dominated by microorganisms (plankton) and supports a range of other plants and animals such as invertebrates, fishes, reptiles and marine mammals. 	Good	Stable	-	✓	✓	✓

10.1 Presence of local attribute

The presence classifications for geomorphological attributes within the PPG master planned area and surrounds are provided below.

- Beaches have a **minor presence** in the PPG master planned area and surrounds
- Dune systems have a **minor presence** in the PPG master planned area and surrounds
- River deltas a **minor presence** in the PPG master planned area and surrounds
- Connectivity: cross-shelf, longshore and vertical has a **moderate presence** in the PPG master planned area and surrounds.

The above presence classifications are based on the following information:

- The key sandy beaches within the PPG master planned area and surrounds are:
 - Eastern coasts of Curtis Island and Facing Island
 - Boyne Island Beach
- Other smaller beaches are located on the inshore islands
- The parabolic dunes near Cape Capricorn on Curtis Island are viewed as regionally significant examples of landscape formation and evolution and include a natural sand blow at Yellow Patch (north eastern Curtis Island) (QDEH 1994)

- Marine tidal sand deltas occur in the following locations within the PPG master planned area and surrounds:
 - Cape Capricorn (north eastern Curtis Island)
 - At the mouth of the Boyne River
 - Colosseum Inlet (QDEH 1994)
- These sand deltas consist of fine sand sediments transported along the coast by longshore drift, and deposited in the mouths of estuaries (QDEH 1994)
- Fitzroy River Delta is a significant example of a river delta (QDEH 1994). However, it is located approximately 35 km further north along the coast line, and is physically separated from the PPG master planned area by The Narrows. Furthermore, the PPG master planned area is not located within the Fitzroy River basin catchment area. It is therefore not considered to be part of the surrounding areas of the PPG master planned area.
- The Narrows is a key example of cross-shelf connectivity. It is one of only four tidal passages in Australia, it separates Curtis Island from the mainland (QDEH 1994). The only other tidal passage in the GBRWHA is the Hinchinbrook Channel, approximately 800 km north of The Narrows.

10.2 Contribution of the local attribute to the OUV of the GBRWHA

The contribution of the local expression of beaches, dunes, river deltas and connectivity to the OUV of the GBRWHA are outlined for each criteria below.

- **Minor contribution** to criterion vii (aesthetic values and superlative natural phenomena) of the OUV of the GBRWHA
- **Minor contribution** to criterion viii (ongoing geological processes) of the OUV of the GBRWHA
- **Minor contribution** to criterion ix (ecological and biological processes) of the OUV of the GBRWHA
- **Minor contribution** to criterion x (biodiversity conservation) of the OUV of the GBRWHA.

These contribution ratings are based on the following information:

Commonwealth or state attribute legislative status

- The listed attributes are not listed under legislation, however, the beaches and parabolic dunes on Curtis Island are protected under the provisions of the NC Act as National Park or Regional Park areas.

Local or regional attribute status

- Refer above.

Notable or iconic attribute value

- The Narrows is one of only four tidal passages in Australia. The only other tidal passage in the GBRWHA is the Hinchinbrook Channel, approximately 800 km north of The Narrows. The Narrows is noted in Lucas et al. (1997) as containing one of the best sequences of mangrove and salt pan communities in the GBRWHA.
- The local expression of the other attributes is not considered to be notable or iconic.

Condition/trend of the attribute

- The Outlook Report 2014 records the attribute conditions in the wider GBR to as good for beaches, dunes and connectivity, with the trend being stable. The attribute condition for river deltas is listed as poor, with no trend provided.



Contribution to attribute sustainability

- It is unlikely that the loss of the local expression of the geomorphological attributes would adversely impact on the sustainability of the attribute more broadly (ie for the whole of the GBRWHA).
- Though The Narrows is a notable example of a tidal passage (ie one of only four tidal passages in Australia), there are numerous other examples of the connectivity attribute throughout the GBRWHA that are considered to be prime examples and are iconic.

Notable presence of the attribute

- Refer above.

Significance of attribute to the preservation of the GBRWHA

- It is unlikely that the loss of the local expression of the geomorphological attributes from the PPG master planned area and surrounds would result in a significant decline in the OUV of the GBRWHA. However, it is noted that The Narrows is an important feature, situated in the surrounds of the PPG master planned area (refer Section 8.2 for further discussion of The Narrows and important mangrove sequences).

11 Cultural heritage values

As outlined in the methodology for identifying the local expression of OUV within the GBRWHA (Adaptive Strategies et al. 2016), the retrospective statement of OUV for the GBRWHA acknowledges that:

“Human interaction with the natural environment is illustrated by strong ongoing links between Aboriginal and Torres Strait Islanders and their sea-country, and includes numerous shell deposits (middens) and fish traps, plus the application of story places and marine totems” (DoE 2015a).

Therefore, while not directly part of the listing criteria for the GBRWHA, important cultural heritage sites or links that exist within the PPG master planned area and surrounds are considered in the assessment below.

The relevant information from the retrospective statement of OUV and the Outlook Report 2014 are summarised in Table 11.1, with respect to the local expression of the OUV of the GBRWHA for the PPG master planned area and surrounds.

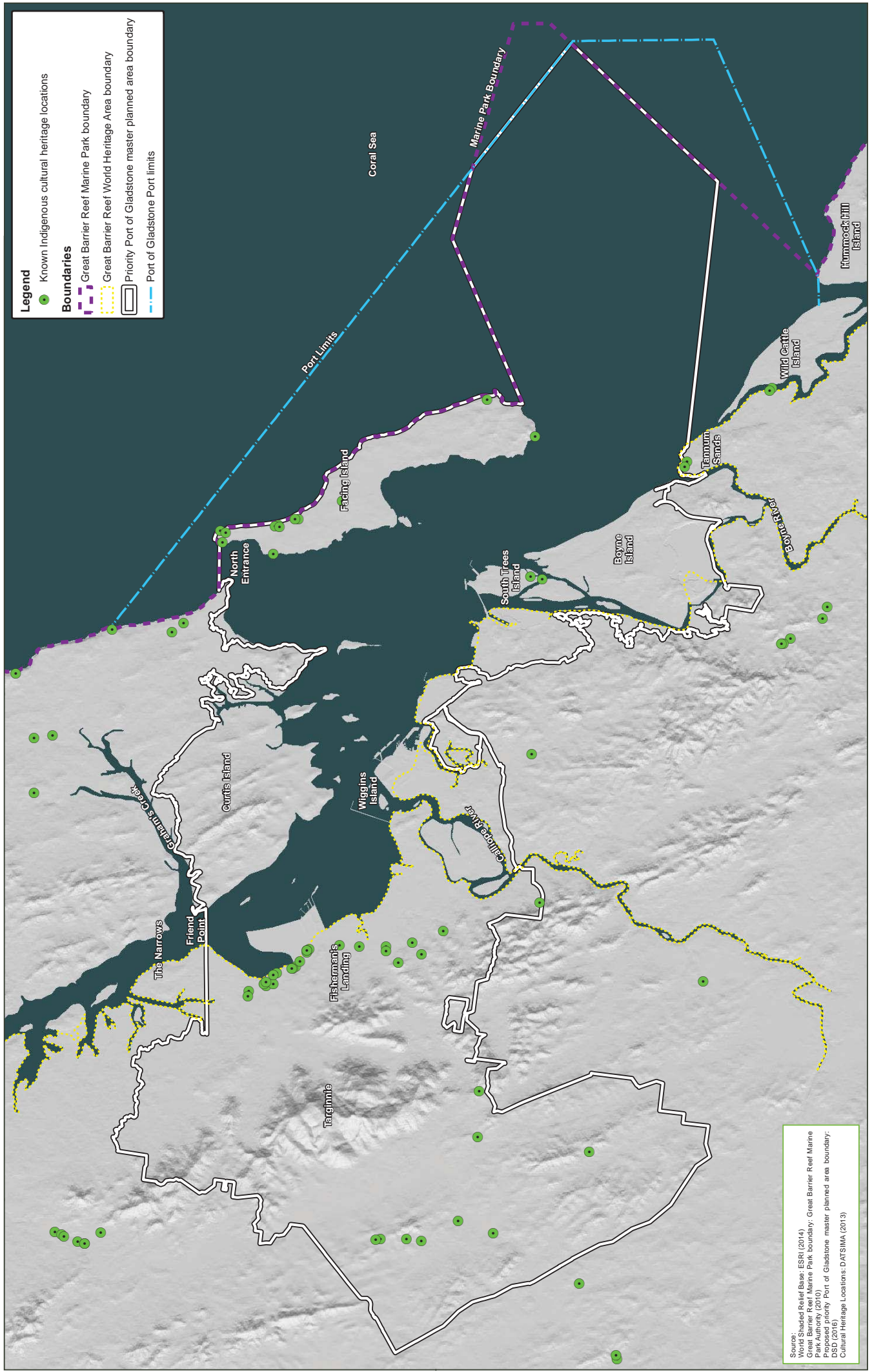
Table 11.1 OUV of the GBRWHA: Cultural heritage values

Attribute	Statement of OUV	GBR Outlook Report 2014			Relevant OUV criteria			
		GBR wide: Significant contribution to OUV	GBR wide condition	GBR wide trend	vii	viii	ix	x
Traditional Owner interaction with the natural environment	Human interaction with the natural environment is illustrated by strong ongoing links between Aboriginal and Torres Strait Islanders and their sea-country, and includes numerous shell deposits (middens) and fish traps, plus the application of story places and marine totems.	Indigenous heritage values: Traditional Owners with connections to the GBRWHA maintain their cultural practices and customs. Places of Indigenous heritage values have not been systematically identified and many have deteriorated, especially around developed areas and on islands. Some species of cultural significance are under pressure. Story, language and songlines are being affected by activities in the region	Poor	N/A New assessment, no trend provided	-	-	✓	-

11.1 Presence of local attribute

The attribute ‘Traditional Owner interaction with the natural environment’ has a **moderate presence** in the PPG master planned area and surrounds based on the following information:

- Figure 11.1 identifies the known cultural heritage artefacts/sites within the PPG master planned area and surrounds.
- There are 353 known cultural heritage artefacts/sites, including:
 - One burial site



Sources:
 World Shaded Relief Base: ESRI (2014)
 Great Barrier Reef Marine Park boundary: Great Barrier Reef Marine Park Authority (2010)
 Proposed priority Port of Gladstone master planned area boundary: DSD (2016)
 Cultural Heritage Locations: DATSIMA (2013)



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 Coordinate system: GDA 1994 MGA Zone 56

Priority Port of Gladstone master planning local expression of OUV of GBRWHA
Figure 11.1: Known Indigenous cultural heritage sites regulated under the Aboriginal Cultural Heritage Act 2003

- One stone arrangement
 - More than 60 shell middens
 - 13 scar trees/carved trees
 - Over 250 artefact scatters
 - A quarry site
- The PPG master planned area and surrounds contains values in terms of traditional Aboriginal use of land and sea. There are a number of culturally significant sites within the PPG master planned area and surrounds, as well as areas where access to particular areas provides culturally significant opportunities.
 - The Port Curtis Coral Coast Indigenous group have formalised their aspirations for sea and country through entering into a Traditional Use of Marine Resource Agreement (TUMRA) (refer Figure 11.2). This TUMRA includes the Capricorn-Bunker Group of reefs, cays and islands, and the PPG master planned area and surrounds.

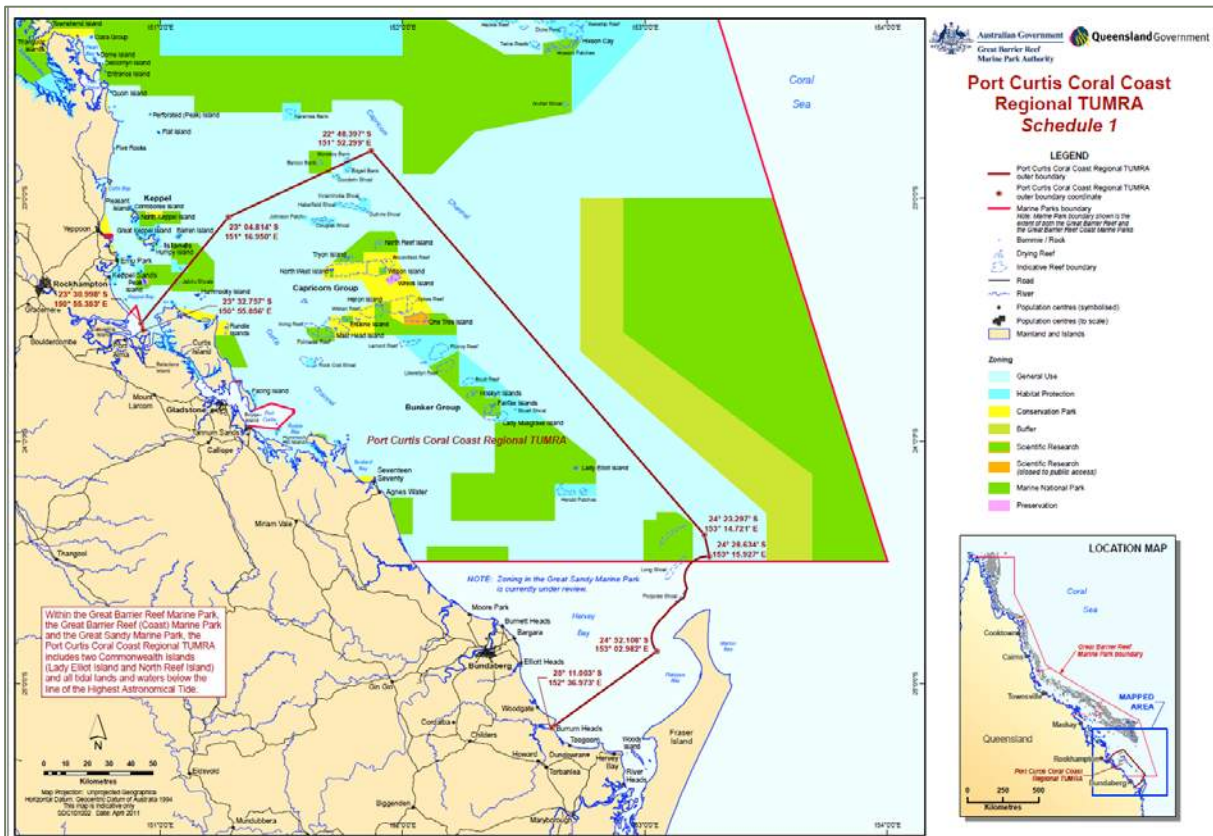


Figure 11.2 Port Curtis Coral Coast Regional TUMRA boundary and the Port of Gladstone

Source: GBRMPA (2011)

11.2 Contribution of the local attribute to the OUV of the GBRWHA

The attribute 'Traditional Owner interaction with the natural environment' has a **moderate contribution** to criterion ix (ecological and biological processes) of the OUV of the GBRWHA based on the following information:

Commonwealth or state attribute legislative status

- Although not listed under legislation, the PPG master planned area and surrounds are covered by a TUMRA which is accredited by GBRMPA and the Queensland Department of National Parks, Sport and Racing.
- The artefacts/sites shown in Figure 11.1 are regulated under the *Aboriginal Cultural Heritage Act 2003* (Qld) (ACH Act). A person who carries out an activity as defined under the ACH Act has a duty of care to take all reasonable and practicable measures to ensure the activity does not harm these sites.

Local or regional attribute status

- Refer above information regarding the TUMRA and the ACH Act.

Notable or iconic attribute value

- The Outlook Report 2014 does not specifically identify sacred sites or other cultural heritage values within the PPG master planned area or surrounds.

Condition/trend of the attribute

- Assessment of cultural heritage values was introduced into the Outlook Reporting for the first time in 2014.
- The Outlook Report 2014 records the attribute conditions in the wider GBR to be poor for sacred sites, sites of particular significance, places important for cultural tradition, stories, songlines, totems, languages, indigenous structure, technology, tools and archaeology. The attribute condition in the wider GBR was recorded as good for cultural practices, observances, customs and lore.
- No trend information is available as this attribute was not assessed in the Outlook Report 2009 (GBRMPA 2009).

Contribution to attribute sustainability

- This is an emerging value in terms of understanding the cultural heritage values of the GBRWHA
- It is not known if the values within the PPG master planned area and surrounds contributed to the ongoing sustainability of the attribute more broadly. It is likely that the loss of the values would result in significant impacts on the preservation of cultural heritage of the Indigenous people represented by the Port Curtis Coral Coast group.

Notable presence of the attribute

- The TUMRA covers the largest area within the GBRWHA
- There are no notable sites included in the Outlook Report 2014 that occur in the PPG master planned area or surrounds.

Significance of attribute to the preservation of the GBRWHA

- It is not known if the loss of the cultural heritage values within the PPG master planned area and surrounds would result in a significant decline of the OUV of the GBRWHA. It is likely that the loss of the values would result in significant impacts on the preservation of cultural heritage of the Indigenous people represented by the Port Curtis Coral Coast group.

12 Marine species diversity

The relevant information from the retrospective statement of OUV and the Outlook Report 2014 relating to marine species diversity is summarised in Table 12.1, with respect to the local expression of the OUV of the GBRWHA for the PPG master planned area and surrounds.

Table 12.1 OUV of the GBRWHA: Marine species diversity diversity

Attribute	Statement of OUV	GBR Outlook Report 2014			Relevant OUV criteria			
		GBR wide: Significant contribution to OUV	GBR wide condition	GBR wide trend	vii	viii	ix	x
Diversity supporting marine species (global conservation significance)	<ul style="list-style-type: none"> ■ Globally significant marine faunal groups include over 4,000 species of molluscs, over 1,500 species of fish, plus a great diversity of sponges, anemones, marine worms, crustaceans, and many others ■ Species diversity, especially the endemic species, means the GBRWHA is of enormous scientific and intrinsic importance 	<ul style="list-style-type: none"> ■ 25 EPBC Act listed threatened marine species occur within the GBRWHA ■ The GBR is considered vital to the recovery and survival of many threatened marine species 	<ul style="list-style-type: none"> ■ Good 	<ul style="list-style-type: none"> ■ Deteriorated 	✓	-	✓	✓

12.1 Presence of local attribute

For the purposes of this attribute, the assessment of local expression of the marine species diversity attribute included assessment of marine species of global conservation significance which are known to occur in the GBRWHA. Species of global conservation significance were defined as those species listed as vulnerable, endangered or critically endangered on the IUCN red list of threatened species.

Species listings under the IUCN red list do not have statutory or regulatory implications, whereas listings under the EPBC Act require approval from the Commonwealth Minister for the Environment where there are likely to be significant impacts on matters of national environmental significance (ie the EPBC Act listings are statutory and regulatory).

Diversity of globally significant marine species has a **moderate presence** in the PPG master planned area and surrounds based on the following information:

- Marine species of global conservation significance which have the potential to occur within the PPG master planned area and surrounds include:
 - Dugong: **Minor presence** in the PPG master planned area and surrounds. The presence of the Dugong in the PPG master planned area and surrounds is assessed in Section 4.1


- Blue whale and Sperm whale: **Minor presence** in the PPG master planned area and surrounds. The presence of the whales in the PPG master planned area and surrounds is assessed in Section 4.2
- Australian humpback dolphin and Australian snubfin dolphin: **Moderate presence** in the PPG master planned area and surrounds. The presence of the dolphins in the PPG master planned area and surrounds is assessed in Section 4.3
- Marine turtle species: **Moderate presence** in the PPG master planned area and surrounds. The presence of the nesting marine turtles in the PPG master planned area and surrounds is assessed in Section 5. Note that the assessment of the marine turtle attribute in Section 5 considers nesting marine turtles, consistent with the description of the marine turtle attribute in the Statement of OUV (DoE 2015), the Outlook Report 2014 and other supporting reports (eg Lucas et al. 1997). The Hawksbill turtle, Olive ridley turtle and Leatherback turtle are not considered in Section 5.
- Shark and ray species, including Estuary stingray, Whale shark, Great white shark, Shortfin mako shark, Longfin mako shark, Porbeagle, Reef manta ray and Giant manta ray: **Minor presence** in the PPG master planned area and surrounds. The presence of fish species in the PPG master planned area and surrounds is discussed in Section 3. The other shark and ray species have been identified through the review of desktop database searches (Appendix C), the retrospective statement of OUV and the Outlook Report 2014.

12.2 Contribution of the local attribute to the OUV of the GBRWHA

Diversity of globally significant marine species is considered to have a **minor contribution** to criterion vii (aesthetic values and superlative natural phenomena) and criterion ix (ecological and biological processes) and a **moderate contribution** to criterion x (biodiversity conservation) based on the following information.

Commonwealth or state attribute legislative status

- Globally significant marine species which have the potential to occur within the PPG master planned area and surrounds include, but may not be limited to the following species:
 - Dugong: Listed as vulnerable at a global scale by the IUCN
 - Blue whale: Listed as endangered at a global scale by the IUCN
 - Sperm whale: Listed as vulnerable at a global scale by the IUCN
 - Australian humpback dolphin: Listed as near threatened at a global scale by the IUCN
 - Australian snubfin dolphin: Listed as near threatened at a global scale by the IUCN
 - Green turtle: Listed as endangered at a global scale by the IUCN
 - Hawksbill turtle: Listed as critically endangered at a global scale by the IUCN
 - Loggerhead turtle: Listed as vulnerable at a global scale by the IUCN
 - Olive ridley turtle: Listed as vulnerable at a global scale by the IUCN
 - Leatherback turtle: Listed as vulnerable at a global scale by the IUCN
 - Estuary Stingray: Listed as vulnerable at a global scale by the IUCN
 - Whale Shark: Listed as vulnerable at a global scale by the IUCN
 - Great White Shark: Listed as vulnerable at a global scale by the IUCN
 - Shortfin mako shark: Listed as vulnerable at a global scale by the IUCN
 - Longfin mako shark: Listed as vulnerable at a global scale by the IUCN
 - Porbeagle: Listed as vulnerable at a global scale by the IUCN

- 
- Reef manta ray: Listed as vulnerable at a global scale by the IUCN
 - Giant manta ray: Listed as vulnerable at a global scale by the IUCN
 - Based on the sparse information on population structure of the Australia humpback dolphin (Para et al. 2004), the Port of Gladstone (including the PPG master planned area and surrounds) is considered to be an important location within the GBRWHA for the species' population, based on the known distribution of the species
 - The PPG master planned area and surrounds are not listed as an area of habitat critical to the survival of the aforementioned globally significant marine species (with the exception of the Australian humpback dolphin), as per applicable recovery plans or conservation advice statements available.

Local or regional attribute status

- Marine fauna species are protected within the GBR Marine Park through permit requirements and activity restrictions in zoned areas of the GBR Marine Park. GBR Marine Park zoning surrounding the PPG master planned area includes 'general use zone', 'habitat protection zone', 'marine national park zone' and 'conservation park zone'.

Notable or iconic attribute value

- Published articles, including the Outlook Report 2014, recognises the distribution of Australian humpback dolphins in the Port of Gladstone as being an important location for this species' distribution within the context of the GBRWHA
- No publications specifically reference the PPG master planned area or surrounds as being a prime example of an area important for the remaining globally significant marine species which have the potential to occur within the PPG master planned area and surrounds

Condition/trend of the attribute

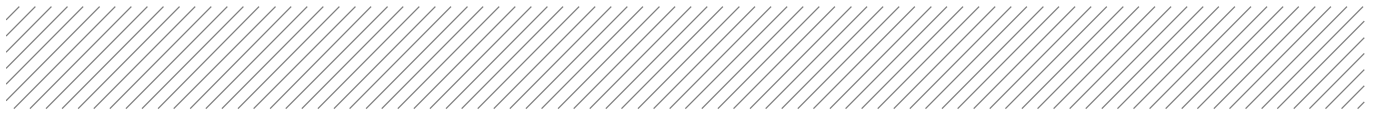
- The Outlook Report 2014 records the attribute conditions in the wider GBR to be good for populations of species and groups of species. The attribute condition trend in the wider GBR was recorded as deteriorated for populations of species and groups of species.

Contribution to attribute sustainability

- Diversity of available habitat types contribute to the diversity of marine species within an area (Lucas et al. 1997). Marine habitat areas within the PPG master planned area and surrounds are associated with coral reefs, seagrass meadows, mangrove communities, hard and soft benthic substrates and beach habitats. Marine habitat areas within the PPG master planned area and surrounds are not considered to be unique to the area and are available throughout the GBRWHA.
- The GBRWHA supports 25 marine species listed under the EPBC Act as threatened (GBRWHA 2014), however the Outlook Report 2014 does not provide a list of species that comprise the 25 EPBC Act listed threatened marine species.
- Based on the database search results for the PPG master planned area and surrounds (refer Appendix C), there are 18 globally significant threatened species with the potential to occur within the PPG master planned area and surrounds. As the Outlook Report 2014 does not provide detail on the individual threatened marine fauna species that occur within the GBRWHA, it is not possible to compare the PPG master planned area threatened marine species numbers.

Notable presence of the attribute

- The globally significant marine species which have the potential to occur within the PPG master planned area and surrounds are mobile species, with the potential to travel long distances. With the exception of the Australian humpback dolphin, the distribution within the GBRWHA of the aforementioned globally significant marine species is not considered to be unique to the PPG master planned area and surrounds.



Significance of attribute to the preservation of the GBRWHA

- The potential loss of habitat areas within the PPG master planned area and surrounds (ie coral reefs, seagrass meadows and mangrove communities) have the potential to have an impact on the species diversity of globally significant marine species within the local area. It is not, however, expected that this would result in the significant decline in the OUV of the GBRWHA.

13 Total species diversity

The relevant information from the retrospective statement of OUV and the Outlook Report 2014 relating to total species diversity is summarised in Table 13.1, with respect to the local expression of the OUV of the GBRWHA for the PPG master planned area and surrounds.

Table 13.1 OUV of the GBRWHA: Total species diversity

Attribute	Statement of OUV	GBR Outlook Report 2014			Relevant OUV criteria			
		GBR wide: Significant contribution to OUV	GBR wide condition	GBR wide trend	vii	viii	ix	x
Total species diversity	<ul style="list-style-type: none"> The GBRWHA encompasses a globally unique array of ecological communities, habitats and species. This diversity of species and habitats, and their interconnectivity, make the GBR one of the richest and most complex natural ecosystems on earth Biologically the unique diversity of the GBR reflects the maturity of an ecosystem that has evolved over millennia 	<ul style="list-style-type: none"> The GBRWHA is one of the world's most diverse ecosystems, with a range of habitats and many thousands of different species Species groups within the GBRWHA include 25 threatened marine species, 76 migratory species, iconic species and at risk species The biodiversity of the GBRWHA is the basis of its OUV recognised in its world heritage listing 	Good	Deteriorated	✓	-	✓	✓

13.1 Presence of local attribute

The assessment of local expression of the total species diversity attribute included assessment of marine, intertidal and terrestrial species.

Detailed attribute assessments for a number of total species diversity components are presented in earlier sections of this document (ie fish species are assessed in Section 3, marine megafauna in Section 4, seabirds and migratory shorebirds in Section 7, and threatened species in Section 8).

Diversity of species has a **moderate presence** in the PPG master planned area and surrounds based on the following information:

- Approximately 46% of seagrass species recorded in the GBRWHA have been recorded in the PPG master planned area and surrounds (GBRMPA 2014a, GPC 2012). Seagrass has a moderate presence in the PPG master planned area and surrounds (refer Section 6.1).

- Approximately 36% of mangrove species recorded in the GBRWHA have been recorded in the PPG master planned area and surrounds (GBRMPA 2014a, GPC 2012). Mangroves have a minor presence in the PPG master planned area and surrounds (refer Section 8.2).
- Approximately 9% of fish species recorded in the GBRWHA have been recorded in the PPG master planned area and surrounds (GBRMPA 2014, Currie and Connelly 2004, Vision Environment 2015). Fish species have a minor presence in the PPG master planned area and surrounds (refer Section 3).
- Approximately 47% of whale and dolphin species recorded in the GBRWHA have the potential to occur within the PPG master planned area and surrounds (GBRMPA 2014a). Whales have a minor presence and dolphins have a moderate presence in the PPG master planned area and surrounds (refer Section 4.2 and Section 4.3).
- Approximately 65.6% of the biomass of breeding seabirds in the GBRWHA occur within the Capricorn-Bunker Group of islands and cays, situated approximately 45 km north east of the PPG master planned area (Dyer et al. 2005, GBRMPA 2012, Hulsman et al. 1997). Seabirds have a minor presence in the PPG master planned area and surrounds (refer Section 7.1).
- Approximately 2.8% of potential shorebird habitat mapped in the GBRWHA is located within the PPG master planned area and surrounds. Shorebird populations which have exceeded 0.1% of total East Asian-Australasian Flyway (EAAF) population are present within the PPG master planned area. Shorebirds and migratory birds have a significant presence in the PPG master planned area and surrounds (refer Section 7.2).
- All species of marine turtles species which have been recorded in the GBRWHA have been recorded in the PPG master planned area and surrounds. Marine turtles have a moderate presence in the PPG master planned area and surrounds (refer Section 12).
- Dugong populations utilise habitats within the PPG master planned area and surrounds and have a minor presence in the PPG master planned area and surrounds (refer Section 4.1).
- When compared to reefs in the northern GBR, or at mid-shelf or outer-shelf areas, reefs in the PPG master planned area and surrounds are generally lower in coral species richness, and tend to be made up of corals along with other benthic organisms (eg algae, sponges) growing on rocks or boulders (Ayling et al. 2012, GBRMPA 2007, DeVantier et al. 2006). Coral species diversity have a minor presence in the PPG master planned area and surrounds (refer Section 1.4).
- Approximately 47% of terrestrial flora species recorded in the GBRWHA have been recorded in the PPG master planned area and surrounds (Lucas et al. 1997, DEHP 2017)
- Wildlife Online identified 1,485 intertidal and terrestrial species within the PPG master planned area and surrounds, including 1,018 flora species and 467 fauna species (DEHP 2017).

13.2 Contribution of the local attribute to the OUV of the GBRWHA

Diversity of species is considered to have a **moderate contribution** to criterion vii (aesthetic values and superlative natural phenomena), criterion ix (ecological and biological processes) and criterion x (biodiversity conservation) based on the following information:

Commonwealth or state attribute legislative status

- The diversity of species which occur within the PPG master planned area and surrounds include conservation significant species, listed under the provisions of the EPBC Act, NC Act and/or the IUCN red list of threatened species.

- 20 threatened intertidal and terrestrial flora and fauna species were identified in the Wildlife Online database as being previously recorded within the PPG master planned area and surrounds (DEHP 2017). An additional 37 threatened intertidal and terrestrial flora and fauna species were identified in the EPBC Act protected matters search tool as potentially occurring within the PPG master planned area and surrounds (DoEE 2016b) (note that the EPBC Act protected matters search tool results are generated by predictive habitat mapping opposed to the Wildlife Online database which is based on species observation records).
- 18 globally threatened marine species have the potential to occur within the PPG master planned area and surrounds (refer Section 12).

Local or regional attribute status

- Marine fauna species are protected within the GBR Marine Park through permit requirements and activity restrictions in zoned areas of the GBR Marine Park. GBR Marine Park zoning surrounding the PPG master planned area includes the 'general use zone', 'habitat protection zone', 'marine national park zone' and 'conservation park zone'.
- The PPG master planned area and surrounds include National Parks and Conservation Parks which are protected under the provisions of the NC Act. Areas designated as National Parks or Conservation Park provide protection to any areas of potential habitat for local flora and fauna assemblages.
- All native fauna species are protected under the provisions of the NC Act, providing protection for diverse local fauna assemblages, regardless of the species conservation status.

Notable or iconic attribute value

- The PPG master planned area and surrounds are not specifically recognised as a prime example of potential habitat for flora and fauna species, including key threatened species, in key publications (ie retrospective statement of OUV, Outlook Report 2014 and Lucas et al. 1997).

Condition/trend of the attribute

- The Outlook Report 2014 records the attribute conditions in the wider GBR to be good for populations of species and groups of species. The attribute condition trend in the wider GBR was recorded as deteriorated for populations of species and groups of species.

Contribution to attribute sustainability

- 18 globally significant marine species potentially to occur within the PPG master planned area and surrounds (refer Appendix C).
- Diversity of available habitat types contribute to the diversity of marine species within an area (Lucas et al. 1997). Marine habitat areas within the PPG master planned area and surrounds are associated with coral reefs, seagrass meadows, mangrove communities, hard and soft benthic substrates and beach habitats. Marine habitat areas within the PPG master planned area and surrounds are not considered to be unique to the area and are available throughout the GBRWHA.
- The potential loss of intertidal and terrestrial habitat areas within the PPG master planned area and surrounds has the potential to have an impact on the species diversity within the local area. Vegetation communities and habitats of the Curtis Coast are similar to the major vegetation types in other parts of Central Queensland (GPC 2012), and thus are not considered to be critical to the sustainability of species diversity within the GBRWHA.

Notable presence of the attribute

- The PPG master planned area and surrounds is not considered to represent a notable presence of species diversity within the GBRWHA. The marine, intertidal and terrestrial habitats within the PPG master planned area and surrounds which provide for diverse local species assemblages are not considered to be unique to the PPG master planned area. The habitat resources available within the PPG master planned area and surrounds are represented in other areas within the GBRWHA.

Significance of attribute to the preservation of the GBRWHA

- The Outlook Report 2014 identifies species components which contribute to the total species diversity of the GBRWHA and are considered to be in poor or very poor condition. Those species components which form part of the local expression of OUV attributes in the PPG master planned area and surrounds, and the attributes presence and contribution in the PPG master planned area and surrounds as identified in this report, are provided in Table 13.2. The species diversity components are also provided in Table 13.2, and were assessed as having a deteriorated condition trend within the GBRWHA.
- The PPG master planned area and surrounds has a significant contribution to dolphins within the GBRWHA. With respect to the deteriorated condition trend of dolphins within the GBRWHA, the significant contribution of dolphins within the PPG master planned area and surrounds is considered to be a notable and significant contribution to dolphins within the GBRWHA.
- The contribution of the local expression of attributes in the PPG master planned area and surrounds is minor overall for those species components which, contribute to the total species diversity of the GBRWHA, and have been assessed as being in poor condition or of deteriorated condition trend (GBRMPA 2014a). The PPG master planned area and surrounds is not considered to have a significant contribution to the overall preservation of total species diversity within the GBRWHA.

Table 13.2 Contribution of the local expression of attributes in the PPG master planned area and surrounds which contribute to total species diversity in the GBRWHA and have been assessed as poor condition or of deteriorated condition trend

Species component	Condition	Condition trend	Contribution of the local expression of attributes
Seagrass	Poor	Deteriorated	Minor (criterion vii and viii) Moderate (criterion ix and x)
Corals	Poor	Deteriorated	Minor (criterion vii, viii, ix and x)
Bony fishes	Good	Deteriorated	Minor (criterion vii, iv and x)
Sharks and rays	Poor	Deteriorated	Minor (criterion vii and ix) Moderate (criterion x)
Marine turtles	Poor	No consistent trend	Minor to moderate (criterion vii and x)
Seabirds	Poor	Not assessed	Minor (criterion vii, ix and x)
Shorebirds	Poor	Not assessed	Significant (criterion x)
Dolphins	Good	Deteriorated	Minor (criterion vii) Significant (criterion x)
Dugongs	Poor	Deteriorated	Moderate (criterion x)

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Wildlife Unlimited Pty Ltd (Wildlife Unlimited), 2015, *Gladstone Ports Corporation Report for Migratory Shorebird Monitoring Port Curtis and the Curtis Coast Annual Summer Survey – 2015*, Report produced for the Ecosystem Research and Monitoring Program Advisory Panel as part of Gladstone Ports Corporation's Ecosystem Research and Monitoring Program.

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Appendix C

Flora and fauna database searches





EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 19/12/16 14:24:44

[Summary](#)

[Details](#)

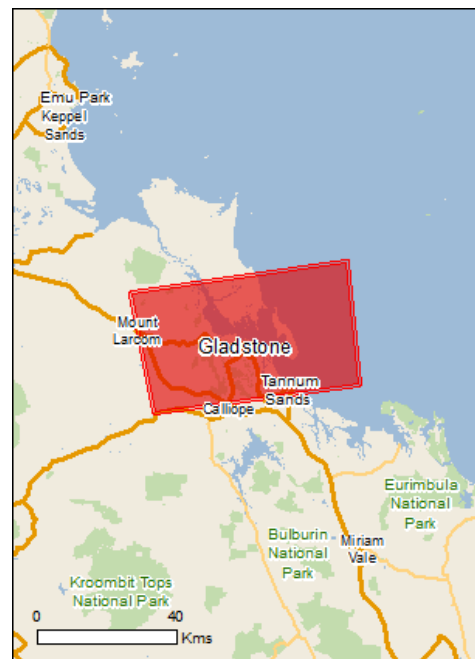
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

[Acknowledgements](#)



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

[Coordinates](#)

Buffer: 1.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the [Administrative Guidelines on Significance](#).

World Heritage Properties:	1
National Heritage Places:	1
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	5
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	7
Listed Threatened Species:	58
Listed Migratory Species:	61

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at <http://www.environment.gov.au/heritage>

A [permit](#) may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	106
Whales and Other Cetaceans:	12
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	8
Regional Forest Agreements:	None
Invasive Species:	42
Nationally Important Wetlands:	3
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

World Heritage Properties [\[Resource Information \]](#)

Name	State	Status
Great Barrier Reef	QLD	Declared property

National Heritage Properties [\[Resource Information \]](#)

Name	State	Status
Natural		
Great Barrier Reef	QLD	Listed place

Great Barrier Reef Marine Park [\[Resource Information \]](#)

Type	Zone	IUCN
General Use	GU-21-6016	VI
Habitat Protection	HP-23-5367	VI
Habitat Protection	HP-23-5369	VI
Habitat Protection	HP-23-5370	VI
Marine National Park	MNP-23-1167	II

Commonwealth Marine Area [\[Resource Information \]](#)

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside the Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

Name

EEZ and Territorial Sea

Listed Threatened Ecological Communities [\[Resource Information \]](#)

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Brigalow (Acacia harpophylla dominant and co-dominant)	Endangered	Community likely to occur within area
Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions	Endangered	Community may occur within area
Littoral Rainforest and Coastal Vine Thickets of Eastern Australia	Critically Endangered	Community likely to occur within area
Lowland Rainforest of Subtropical Australia	Critically Endangered	Community likely to occur within area
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	Endangered	Community likely to occur within area
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	Community likely to occur within area
Weeping Myall Woodlands	Endangered	Community may occur within area

Listed Threatened Species [\[Resource Information \]](#)

Name	Status	Type of Presence
Birds		
Botaurus poiciloptilus		
Australasian Bittern [1001]	Endangered	Species or species habitat may occur within area
Calidris canutus		
Red Knot, Knot [855]	Endangered	Roosting known to occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur

Name	Status	Type of Presence within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Cyclopsitta diophthalma coxeni Coxen's Fig-Parrot [59714]	Endangered	Species or species habitat may occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat likely to occur within area
Fregatta grallaria grallaria White-bellied Storm-Petrel (Tasman Sea), White-bellied Storm-Petrel (Australasian) [64438]	Vulnerable	Species or species habitat likely to occur within area
Geophaps scripta scripta Squatter Pigeon (southern) [64440]	Vulnerable	Species or species habitat known to occur within area
Limosa lapponica baueri Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat known to occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Neochmia ruficauda ruficauda Star Finch (eastern), Star Finch (southern) [26027]	Endangered	Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat likely to occur within area
Phoebastria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Poephila cincta cincta Southern Black-throated Finch [64447]	Endangered	Species or species habitat likely to occur within area
Pterodroma neglecta neglecta Kermadec Petrel (western) [64450]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Turnix melanogaster Black-breasted Button-quail [923]	Vulnerable	Species or species habitat known to occur

Name	Status	Type of Presence within area
Mammals		
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Chalinolobus dwyeri Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat likely to occur within area
Dasyurus hallucatus Northern Quoll, Digul [331]	Endangered	Species or species habitat known to occur within area
Macroderma gigas Ghost Bat [174]	Vulnerable	Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Breeding known to occur within area
Nyctophilus corbeni Corben's Long-eared Bat, South-eastern Long-eared Bat [83395]	Vulnerable	Species or species habitat may occur within area
Petauroides volans Greater Glider [254]	Vulnerable	Species or species habitat known to occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT) Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat likely to occur within area
Pteropus poliocephalus Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Xeromys myoides Water Mouse, False Water Rat, Yirrkoo [66]	Vulnerable	Species or species habitat known to occur within area
Other		
Cycas megacarpa [55794]	Endangered	Species or species habitat known to occur within area
Cycas ophiolitica [55797]	Endangered	Species or species habitat likely to occur within area
Plants		
Atalaya collina Yarwun Whitewood [55417]	Endangered	Species or species habitat known to occur within area
Bosistoa transversa Three-leaved Bosistoa, Yellow Satinheart [16091]	Vulnerable	Species or species habitat likely to occur within area
Bulbophyllum globuliforme Miniature Moss-orchid, Hoop Pine Orchid [6649]	Vulnerable	Species or species habitat likely to occur within area
Cupaniopsis shirleyana Wedge-leaf Tuckeroo [3205]	Vulnerable	Species or species habitat likely to occur within area
Dichanthium setosum bluegrass [14159]	Vulnerable	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Macadamia integrifolia Macadamia Nut, Queensland Nut Tree, Smooth-shelled Macadamia, Bush Nut, Nut Oak [7326]	Vulnerable	Species or species habitat likely to occur within area
Marsdenia brevifolia [64585]	Vulnerable	Species or species habitat may occur within area
Parsonsia larcomensis Mt Larcom Silk Pod [64587]	Vulnerable	Species or species habitat known to occur within area
Phaius australis Lesser Swamp-orchid [5872]	Endangered	Species or species habitat likely to occur within area
Samadera bidwillii Quassia [29708]	Vulnerable	Species or species habitat known to occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Delma torquata Collared Delma [1656]	Vulnerable	Species or species habitat may occur within area
Denisonia maculata Ornamental Snake [1193]	Vulnerable	Species or species habitat may occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Egernia rugosa Yakka Skink [1420]	Vulnerable	Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Furina dunmalli Dunmall's Snake [59254]	Vulnerable	Species or species habitat known to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Rheodytes leukops Fitzroy River Turtle, Fitzroy Tortoise, Fitzroy Turtle, White-eyed River Diver [1761]	Vulnerable	Species or species habitat may occur within area
Sharks		
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Breeding may occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within

Name	Status	Type of Presence area
Listed Migratory Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Foraging, feeding or related behaviour known to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat likely to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Species or species habitat likely to occur within area
Sterna albifrons Little Tern [813]		Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Migratory Marine Species		
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Dugong dugon Dugong [28]		Species or species

Name	Threatened	Type of Presence
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	habitat known to occur within area Species or species habitat known to occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat may occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding likely to occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat likely to occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Breeding known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Orcaella brevirostris Irrawaddy Dolphin [45]		Species or species habitat likely to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Breeding may occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Breeding known to occur within area
Migratory Terrestrial Species		
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat known to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Roosting known to occur

Name	Threatened	Type of Presence within area
Arenaria interpres Ruddy Turnstone [872]		Roosting known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Roosting known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Roosting may occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Heteroscelus brevipes Grey-tailed Tattler [59311]		Roosting known to occur within area
Limicola falcinellus Broad-billed Sandpiper [842]		Roosting known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting likely to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species

Name	Threatened	Type of Presence
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		habitat known to occur within area Roosting known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Roosting known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [\[Resource Information \]](#)

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name

Defence - GLADSTONE ARES DEPOT

Listed Marine Species [\[Resource Information \]](#)

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Roosting known to occur within area
Anous stolidus Common Noddy [825]		Foraging, feeding or related behaviour known to occur within area
Anseranas semipalmata Magpie Goose [978]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Arenaria interpres Ruddy Turnstone [872]		Roosting known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Roosting known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur

Name	Threatened	Type of Presence
Calidris ruficollis Red-necked Stint [860]		within area Roosting known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Roosting known to occur within area
Cuculus saturatus Oriental Cuckoo, Himalayan Cuckoo [710]		Species or species habitat may occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat likely to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Roosting may occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Heteroscelus brevipes Grey-tailed Tattler [59311]		Roosting known to occur within area
Himantopus himantopus Black-winged Stilt [870]		Roosting known to occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area
Limicola falcinellus Broad-billed Sandpiper [842]		Roosting known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat known to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting likely to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat likely to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Phoebastria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Species or species habitat likely to occur within area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Roosting known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Sterna albifrons Little Tern [813]		Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Roosting known to occur within area
Fish		

Name	Threatened	Type of Presence
Acentronura tentaculata Shortpouch Pygmy Pipehorse [66187]		Species or species habitat may occur within area
Campichthys tryoni Tryon's Pipefish [66193]		Species or species habitat may occur within area
Choeroichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
Corythoichthys amplexus Fijian Banded Pipefish, Brown-banded Pipefish [66199]		Species or species habitat may occur within area
Corythoichthys flavofasciatus Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200]		Species or species habitat may occur within area
Corythoichthys haematopterus Reef-top Pipefish [66201]		Species or species habitat may occur within area
Corythoichthys intestinalis Australian Messmate Pipefish, Banded Pipefish [66202]		Species or species habitat may occur within area
Corythoichthys ocellatus Orange-spotted Pipefish, Ocellated Pipefish [66203]		Species or species habitat may occur within area
Corythoichthys paxtoni Paxton's Pipefish [66204]		Species or species habitat may occur within area
Corythoichthys schultzi Schultz's Pipefish [66205]		Species or species habitat may occur within area
Doryrhamphus excisus Bluestripe Pipefish, Indian Blue-stripe Pipefish, Pacific Blue-stripe Pipefish [66211]		Species or species habitat may occur within area
Festucalex cinctus Girdled Pipefish [66214]		Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Halicampus dunckeri Red-hair Pipefish, Duncker's Pipefish [66220]		Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus nitidus Glittering Pipefish [66224]		Species or species habitat may occur within area
Halicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area
Hippichthys cyanospilos Blue-speckled Pipefish, Blue-spotted Pipefish [66228]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Hippichthys heptagonus Madura Pipefish, Reticulated Freshwater Pipefish [66229]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippocampus bargibanti Pygmy Seahorse [66721]		Species or species habitat may occur within area
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area
Hippocampus zebra Zebra Seahorse [66241]		Species or species habitat may occur within area
Lissocampus runa Javelin Pipefish [66251]		Species or species habitat may occur within area
Micrognathus andersonii Anderson's Pipefish, Shortnose Pipefish [66253]		Species or species habitat may occur within area
Micrognathus brevirostris thorntail Pipefish, Thorn-tailed Pipefish [66254]		Species or species habitat may occur within area
Nannocampus pictus Painted Pipefish, Reef Pipefish [66263]		Species or species habitat may occur within area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Solenostomus paegnius Rough-snout Ghost Pipefish [68425]		Species or species habitat may occur within area
Solenostomus paradoxus Ornate Ghostpipefish, Harlequin Ghost Pipefish, Ornate Ghost Pipefish [66184]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Mammals		
Dugong dugon Dugong [28]		Species or species habitat known to occur within area
Reptiles		
Acalyptophis peronii Horned Seasnake [1114]		Species or species habitat may occur within

Name	Threatened	Type of Presence area
Aipysurus duboisii Dubois' Seasnake [1116]		Species or species habitat may occur within area
Aipysurus eydouxii Spine-tailed Seasnake [1117]		Species or species habitat may occur within area
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area
Astrotia stokesii Stokes' Seasnake [1122]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Disteira major Olive-headed Seasnake [1124]		Species or species habitat may occur within area
Emydocephalus annulatus Turtle-headed Seasnake [1125]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Lapemis hardwickii Spine-bellied Seasnake [1113]		Species or species habitat may occur within area
Laticauda colubrina a sea krait [1092]		Species or species habitat may occur within area
Laticauda laticaudata a sea krait [1093]		Species or species habitat may occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within

Name	Threatened	Type of Presence area
Whales and other Cetaceans		[Resource Information]
Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Breeding known to occur within area
Orcaella brevirostris Irrawaddy Dolphin [45]		Species or species habitat likely to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Breeding known to occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area

Extra Information

State and Territory Reserves		[Resource Information]
Name	State	
Boyne Island	QLD	
Calliope	QLD	
Curtis Island	QLD	
Curtis Island	QLD	
Curtis Island	QLD	
Garden Island	QLD	
Southend	QLD	
Wild Cattle Island	QLD	

Invasive Species**[Resource Information]**

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resources Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Lonchura punctulata Nutmeg Mannikin [399]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Equus caballus Horse [5]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur

Name	Status	Type of Presence
Oryctolagus cuniculus Rabbit, European Rabbit [128]		within area Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Acacia nilotica subsp. indica Prickly Acacia [6196]		Species or species habitat may occur within area
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus africanus Climbing Asparagus, Climbing Asparagus Fern [66907]		Species or species habitat likely to occur within area
Asparagus plumosus Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Cryptostegia grandiflora Rubber Vine, Rubbervine, India Rubber Vine, India Rubbervine, Palay Rubbervine, Purple Allamanda [18913]		Species or species habitat likely to occur within area
Dolichandra unguis-cati Cat's Claw Vine, Yellow Trumpet Vine, Cat's Claw Creeper, Funnel Creeper [85119]		Species or species habitat likely to occur within area
Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Hymenachne amplexicaulis Hymenachne, Olive Hymenachne, Water Stargrass, West Indian Grass, West Indian Marsh Grass [31754]		Species or species habitat likely to occur within area
Jatropha gossypifolia Cotton-leaved Physic-Nut, Bellyache Bush, Cotton-leaf Physic Nut, Cotton-leaf Jatropha, Black Physic Nut [7507]		Species or species habitat likely to occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Parkinsonia aculeata Parkinsonia, Jerusalem Thorn, Jelly Bean Tree,		Species or species

Name	Status	Type of Presence
Horse Bean [12301]		habitat likely to occur within area
Parthenium hysterophorus Parthenium Weed, Bitter Weed, Carrot Grass, False Ragweed [19566]		Species or species habitat likely to occur within area
Prosopis spp. Mesquite, Algaroba [68407]		Species or species habitat likely to occur within area
Protasparagus densiflorus Asparagus Fern, Plume Asparagus [5015]		Species or species habitat likely to occur within area
Protasparagus plumosus Climbing Asparagus-fern, Ferny Asparagus [11747]		Species or species habitat likely to occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Vachellia nilotica Prickly Acacia, Blackthorn, Prickly Mimosa, Black Piquant, Babul [84351]		Species or species habitat likely to occur within area

Nationally Important Wetlands		[Resource Information]
Name		State
Great Barrier Reef Marine Park		QLD
Port Curtis		QLD
The Narrows		QLD

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-23.72412 150.96325,-23.65122 151.51372,-23.9353 151.5441,-24.00065 151.02245,-23.72412 150.96325

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- [-Office of Environment and Heritage, New South Wales](#)
- [-Department of Environment and Primary Industries, Victoria](#)
- [-Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [-Department of Environment, Water and Natural Resources, South Australia](#)
- [-Department of Land and Resource Management, Northern Territory](#)
- [-Department of Environmental and Heritage Protection, Queensland](#)
- [-Department of Parks and Wildlife, Western Australia](#)
- [-Environment and Planning Directorate, ACT](#)
- [-Birdlife Australia](#)
- [-Australian Bird and Bat Banding Scheme](#)
- [-Australian National Wildlife Collection](#)
- Natural history museums of Australia
- [-Museum Victoria](#)
- [-Australian Museum](#)
- [-South Australian Museum](#)
- [-Queensland Museum](#)
- [-Online Zoological Collections of Australian Museums](#)
- [-Queensland Herbarium](#)
- [-National Herbarium of NSW](#)
- [-Royal Botanic Gardens and National Herbarium of Victoria](#)
- [-Tasmanian Herbarium](#)
- [-State Herbarium of South Australia](#)
- [-Northern Territory Herbarium](#)
- [-Western Australian Herbarium](#)
- [-Australian National Herbarium, Canberra](#)
- [-University of New England](#)
- [-Ocean Biogeographic Information System](#)
- [-Australian Government, Department of Defence](#)
- [Forestry Corporation, NSW](#)
- [-Geoscience Australia](#)
- [-CSIRO](#)
- [-Australian Tropical Herbarium, Cairns](#)
- [-eBird Australia](#)
- [-Australian Government – Australian Antarctic Data Centre](#)
- [-Museum and Art Gallery of the Northern Territory](#)
- [-Australian Government National Environmental Science Program](#)
- [-Australian Institute of Marine Science](#)
- [-Reef Life Survey Australia](#)
- [-American Museum of Natural History](#)
- [-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania](#)
- [-Tasmanian Museum and Art Gallery, Hobart, Tasmania](#)
- Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the [Contact Us](#) page.



Queensland Government

Wildlife Online Extract

Search Criteria: Species List for a Defined Area

Species: All

Type: All

Status: All

Records: All

Date: All

Latitude: 23.7241 to 23.9353

Longitude: 150.9632 to 151.5441

Email: leesa.leathbridge@aurecongroup.com

Date submitted: Monday 19 Dec 2016 13:17:00

Date extracted: Monday 19 Dec 2016 13:20:03

The number of records retrieved = 1839

Disclaimer

As the DSITIA is still in a process of collating and vetting data, it is possible the information given is not complete. The information provided should only be used for the project for which it was requested and it should be appropriately acknowledged as being derived from Wildlife Online when it is used.

The State of Queensland does not invite reliance upon, nor accept responsibility for this information. Persons should satisfy themselves through independent means as to the accuracy and completeness of this information.

No statements, representations or warranties are made about the accuracy or completeness of this information. The State of Queensland disclaims all responsibility for this information and all liability (including without limitation, liability in negligence) for all expenses, losses, damages and costs you may incur as a result of the information being inaccurate or incomplete in any way for any reason.

Feedback about Wildlife Online should be emailed to wildlife.online@science.dsitia.qld.gov.au

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	amphibians	Bufo	<i>Rhinella marina</i>	cane toad	Y			93/2
animals	amphibians	Hylidae	<i>Litoria rothii</i>	northern laughing treefrog		C		6
animals	amphibians	Hylidae	<i>Litoria dentata</i>	bleating treefrog		C		5/1
animals	amphibians	Hylidae	<i>Litoria inermis</i>	bumpy rocketfrog		C		8/1
animals	amphibians	Hylidae	<i>Litoria rubella</i>	ruddy treefrog		C		20/4
animals	amphibians	Hylidae	<i>Litoria caerulea</i>	common green treefrog		C		26/2
animals	amphibians	Hylidae	<i>Litoria wilcoxii</i>	eastern stony creek frog		C		5
animals	amphibians	Hylidae	<i>Litoria gracilentata</i>	graceful treefrog		C		5
animals	amphibians	Hylidae	<i>Litoria latopalmata</i>	broad palmed rocketfrog		C		12/1
animals	amphibians	Hylidae	<i>Cyclorana alboguttata</i>	greenstripe frog		C		3
animals	amphibians	Hylidae	<i>Litoria fallax</i>	eastern sedgefrog		C		20
animals	amphibians	Hylidae	<i>Litoria nasuta</i>	striped rocketfrog		C		9
animals	amphibians	Limnodynastidae	<i>Limnodynastes peronii</i>	striped marshfrog		C		9
animals	amphibians	Limnodynastidae	<i>Limnodynastes tasmaniensis</i>	spotted grassfrog		C		17
animals	amphibians	Limnodynastidae	<i>Limnodynastes fletcheri</i>	barking frog		C		1
animals	amphibians	Limnodynastidae	<i>Platyplectrum ornatum</i>	ornate burrowing frog		C		21/1
animals	amphibians	Limnodynastidae	<i>Limnodynastes terraereginae</i>	scarlet sided pobblebonk		C		15
animals	amphibians	Limnodynastidae	<i>Limnodynastes salmini</i>	salmon striped frog		C		3
animals	amphibians	Myobatrachidae	<i>Pseudophryne raveni</i>	copper backed broodfrog		C		3/2
animals	amphibians	Myobatrachidae	<i>Pseudophryne major</i>	great brown broodfrog		C		13/2
animals	amphibians	Myobatrachidae	<i>Crinia deserticola</i>	chirping froglet		C		3
animals	amphibians	Myobatrachidae	<i>Uperoleia rugosa</i>	chubby gungan		C		7
animals	amphibians	Myobatrachidae	<i>Acanthiza lineata</i>	striated thornbill		C		1
animals	birds	Acanthizidae	<i>Acanthiza pusilla</i>	brown thornbill		C		4
animals	birds	Acanthizidae	<i>Gerygone olivacea</i>	white-throated gerygone		C		9
animals	birds	Acanthizidae	<i>Gerygone levigaster</i>	mangrove gerygone		C		8
animals	birds	Acanthizidae	<i>Gerygone palpebrosa</i>	fairy gerygone		C		10
animals	birds	Acanthizidae	<i>Sericornis frontalis</i>	white-browed scrubwren		C		9
animals	birds	Acanthizidae	<i>Smicrornis brevirostris</i>	weebill		C		12
animals	birds	Acanthizidae	<i>Acanthiza nana</i>	yellow thornbill		C		3
animals	birds	Accipitridae	<i>Aviceda subcristata</i>	Pacific baza		C		14
animals	birds	Accipitridae	<i>Aquila audax</i>	wedge-tailed eagle		C		12
animals	birds	Accipitridae	<i>Milvus migrans</i>	black kite		C		16
animals	birds	Accipitridae	<i>Haliaeetus leucogaster</i>	brahminy kite		C		53/1
animals	birds	Accipitridae	<i>Haliaeetus indus</i>	spotted harrier		C		1
animals	birds	Accipitridae	<i>Circus assimilis</i>	black-shouldered kite		C		2
animals	birds	Accipitridae	<i>Elanus axillaris</i>	eastern osprey		C		24
animals	birds	Accipitridae	<i>Pandion cristatus</i>	square-tailed kite		SL		6
animals	birds	Accipitridae	<i>Lophoictinia isura</i>	brown goshawk		C		7
animals	birds	Accipitridae	<i>Accipiter fasciatus</i>	whistling kite		C		50
animals	birds	Accipitridae	<i>Haliaeetus leucogaster</i>	white-bellied sea-eagle		C		29
animals	birds	Accipitridae	<i>Hieraetus morphnoides</i>	little eagle		C		1
animals	birds	Accipitridae	<i>Accipiter cirrocephalus</i>	collared sparrowhawk		C		4
animals	birds	Accipitridae	<i>Accipiter novaehollandiae</i>	grey goshawk		C		5
animals	birds	Acrocephalidae	<i>Acrocephalus australis</i>	Australian reed-warbler		C		4
animals	birds	Aegothelidae	<i>Aegothales cristatus</i>	Australian owl-nightjar		C		23

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	birds	Alaudidae	<i>Mirafra javanica</i>	Horsfield's bushlark		C		2
animals	birds	Alcedinidae	<i>Ceyx azureus</i>	azure kingfisher		C		3
animals	birds	Anatidae	<i>Chenonetta jubata</i>	Australian wood duck		C		35
animals	birds	Anatidae	<i>Anas castanea</i>	chestnut teal		C		9
animals	birds	Anatidae	<i>Anas gracilis</i>	grey teal		C		11
animals	birds	Anatidae	<i>Cygnus atratus</i>	black swan		C		18
animals	birds	Anatidae	<i>Nettion coromandelianus</i>	cotton pygmy-goose		C		9
animals	birds	Anatidae	<i>Dendrocygna arcuata</i>	wandering whistling-duck		C		13
animals	birds	Anatidae	<i>Anas superciliosa</i>	Pacific black duck		C		56
animals	birds	Anatidae	<i>Aythya australis</i>	hardhead		C		23
animals	birds	Anatidae	<i>Dendrocygna eytoni</i>	plumed whistling-duck		C		6
animals	birds	Anatidae	<i>Tadorna radjah</i>	radjah shelduck		C		5
animals	birds	Anatidae	<i>Anas rhyncchotis</i>	Australasian shoveler		C		1
animals	birds	Anhingaidae	<i>Anhinga novae-hollandiae</i>	Australasian darter		C		47
animals	birds	Anseranatidae	<i>Anseranas semipalmata</i>	magpie goose		C		15
animals	birds	Apodidae	<i>Apus pacificus</i>	fork-tailed swift		SL		1
animals	birds	Apodidae	<i>Hirundapus caudacutus</i>	white-throated needletail		SL		3
animals	birds	Apodidae	<i>Aerodramus terraereginae</i>	Australian swiftlet		C		1
animals	birds	Ardeidae	<i>Ardea alba modesta</i>	eastern great egret		C		47
animals	birds	Ardeidae	<i>Ardea ibis</i>	cattle egret		C		2
animals	birds	Ardeidae	<i>Egretta sacra</i>	eastern reef egret		C		23/4
animals	birds	Ardeidae	<i>Ardea pacifica</i>	white-necked heron		C		6
animals	birds	Ardeidae	<i>Ardea intermedia</i>	intermediate egret		C		16
animals	birds	Ardeidae	<i>Egretta garzetta</i>	little egret		C		66
animals	birds	Ardeidae	<i>Butorides striata</i>	striated heron		C		58
animals	birds	Ardeidae	<i>Ixobrychus dubius</i>	Australian little bittern		C		1
animals	birds	Ardeidae	<i>Egretta novae-hollandiae</i>	white-faced heron		C		52
animals	birds	Ardeidae	<i>Nycticorax caledonicus</i>	nankeen night-heron		C		7
animals	birds	Ardeidae	<i>Ixobrychus flavicollis</i>	black bittern		C		3
animals	birds	Artamidae	<i>Cracticus torquatus</i>	grey butcherbird		C		22
animals	birds	Artamidae	<i>Cracticus nigrogularis</i>	pled butcherbird		C		42
animals	birds	Artamidae	<i>Artamus leucorhynchus</i>	white-breasted woodswallow		C		21
animals	birds	Artamidae	<i>Strepera graculina graculina</i>	pled currawong (eastern Australia)		C		1
animals	birds	Artamidae	<i>Artamus cinereus</i>	black-faced woodswallow		C		3
animals	birds	Artamidae	<i>Cracticus tibicen</i>	Australian magpie		C		96
animals	birds	Artamidae	<i>Strepera graculina</i>	pled currawong		C		14
animals	birds	Artamidae	<i>Artamus cyanopterus</i>	dusky woodswallow		C		2
animals	birds	Burhinidae	<i>Esacus magnirostris</i>	beach stone-curlew		V		23
animals	birds	Burhinidae	<i>Burhinus grallarius</i>	bush stone-curlew		C		10
animals	birds	Cacatuidae	<i>Cacatua galerita</i>	sulphur-crested cockatoo		C		20
animals	birds	Cacatuidae	<i>Eolophus roseicapillus</i>	galah		C		21
animals	birds	Cacatuidae	<i>Calyptorhynchus banksii banksii</i>	red-tailed black-cockatoo		C		2
animals	birds	Cacatuidae	<i>Calyptorhynchus funereus</i>	(Cape York & Eastern Aust)		C		1
animals	birds	Cacatuidae	<i>Calyptorhynchus banksii</i>	yellow-tailed black-cockatoo		C		23
animals	birds	Campephagidae	<i>Lalage leucomela</i>	red-tailed black-cockatoo varied triller		C		20

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	birds	Campephagidae	<i>Coracina papuensis</i>	white-bellied cuckoo-shrike		C		19
animals	birds	Campephagidae	<i>Coracina tenuirostris</i>	cicadabird		C		19
animals	birds	Campephagidae	<i>Coracina novaehollandiae</i>	black-faced cuckoo-shrike		C		57
animals	birds	Campephagidae	<i>Lalage tricolor</i>	white-winged triller		C		1
animals	birds	Caprimulgidae	<i>Caprimulgus macrurus</i>	large-tailed nightjar		C		10
animals	birds	Casuariidae	<i>Dromaius novaehollandiae</i>	emu		C		3
animals	birds	Charadriidae	<i>Vanellus miles</i>	masked lapwing		C		30
animals	birds	Charadriidae	<i>Charadrius leschenaultii</i>	greater sand plover		SL	V	1
animals	birds	Charadriidae	<i>Charadrius mongolus</i>	lesser sand plover		SL	E	14
animals	birds	Charadriidae	<i>Vanellus miles novaehollandiae</i>	masked lapwing (southern subspecies)		C		27
animals	birds	Charadriidae	<i>Pluvialis fulva</i>	Pacific golden plover		SL		6
animals	birds	Charadriidae	<i>Charadrius ruficapillus</i>	red-capped plover		C		39
animals	birds	Charadriidae	<i>Pluvialis squatarola</i>	grey plover		SL		3
animals	birds	Charadriidae	<i>Charadrius bicinctus</i>	double-banded plover		SL		1
animals	birds	Charadriidae	<i>Charadrius melanopus</i>	black-fronted dotterel		C		7
animals	birds	Charadriidae	<i>Euseyornis melanops</i>	black-necked stork		C		3
animals	birds	Ciconiidae	<i>Ephippiorhynchus asiaticus</i>	golden-headed cisticola		C		18
animals	birds	Cisticolidae	<i>Cisticola exilis</i>	white-throated treecreeper (southern)		C		5
animals	birds	Climacteridae	<i>Cormobates leucophaea metastasis</i>	brown treecreeper		C		3
animals	birds	Climacteridae	<i>Climacteris picumnus</i>	rose-crowned fruit-dove		C		5
animals	birds	Columbidae	<i>Ptilinopus regina</i>	peaceful dove		C		61
animals	birds	Columbidae	<i>Geopelia striata</i>	crested pigeon		C		27
animals	birds	Columbidae	<i>Ocyphaps lophotes</i>	common bronzewing		C		5
animals	birds	Columbidae	<i>Phaps chalcoptera</i>	diamond dove		C		1
animals	birds	Columbidae	<i>Geopelia cuneata</i>	rock dove	Y			8
animals	birds	Columbidae	<i>Columba livia</i>	emerald dove		C		4
animals	birds	Columbidae	<i>Chalcophaps indica</i>	bar-shouldered dove		C		50
animals	birds	Columbidae	<i>Geopelia humeralis</i>	brown cuckoo-dove		C		4
animals	birds	Columbidae	<i>Macropygia amboinensis</i>	spotted dove	Y			4
animals	birds	Columbidae	<i>Streptopelia chinensis</i>	wonga pigeon		C		2
animals	birds	Columbidae	<i>Leucosarcia melanoleuca</i>	topknot pigeon		C		1
animals	birds	Columbidae	<i>Lopholaimus antarcticus</i>	squatter pigeon (southern subspecies)		V	V	26
animals	birds	Columbidae	<i>Geophaps scripta scripta</i>	dollarbird		C		24
animals	birds	Coraciidae	<i>Eurystomus orientalis</i>	white-winged chough		C		18
animals	birds	Corcoracidae	<i>Corcorax melanorhamphos</i>	Torresian crow		C		98
animals	birds	Corvidae	<i>Corvus orru</i>	Australian raven		C		3
animals	birds	Corvidae	<i>Corvus coronoides</i>	Horsfield's bronze-cuckoo		C		4
animals	birds	Cuculidae	<i>Chalcites basalis</i>	oriental cuckoo		SL		1
animals	birds	Cuculidae	<i>Cuculus optatus</i>	shining bronze-cuckoo		C		3
animals	birds	Cuculidae	<i>Chalcites lucidus</i>	eastern koel		C		24
animals	birds	Cuculidae	<i>Eudynamys orientalis</i>	pallid cuckoo		C		3/1
animals	birds	Cuculidae	<i>Cacomantis pallidus</i>	little bronze-cuckoo		C		3
animals	birds	Cuculidae	<i>Chalcites minutillus barmardi</i>	channel-billed cuckoo		C		32
animals	birds	Cuculidae	<i>Scythrops novaehollandiae</i>	fan-tailed cuckoo		C		13/2
animals	birds	Cuculidae	<i>Cacomantis flabelliformis</i>	pheasant coucal		C		37
animals	birds	Cuculidae	<i>Centropus phasianinus</i>	brush cuckoo		C		7
animals	birds	Cuculidae	<i>Cacomantis variolosus</i>					

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	birds	Dicruridae	<i>Dicrurus bracteatus bracteatus</i>	spangled drongo (eastern Australia)		C		2
animals	birds	Dicruridae	<i>Dicrurus bracteatus</i>	spangled drongo		C		54
animals	birds	Estrilidae	<i>Lonchura punctulata</i>	nutmeg mannikin	Y			4
animals	birds	Estrilidae	<i>Taeniopygia bichenovii</i>	double-barred finch		C		30
animals	birds	Estrilidae	<i>Lonchura castaneothorax</i>	chestnut-breasted mannikin		C		7
animals	birds	Estrilidae	<i>Taeniopygia guttata</i>	zebra finch		C		2
animals	birds	Eurostopodidae	<i>Eurostopodus mystacalis</i>	white-throated nightjar		C		7
animals	birds	Falconidae	<i>Falco cenchroides</i>	nankeen kestrel		C		16
animals	birds	Falconidae	<i>Falco peregrinus</i>	peregrine falcon		C		2
animals	birds	Falconidae	<i>Falco berigora</i>	brown falcon		C		4
animals	birds	Falconidae	<i>Falco longipennis</i>	Australian hobby		C		2
animals	birds	Fregatidae	<i>Fregata ariel</i>	lesser frigatebird		SL		1
animals	birds	Gruidae	<i>Grus rubicunda</i>	brolga		C		6
animals	birds	Haematopodidae	<i>Haematopus longirostris</i>	Australian pied oystercatcher		C		64
animals	birds	Haematopodidae	<i>Haematopus fuliginosus</i>	sooty oystercatcher		C		7/1
animals	birds	Halcyonidae	<i>Todiramphus sordidus</i>	Torresian kingfisher		C		16
animals	birds	Halcyonidae	<i>Todiramphus sanctus</i>	sacred kingfisher		C		20
animals	birds	Halcyonidae	<i>Dacelo novaeguineae</i>	laughing kookaburra		C		82
animals	birds	Halcyonidae	<i>Dacelo leachii</i>	blue-winged kookaburra		C		24
animals	birds	Halcyonidae	<i>Todiramphus macleayii</i>	forest kingfisher		C		36
animals	birds	Hirundinidae	<i>Hirundo neoxena</i>	welcome swallow		C		59
animals	birds	Hirundinidae	<i>Petrochelidon ariel</i>	fairy martin		C		13
animals	birds	Hirundinidae	<i>Petrochelidon nigricans</i>	tree martin	Y	C		8
animals	birds	Hirundinidae	<i>Irediparra gallinacea</i>	comb-crested jacana		C		15
animals	birds	Jacaniidae	<i>Chlidonias hybrida</i>	whiskered tern		C		2
animals	birds	Laridae	<i>Thalasseus bergii</i>	crested tern		SL		41
animals	birds	Laridae	<i>Larus dominicanus</i>	kelp gull		C		1
animals	birds	Laridae	<i>Anous minutus</i>	black noddy		C		2
animals	birds	Laridae	<i>Chlidonias leucopterus</i>	white-winged black tern		SL		1
animals	birds	Laridae	<i>Hydroprogne caspia</i>	Caspian tern		SL		46
animals	birds	Laridae	<i>Chroicocephalus novaehollandiae</i>	silver gull		C		81/1
animals	birds	Laridae	<i>Thalasseus bengalensis</i>	lesser crested tern		C		5
animals	birds	Laridae	<i>Gelochelidon nilotica</i>	gull-billed tern		SL		44
animals	birds	Laridae	<i>Sterna albigrons</i>	little tern		SL		10
animals	birds	Maluridae	<i>Malurus melanocephalus</i>	red-backed fairy-wren		C		46/2
animals	birds	Maluridae	<i>Malurus lamberti</i>	variegated fairy-wren		C		4
animals	birds	Megaluridae	<i>Megalurus timoriensis</i>	tawny grassbird		C		7
animals	birds	Megapodiidae	<i>Alectura lathamii</i>	Australian brush-turkey		C		19
animals	birds	Megapodiidae	<i>Megapodius reinwardt</i>	orange-footed scrubfowl		C		1
animals	birds	Meliphagidae	<i>Philemon citreogularis</i>	little friarbird		C		33
animals	birds	Meliphagidae	<i>Myzomela sanguinolenta</i>	scarlet honeyeater		C		22
animals	birds	Meliphagidae	<i>Acanthagenys rufogularis</i>	spiny-cheeked honeyeater		C		1
animals	birds	Meliphagidae	<i>Melithreptus albogularis</i>	white-throated honeyeater		C		67
animals	birds	Meliphagidae	<i>Plectorhyncha lanceolata</i>	striped honeyeater		C		2
animals	birds	Meliphagidae	<i>Gavicalis fasciogularis</i>	mangrove honeyeater		C		23
animals	birds	Meliphagidae	<i>Myzomela obscura</i>	dusky honeyeater		C		14

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	birds	Meliphagidae	<i>Meliphaga lewinii</i>	Lewin's honeyeater		C		32
animals	birds	Meliphagidae	<i>Caligavis chrysops</i>	yellow-faced honeyeater		C		4
animals	birds	Meliphagidae	<i>Entomyzon cyanotis</i>	blue-faced honeyeater		C		52
animals	birds	Meliphagidae	<i>Phylidonyris niger</i>	white-cheeked honeyeater		C		1
animals	birds	Meliphagidae	<i>Gavicalis virescens</i>	singing honeyeater		C		2
animals	birds	Meliphagidae	<i>Lichmera indistincta</i>	brown honeyeater		C		58
animals	birds	Meliphagidae	<i>Melithreptus gularis</i>	black-chinned honeyeater		C		3
animals	birds	Meliphagidae	<i>Melithreptus lunatus</i>	white-naped honeyeater		C		4
animals	birds	Meliphagidae	<i>Nesoptilotis leucotis</i>	white-eared honeyeater		C		2
animals	birds	Meliphagidae	<i>Philemon corniculatus</i>	noisy friarbird		C		61
animals	birds	Meliphagidae	<i>Lichenostomus melanops</i>	yellow-tufted honeyeater		C		2
animals	birds	Meliphagidae	<i>Manorina melanocephala</i>	noisy miner		C		41
animals	birds	Meropidae	<i>Merops ornatus</i>	rainbow bee-eater		C		47
animals	birds	Monarchidae	<i>Monarcha melanopsis</i>	black-faced monarch		SL		6
animals	birds	Monarchidae	<i>Symphysichrus trivirgatus</i>	spectacled monarch		SL		10
animals	birds	Monarchidae	<i>Carteromys leucotis</i>	white-eared monarch		C		3
animals	birds	Monarchidae	<i>Myiagra alecto</i>	shining flycatcher		C		3
animals	birds	Monarchidae	<i>Grallina cyanoleuca</i>	magpie-lark		C		51
animals	birds	Monarchidae	<i>Myiagra cyanoleuca</i>	satin flycatcher		SL		6
animals	birds	Monarchidae	<i>Myiagra rubecula</i>	leaden flycatcher		C		35
animals	birds	Monarchidae	<i>Myiagra inquieta</i>	restless flycatcher		C		3
animals	birds	Motacillidae	<i>Anthus novaeseelandiae</i>	Australasian pipit		C		17
animals	birds	Nectariniidae	<i>Nectarinia jugularis</i>	olive-backed sunbird		C		4
animals	birds	Nectariniidae	<i>Dicaeum hirundinaceum</i>	mistletoebird		C		41
animals	birds	Neosittidae	<i>Daphoenositta chrysoptera</i>	varied sittella		C		5/1
animals	birds	Oriolidae	<i>Oriolus sagittatus</i>	olive-backed oriole		C		19
animals	birds	Oriolidae	<i>Sphecotheres vieilloti</i>	Australasian figbird		C		49
animals	birds	Otididae	<i>Ardeotis australis</i>	Australian bustard		C		5
animals	birds	Pachycephalidae	<i>Pachycephala pectoralis</i>	golden whistler		C		6
animals	birds	Pachycephalidae	<i>Pachycephala rufiventris</i>	rufous whistler		C		32
animals	birds	Pachycephalidae	<i>Colluricincla megarrhyncha</i>	little shrike-thrush		C		18
animals	birds	Pachycephalidae	<i>Colluricincla harmonica</i>	grey shrike-thrush		C		25
animals	birds	Paradisaeidae	<i>Ptiloris paradiseus</i>	paradise riflebird		C		1
animals	birds	Pardalotidae	<i>Pardalotus punctatus</i>	spotted pardalote		C		6
animals	birds	Pardalotidae	<i>Pardalotus striatus</i>	striated pardalote		C		51
animals	birds	Passeridae	<i>Passer domesticus</i>	house sparrow	Y	C		14
animals	birds	Pelecanidae	<i>Pelecanus conspicillatus</i>	Australian pelican		C		41
animals	birds	Petroicidae	<i>Microeca fascians</i>	jacky winter		C		1
animals	birds	Petroicidae	<i>Petroica goodenovii</i>	red-capped robin		C		1
animals	birds	Petroicidae	<i>Eopsaltria australis</i>	eastern yellow robin		C		3
animals	birds	Petroicidae	<i>Petroica rosea</i>	rose robin		C		1
animals	birds	Phalacrocoracidae	<i>Phalacrocorax sulcirostris</i>	little black cormorant		C		25
animals	birds	Phalacrocoracidae	<i>Microcarbo melanoleucos</i>	little pied cormorant		C		41
animals	birds	Phalacrocoracidae	<i>Phalacrocorax varius</i>	pied cormorant		C		33
animals	birds	Phalacrocoracidae	<i>Phalacrocorax carbo</i>	great cormorant		C		4
animals	birds	Phasianidae	<i>Coturnix ypsilophora</i>	brown quail		C		10

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animals	birds	Phasianidae	<i>Coturnix pectoralis</i>	stubble quail	C			2
animals	birds	Pittidae	<i>Pitta versicolor</i>	noisy pitta	C			1
animals	birds	Podargidae	<i>Podargus strigoides</i>	tawny frogmouth	C			30
animals	birds	Tachybaptidae	<i>Tachybaptus novaehollandiae</i>	Australasian grebe	C			19
animals	birds	Podicipedidae	<i>Poliiocephalus poliocephalus</i>	hoary-headed grebe	C			2
animals	birds	Pomatostomidae	<i>Pomatostomus temporalis</i>	grey-crowned babbler	C			19
animals	birds	Procellariidae	<i>Ardenna pacifica</i>	wedge-tailed shearwater	SL			1
animals	birds	Psittacidae	<i>Trichoglossus haematodus moluccanus</i>	rainbow lorikeet	C			96
animals	birds	Psittacidae	<i>Aprornis erythropterus</i>	red-winged parrot	C			9
animals	birds	Psittacidae	<i>Trichoglossus chloroleptoides</i>	scaly-breasted lorikeet	C			49
animals	birds	Psittacidae	<i>Platyercus adscitus</i>	pale-headed rosella	C			42
animals	birds	Psittacidae	<i>Alisterus scapularis</i>	Australian king-parrot	C			12
animals	birds	Psittacidae	<i>Parvipsitta pusilla</i>	little lorikeet	C			12
animals	birds	Psittacidae	<i>Platyercus adscitus palliceps</i>	pale-headed rosella (southern form)	C			4
animals	birds	Psittacidae	<i>Glossopsitta concinna</i>	musk lorikeet	C			1
animals	birds	Psittacidae	<i>Psophodes olivaceus</i>	eastern whiplbird	C			2
animals	birds	Rallidae	<i>Gallinula tenebrosa</i>	dusky moorhen	C			29
animals	birds	Rallidae	<i>Tribonyx ventralis</i>	black-tailed native-hen	C			2
animals	birds	Rallidae	<i>Lewinia pectoralis</i>	Lewin's rail	C			1
animals	birds	Rallidae	<i>Porphyrion melanotus</i>	purple swamphen	C			27
animals	birds	Rallidae	<i>Fulica atra</i>	Eurasian coot	C			12
animals	birds	Recurvirostridae	<i>Recurvirostra novaehollandiae</i>	red-necked avocet	C			2
animals	birds	Recurvirostridae	<i>Himantopus himantopus</i>	black-winged stilt	C			10
animals	birds	Rhipiduridae	<i>Rhipidura leucophrys</i>	willie wagtail	C			43
animals	birds	Rhipiduridae	<i>Rhipidura rufifrons</i>	rufous fantail	SL			15
animals	birds	Rhipiduridae	<i>Rhipidura albiscapa</i>	grey fantail	C			27
animals	birds	Rhipiduridae	<i>Rhipidura leucophrys leucophrys</i>	willie wagtail (southern)	C			1
animals	birds	Scolopacidae	<i>Limosa sp.</i>	sanderling	SL			1
animals	birds	Scolopacidae	<i>Calidris alba</i>	eastern curlew	V	CE		100
animals	birds	Scolopacidae	<i>Numenius madagascariensis</i>	Western Alaskan bar-tailed godwit	SL	V		61
animals	birds	Scolopacidae	<i>Limosa lapponica baueri</i>	great knot	SL	CE		6
animals	birds	Scolopacidae	<i>Calidris tenuirostris</i>	wandering tattler	SL			2
animals	birds	Scolopacidae	<i>Tringa incana</i>	terek sandpiper	SL			28/1
animals	birds	Scolopacidae	<i>Xenus cinereus</i>	grey-tailed tattler	SL			80
animals	birds	Scolopacidae	<i>Tringa brevipes</i>	red knot	SL	E		1
animals	birds	Scolopacidae	<i>Calidris canutus</i>	common greenshank	SL			1
animals	birds	Scolopacidae	<i>Heteroscelus sp.</i>	whimbrel	SL			10
animals	birds	Scolopacidae	<i>Tringa nebularia</i>	common sandpiper	SL			123
animals	birds	Scolopacidae	<i>Numenius phaeopus</i>	ruddy turnstone	SL			4
animals	birds	Scolopacidae	<i>Actitis hypoleucos</i>	sharp-tailed sandpiper	SL			3
animals	birds	Scolopacidae	<i>Arenaria interpres</i>	marsh sandpiper	SL			5
animals	birds	Scolopacidae	<i>Calidris acuminata</i>	curlew sandpiper	SL			3
animals	birds	Scolopacidae	<i>Tringa stagnatilis</i>	red-necked stint	SL	CE		7
animals	birds	Scolopacidae	<i>Calidris ferruginea</i>	broad-billed sandpiper	SL			18
animals	birds	Scolopacidae	<i>Calidris ruficollis</i>		SL			1
animals	birds	Scolopacidae	<i>Limicola falcinellus</i>		SL			1

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animals	birds	Strigidae	<i>Ninox boobook</i>	southern boobook		C		30
animals	birds	Strigidae	<i>Ninox connivens</i>	barking owl		C		5
animals	birds	Strigidae	<i>Ninox strenua</i>	powerful owl		V		7
animals	birds	Sulidae	<i>Sula leucogaster</i>	brown booby		SL		3/1
animals	birds	Threskiornithidae	<i>Platalea regia</i>	royal spoonbill		C		14
animals	birds	Threskiornithidae	<i>Platalea flavipes</i>	yellow-billed spoonbill		C		3
animals	birds	Threskiornithidae	<i>Plegadis falcinellus</i>	glossy ibis		SL		3
animals	birds	Threskiornithidae	<i>Threskiornis molucca</i>	Australian white ibis		C		26
animals	birds	Timaliidae	<i>Threskiornis spinicollis</i>	straw-necked ibis		C		17
animals	birds	Timaliidae	<i>Zosterops lateralis</i>	silveryeye		C		15
animals	birds	Timaliidae	<i>Zosterops lateralis cornwalli</i>	silveryeye (eastern)		C		1
animals	birds	Turnicidae	<i>Zosterops lateralis</i>	painted button-quail		C		4
animals	birds	Turnicidae	<i>Turnix varius</i>	red-backed button-quail		C		3
animals	birds	Turnicidae	<i>Turnix maculosus</i>	black-breasted button-quail		V	V	12
animals	birds	Turnicidae	<i>Turnix melanogaster</i>	estuary stingray		NT		1
animals	birds	Turnicidae	<i>Hemitygon fluviatorum</i>	purple oak-blue				2
cartilaginous fishes		Dasyatidae	<i>Arhopala eupolis</i>	small dusky-blue				2
animals	insects	Lycanidae	<i>Candalaria erinus erinus</i>	glasswing				1
animals	insects	Lycanidae	<i>Acraea andromacha andromacha</i>	small dusky-blue				1
animals	insects	Nymphalidae	<i>Euploea tulliolus tulliolus</i>	purple crow				2
animals	insects	Nymphalidae	<i>Junonia orithya albicincta</i>	blue argus				1
animals	insects	Nymphalidae	<i>Danaus plexippus plexippus</i>	monarch				2
animals	insects	Nymphalidae	<i>Cupha prosopis</i>	common crow				1
animals	insects	Nymphalidae	<i>Euploea core corinna</i>	common evening-brown				1
animals	insects	Nymphalidae	<i>Melanitis leda bankia</i>	marsh tiger				3
animals	insects	Nymphalidae	<i>Danaus affinis affinis</i>	meadow argus				2
animals	insects	Nymphalidae	<i>Junonia villida calybe</i>	blue tiger				1
animals	insects	Nymphalidae	<i>Tirumala hamata hamata</i>	varied eggfly				3
animals	insects	Nymphalidae	<i>Hypolimnas bolina nerina</i>	orange ringlet				2
animals	insects	Nymphalidae	<i>Hypocysta atlante atlante</i>	tailed emperor				1
animals	insects	Nymphalidae	<i>Polyura sempronius sempronius</i>	white-banded plane (southern subspecies)				1
animals	insects	Nymphalidae	<i>Phaedyma shepherdi shepherdi</i>	orchard swallowtail (Australian subspecies)				1
animals	insects	Papilionidae	<i>Papilio aegaeus</i>	yellow albatross				2
animals	insects	Papilionidae	<i>Papilio aegaeus aegaeus</i>	small grass-yellow				1
animals	insects	Pieridae	<i>Appias paulina ego</i>	large grass-yellow				2
animals	insects	Pieridae	<i>Cepora perimale</i>	caper white				2
animals	insects	Pieridae	<i>Eurema smilax</i>	scarlet jezebel				1
animals	insects	Pieridae	<i>Eurema hecabe</i>	European cattle				6
animals	insects	Pieridae	<i>Belenois java teutonia</i>	red fox		Y		1
animals	insects	Pieridae	<i>Delias argenthona argenthona</i>	dingo		Y		3
animals	mammals	Bovidae	<i>Bos taurus</i>	dog				4
animals	mammals	Bovidae	<i>Vulpes vulpes</i>	common planigale			C	6
animals	mammals	Canidae	<i>Canis lupus dingo</i>					11
animals	mammals	Canidae	<i>Canis lupus familiaris</i>					
animals	mammals	Dasyuridae	<i>Planigale maculata</i>					

Kingdom Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	Dasyuridae	<i>Smynthopsis murina</i>	common dunnart		C		3
animals	Dasyuridae	<i>Dasyurus hallucatus</i>	northern quoll		C	E	2
animals	Delphinidae	<i>Tursiops aduncus</i>	Indo-Pacific bottlenose dolphin		C		2
animals	Delphinidae	<i>Sousa sahulensis</i>	Australian humpback dolphin		V		7
animals	Dugongidae	<i>Dugong dugon</i>	dugong		V		3
animals	Emballonuridae	<i>Saccolaimus flaviventris</i>	yellow-bellied sheath-tail bat		C		16
animals	Emballonuridae	<i>Taphozous troughtoni</i>	Troughton's sheath-tail bat		C		9
animals	Emballonuridae	<i>Taphozous australis</i>	coastal sheath-tail bat		NT		3
animals	Equidae	<i>Equus caballus</i>	horse	Y			3
animals	Felidae	<i>Felis catus</i>	cat	Y			4
animals	Felidae	<i>Lepus europaeus</i>	European brown hare	Y			6
animals	Leporidae	<i>Oryctolagus cuniculus</i>	rabbit	Y			11
animals	Leporidae	<i>Macropus agilis</i>	agile wallaby		C		6
animals	Macropodidae	<i>Macropus sp.</i>					2
animals	Macropodidae	<i>Macropus dorsalis</i>	black-striped wallaby		C		1
animals	Macropodidae	<i>Macropus robustus</i>	common wallaroo		C		3
animals	Macropodidae	<i>Macropus giganteus</i>	eastern grey kangaroo		C		2
animals	Macropodidae	<i>Macropus parryi</i>	whiptail wallaby		C		37
animals	Macropodidae	<i>Petrogale herberti</i>	Herbert's rock-wallaby		C		23
animals	Macropodidae	<i>Wallabia bicolor</i>	swamp wallaby		C		1
animals	Macropodidae	<i>Thylogale thetis</i>	red-necked pademelon		C		20
animals	Macropodidae	<i>Macropus rufogriseus</i>	red-necked wallaby		C		1
animals	Macropodidae	<i>Thylogale stigmatica</i>	red-legged pademelon		C		2
animals	Macropodidae	<i>Miniopterus australis</i>	little bent-wing bat		C		1
animals	Miniopteridae	<i>Miniopterus schreibersii oceanensis</i>	eastern bent-wing bat		C		21
animals	Miniopteridae	<i>Tadarida australis</i>	white-striped freetail bat		C		12
animals	Molossidae	<i>Chaerephon jobensis</i>	northern freetail bat		C		9
animals	Molossidae	<i>Mormopterus lumsdenae</i>	northern free-tailed bat		C		7
animals	Molossidae	<i>Mormopterus norfolkensis</i>	east coast freetail bat		C		6
animals	Molossidae	<i>Mormopterus ridei</i>	east coast freetail bat		C		4
animals	Molossidae	<i>Mormopterus sp.</i>	eastern free-tailed bat		C		3
animals	Muridae	<i>Hydromys chrysogaster</i>	water rat		C		5
animals	Muridae	<i>Melomys cervinipes</i>	fawn-footed melomys		C		2
animals	Muridae	<i>Xeromys myoides</i>	water mouse		V	V	5
animals	Muridae	<i>Rattus fuscipes</i>	bush rat		C		12/1
animals	Muridae	<i>Melomys burtoni</i>	grassland melomys		C		1
animals	Muridae	<i>Rattus tunneyi</i>	pale field-rat		C		11
animals	Muridae	<i>Rattus rattus</i>	black rat	Y	C		1
animals	Muridae	<i>Mus musculus</i>	house mouse	Y	Y		3
animals	Muridae	<i>Melomys sp.</i>					14
animals	Peramelidae	<i>Perameles nasuta</i>	long-nosed bandicoot		C		1
animals	Peramelidae	<i>Isoodon macrourus</i>	northern brown bandicoot		C		1
animals	Petauridae	<i>Petaurus australis australis</i>	yellow-bellied glider (southern subspecies)		C		19
animals	Petauridae	<i>Petaurus norfolkensis</i>	squirrel glider		C		15/3

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animals	mammals	Petauridae	<i>Petaurus sp.</i>	sugar glider				1
animals	mammals	Petauridae	<i>Petaurus breviceps</i>	common brushtail possum	C			7
animals	mammals	Phalangeridae	<i>Trichosurus vulpecula</i>	koala	C			39
animals	mammals	Phalangeridae	<i>Phascogalea cinerea</i>	rufous bettong	V		V	4
animals	mammals	Potoridae	<i>Aepyprymnus rufescens</i>	common ringtail possum	C			13
animals	mammals	Pseudocheiridae	<i>Pseudocheirus peregrinus</i>	southern greater glider	C		V	2
animals	mammals	Pseudocheiridae	<i>Petaurides volans volans</i>	little red flying-fox	C			25
animals	mammals	Pteropodidae	<i>Pteropus scapulatus</i>	grey-headed flying-fox	C		V	4
animals	mammals	Pteropodidae	<i>Pteropus poliocephalus</i>	black flying-fox	C			6
animals	mammals	Pteropodidae	<i>Pteropus alecto</i>	pig	Y		C	13
animals	mammals	Suidae	<i>Sus scrofa</i>	short-beaked echidna		SL		3
animals	mammals	Tachyglossidae	<i>Tachyglossus aculeatus</i>	hoary wattled bat				10
animals	mammals	Vespertilionidae	<i>Chalinolobus nigrogriseus</i>	lesser long-eared bat	C			7
animals	mammals	Vespertilionidae	<i>Nyctophilus geoffroyi</i>	little forest bat	C			1
animals	mammals	Vespertilionidae	<i>Vespertilio vulturinus</i>	greater broad-nosed bat	C			1
animals	mammals	Vespertilionidae	<i>Scoteanax rueppellii</i>	little pied bat	C			6
animals	mammals	Vespertilionidae	<i>Chalinolobus picatus</i>	Gould's wattled bat	C			8
animals	mammals	Vespertilionidae	<i>Chalinolobus gouldii</i>	Gould's wattled bat	C			17
animals	mammals	Vespertilionidae	<i>Vespertilio pumilus</i>	eastern forest bat	C			4
animals	mammals	Vespertilionidae	<i>Scotorepens greyii</i>	little broad-nosed bat	C			14
animals	mammals	Vespertilionidae	<i>Nyctophilus gouldi</i>	Gould's long-eared bat	C			4
animals	mammals	Vespertilionidae	<i>Chalinolobus morio</i>	chocolate wattled bat	C			2
animals	mammals	Vespertilionidae	<i>Scotorepens orion</i>	south-eastern broad-nosed bat	C			8
animals	mammals	Vespertilionidae	<i>Nyctophilus bifax</i>	northern long-eared bat	C			2
animals	mammals	Vespertilionidae	<i>Scotorepens sp.</i>					2
animals	mammals	Vespertilionidae	<i>Nyctophilus sp.</i>					5
animals	mammals	Vespertilionidae	<i>Nyctophilus sp.</i>					1
animals	mammals	Vespertilionidae	<i>Myotis macropus</i>	large-footed myotis	C			1
animals	ray-finned fishes	Ambassidae	<i>Ambassis agassizii</i>	Agassiz's glassfish				26
animals	ray-finned fishes	Anguillidae	<i>Anguilla reinhardtii</i>	longfin eel				2
animals	ray-finned fishes	Apogonidae	<i>Glossamia aprion</i>	mouth almighty				9
animals	ray-finned fishes	Atherinidae	<i>Craterocephalus stercusmuscarum</i>	flyspecked hardyhead				16
animals	ray-finned fishes	Centropomidae	<i>Lates calcarifer</i>	barramundi				3
animals	ray-finned fishes	Clupeidae	<i>Nematalosa erebi</i>	bony bream				6
animals	ray-finned fishes	Eleotridae	<i>Hypseleotris species 1</i>	Midgley's carp gudgeon				2
animals	ray-finned fishes	Eleotridae	<i>Hypseleotris compressa</i>	empire gudgeon				17
animals	ray-finned fishes	Eleotridae	<i>Gobiomorphus australis</i>	striped gudgeon				2
animals	ray-finned fishes	Eleotridae	<i>Hypseleotris galli</i>	firetail gudgeon				6
animals	ray-finned fishes	Eleotridae	<i>Mogurnda adspersa</i>	southern purplespotted gudgeon				5
animals	ray-finned fishes	Hemiramphidae	<i>Arrhamphus sclerolepis</i>	snubnose garfish				2
animals	ray-finned fishes	Kuhliidae	<i>Kuhlia rupestris</i>	jungle perch				3
animals	ray-finned fishes	Lutjanidae	<i>Lutjanus argentimaculatus</i>	mangrove jack				1
animals	ray-finned fishes	Megalopidae	<i>Megalops cyprinoides</i>	oxeye herring				1
animals	ray-finned fishes	Melanotaeniidae	<i>Melanotaenia splendida splendida</i>	eastern rainbowfish				30
animals	ray-finned fishes	Monodactylidae	<i>Monodactylus argenteus</i>	diamondfish				1
animals	ray-finned fishes	Mugilidae	<i>Mugil cephalus</i>	sea mullet				11
animals	ray-finned fishes	Poeciliidae	<i>Poecilia reticulata</i>	guppy	Y			3

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animals	ray-finned fishes	Poeciliidae	<i>Gambusia holbrooki</i>	mosquitofish	Y			9
animals	ray-finned fishes	Pseudomugilidae	<i>Pseudomugil signifer</i>	Pacific blue eye				4
animals	ray-finned fishes	Scatophagidae	<i>Scatophagus argus</i>	spotted scat				1
animals	ray-finned fishes	Scatophagidae	<i>Selenotoca multifasciata</i>	striped scat				2
animals	ray-finned fishes	Terapontidae	<i>Leiopotherapon unicolor</i>	spangled perch				11
animals	ray-finned fishes	Terapontidae	<i>Terapon jarbua</i>	crested grunter				2
animals	ray-finned fishes	Terapontidae	<i>Amniataba percoides</i>	barred grunter				2
animals	reptiles	Agamidae	<i>Diporiphora australis</i>	tommy roundhead		C		6
animals	reptiles	Agamidae	<i>Pogona barbata</i>	bearded dragon		C		10
animals	reptiles	Agamidae	<i>Diporiphora nobbi</i>	nobbi		C		5
animals	reptiles	Agamidae	<i>Chlamydosaurus kingii</i>	frilled lizard		C		5
animals	reptiles	Boidae	<i>Antaresia maculosa</i>	spotted python		C		3
animals	reptiles	Boidae	<i>Morelia spilota</i>	carpet python		C		7
animals	reptiles	Boidae	<i>Aspides melanocephalus</i>	black-headed python		C		2
animals	reptiles	Chelidae	<i>Eiseya albagula</i>	southern snapping turtle		E	OE	1
animals	reptiles	Chelidae	<i>Wollumbinia latisternum</i>	saw-shelled turtle		C		2
animals	reptiles	Chelidae	<i>Emydura macquarii krefftii</i>	Kreff's river turtle		C		8
animals	reptiles	Chelidae	<i>Emydura sp.</i>					1
animals	reptiles	Cheloniidae	<i>Caretta caretta</i>	loggerhead turtle		E		1
animals	reptiles	Cheloniidae	<i>Natator depressus</i>	flatback turtle		V		5
animals	reptiles	Cheloniidae	<i>Chelonia mydas</i>	green turtle		V	V	5
animals	reptiles	Colubridae	<i>Dendrelaphis punctulatus</i>	green tree snake		C		36
animals	reptiles	Colubridae	<i>Boiga irregularis</i>	brown tree snake		C		5
animals	reptiles	Colubridae	<i>Tropidonophis mairii</i>	freshwater snake		C		9/1
animals	reptiles	Diplodactylidae	<i>Oedura monilis</i>	ocellated velvet gecko		C		4
animals	reptiles	Diplodactylidae	<i>Amalosa rhombifer</i>	zig-zag gecko		C		23
animals	reptiles	Diplodactylidae	<i>Diplodactylus vittatus</i>	wood gecko		C		11
animals	reptiles	Diplodactylidae	<i>Oedura tryoni</i>	southern spotted velvet gecko		C		4
animals	reptiles	Elapidae	<i>Hemiaspis signata</i>	black-bellied swamp snake		C		1
animals	reptiles	Elapidae	<i>Cryptophis nigrostriatus</i>	black-striped snake		C		1
animals	reptiles	Elapidae	<i>Pseudechis porphyriacus</i>	red-bellied black snake		C		2
animals	reptiles	Elapidae	<i>Oxyuranus scutellatus</i>	coastal taipan		C		4
animals	reptiles	Elapidae	<i>Hoplocephalus bitorquatus</i>	eastern small-eyed snake		C		3
animals	reptiles	Elapidae	<i>Furina diadema</i>	pale-headed snake		C		1
animals	reptiles	Elapidae	<i>Demansia torquata</i>	red-naped snake		C		8
animals	reptiles	Elapidae	<i>Hydrophis elegans</i>	collared whipsnake		C		1
animals	reptiles	Elapidae	<i>Cacophis harriettae</i>	elegant sea snake		C		1
animals	reptiles	Elapidae	<i>Cryptophis boschmai</i>	white-crowned snake		C		2
animals	reptiles	Elapidae	<i>Demansia psammophis</i>	Carpentaria whip snake		C		4/1
animals	reptiles	Elapidae	<i>Demansia vestigiata</i>	yellow-faced whipsnake		C		9
animals	reptiles	Elapidae	<i>Pseudonaja textilis</i>	lesser black whipsnake		C		7
animals	reptiles	Elapidae	<i>Vermicella annulata</i>	eastern brown snake		C		6
animals	reptiles	Gekkonidae	<i>Gehyra dubia</i>	bandy-bandy		C		9
animals	reptiles	Gekkonidae	<i>Gehyra catenata</i>	dubious dtella		C		20
animals	reptiles	Gekkonidae	<i>Heteronotia binoei</i>	chain-backed dtella		C		3
animals	reptiles	Gekkonidae		Bynoe's gecko		C		39

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animals	Pygopodidae	<i>Paradelma orientalis</i>	brigalow scaly-foot		C		1
animals	Pygopodidae	<i>Lialis burtonis</i>	Burton's legless lizard		C		10
animals	Scincidae	<i>Carlia schmeltzii</i>	robust rainbow-skink		C		46/4
animals	Scincidae	<i>Concinnia martini</i>	dark bar-sided skink		C		1
animals	Scincidae	<i>Bellatorias frerei</i>	major skink		C		1
animals	Scincidae	<i>Ctenotus spaldingi</i>	straight-browed ctenotus		C		4/1
animals	Scincidae	<i>Tiliqua scincoides</i>	eastern blue-tongued lizard		C		2
animals	Scincidae	<i>Glaphyromorphus sp.</i>	diamond-shielded sunskink		C		3
animals	Scincidae	<i>Lampropholis adonis</i>	tree-base litter-skink		C		62/4
animals	Scincidae	<i>Lygisaurus foliorum</i>	south-eastern morethia skink		C		1
animals	Scincidae	<i>Morethia boulengeri</i>	northern bar-sided skink		C		9
animals	Scincidae	<i>Concinnia brachysoma</i>	copper-tailed skink		C		17/1
animals	Scincidae	<i>Ctenotus taeniolatus</i>	three-clawed worm-skink		C		9
animals	Scincidae	<i>Anomalopus verreauxii</i>	dark-flecked garden sunskink		C		13
animals	Scincidae	<i>Lampropholis delicata</i>	fire-tailed skink		C		11/2
animals	Scincidae	<i>Morethia taeniopleura</i>	dwarf litter-skink		C		1
animals	Scincidae	<i>Pygmaeascincus timlowi</i>	pale-flecked garden sunskink		C		1
animals	Scincidae	<i>Lampropholis guichenoti</i>	cone-eared calyptotis		C		2
animals	Scincidae	<i>Calyptotis lepidorostrum</i>	pink-tongued lizard		C		2
animals	Scincidae	<i>Cyclodomorphus gerrardii</i>	Cooloola snake-skink		C		2
animals	Scincidae	<i>Ophioscincus cooloolensis</i>	fine-spotted mulch-skink		C		9
animals	Scincidae	<i>Glaphyromorphus punctulatus</i>			C		20/4
animals	Scincidae	<i>Carlia pectoralis sensu lato</i>			C		46
animals	Scincidae	<i>Cryptoblepharus virgatus sensu lato</i>			C		1/1
animals	Scincidae	<i>Cryptoblepharus plagiocephalus sensu lato</i>	shaded-litter rainbow-skink		C		21
animals	Scincidae	<i>Carlia munda</i>	tussock rainbow-skink		C		51/1
animals	Scincidae	<i>Carlia vivax</i>			C		1
animals	Scincidae	<i>Morethia sp.</i>	common dwarf skink		C		5/1
animals	Scincidae	<i>Menetia greyii</i>	bar-sided skink		C		7/1
animals	Scincidae	<i>Concinnia tenuis</i>	eastern water skink		C		9/5
animals	Scincidae	<i>Eulamprus quoyii</i>	eastern mulch slider		C		6
animals	Scincidae	<i>Lerista fragilis</i>	open-litter rainbow skink		C		1
animals	Scincidae	<i>Carlia pectoralis</i>	brown-snouted blind snake		C		6
animals	Typhlopidae	<i>Anilius wiedii</i>	claw-snouted blind snake		C		2
animals	Typhlopidae	<i>Anilius unguirostris</i>	rusty monitor		C		2
animals	Varanidae	<i>Varanus semiremex</i>	sand monitor		C		3
animals	Varanidae	<i>Varanus gouldii</i>	lace monitor		C		3
animals	Varanidae	<i>Varanus varius</i>	black-tailed monitor		C		7
animals	Varanidae	<i>Varanus tristis</i>	Unknown or Code Pending		C		1
fungi	Indeterminate	<i>Indeterminate</i>			C		1/1
fungi	Basidiomycota	<i>Loweporus tephroporus</i>			C		1/1
fungi	Basidiomycota	<i>Antrodia</i>	green-spored parasol		C		1/1
fungi	Basidiomycota	<i>Chlorophyllum molybdites</i>			C		1/1
fungi	Arthopyreniaceae	<i>Arthopyrenia cinereopruinosa</i>			C		1/1
fungi	Candelariaceae	<i>Candelaria concolor</i>			C		1/1
fungi	Coccocarpiaceae	<i>Coccocarpia palmicola</i>			C		2/2

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fungi	sac fungi	Haematommaceae	<i>Haematomma collatum</i>			C		1/1
fungi	sac fungi	Haematommaceae	<i>Haematomma africanum</i>			C		3/3
fungi	sac fungi	Haematommaceae	<i>Haematomma</i>			C		1/1
fungi	sac fungi	Lecanoraceae	<i>Lecanora achroa</i>			C		1/1
fungi	sac fungi	Lecanoraceae	<i>Protoparmelia australiensis</i>			C		1/1
fungi	sac fungi	Lecanoraceae	<i>Tephromela atra</i>			C		1/1
fungi	sac fungi	Lecanoraceae	<i>Lecanora</i>			C		1/1
fungi	sac fungi	Lichen	<i>Lichen</i>			C		1/1
fungi	sac fungi	Mycocaliciaceae	<i>Chaenothecopsis</i>			C		3/3
fungi	sac fungi	Parmeliaceae	<i>Parmotrema robustum</i>			C		1/1
fungi	sac fungi	Parmeliaceae	<i>Parmotrema</i>			C		1/1
fungi	sac fungi	Physciaceae	<i>Dirinaria picta</i>			C		1/1
fungi	sac fungi	Physciaceae	<i>Buellia</i>			C		1/1
fungi	sac fungi	Physciaceae	<i>Hyperphyscia adglutinata</i>			C		1/1
fungi	sac fungi	Physciaceae	<i>Dirinaria confluens</i>			C		1/1
fungi	sac fungi	Physciaceae	<i>Heterodermia obscurata</i>			C		4/4
fungi	sac fungi	Physciaceae	<i>Dirinaria flava</i>			C		1/1
fungi	sac fungi	Physciaceae	<i>Pyxine cocoes</i>			C		1/1
fungi	sac fungi	Physciaceae	<i>Pyxine australiensis</i>			C		1/1
fungi	sac fungi	Ramalinaceae	<i>Ramalina subfraxinea</i> var. <i>norstictica</i>			C		3/3
fungi	sac fungi	Ramalinaceae	<i>Ramalina inflata</i> subsp. <i>perpusilla</i>			C		9/9
fungi	sac fungi	Ramalinaceae	<i>Ramalina inflata</i> subsp. <i>inflata</i>			C		3/3
fungi	sac fungi	Ramalinaceae	<i>Ramalina confirmata</i>			C		1/1
fungi	sac fungi	Ramalinaceae	<i>Ramalina peruviana</i>			C		14/14
fungi	sac fungi	Ramalinaceae	<i>Ramalina nervulosa</i>			C		3/3
fungi	sac fungi	Ramalinaceae	<i>Ramalina pacifica</i>			C		8/8
fungi	sac fungi	Ramalinaceae	<i>Ramalina luciae</i>			C		5/5
fungi	sac fungi	Ramalinaceae	<i>Ramalina tenella</i>			C		8/8
fungi	sac fungi	Roccellaceae	<i>Roccella montagnei</i>			C		1/1
fungi	sac fungi	Teloschistaceae	<i>Teloschistes flavicans</i>			C		1/1
fungi	sac fungi	Usneaceae	<i>Usnea nidifica</i>			C		3/3
fungi	sac fungi	Usneaceae	<i>Usnea dasaea</i>			C		1/1
plants	conifers	Araucariaceae	<i>Araucaria cunninghamii</i>					1
plants	conifers	Pinaceae	<i>Pinus elliotii</i>		Y			1
plants	cycads	Cycadaceae	<i>Cycas megacarpa</i>			E	E	5/3
plants	cycads	Zamiaceae	<i>Macrozamia</i>			C		1
plants	cycads	Zamiaceae	<i>Macrozamia miquelii</i>			C		14/7
plants	ferns	Adiantaceae	<i>Pellaea nana</i>			C		5/1
plants	ferns	Adiantaceae	<i>Chellianthes distans</i>			C		1
plants	ferns	Adiantaceae	<i>Chellianthes sieberi</i>			C		20
plants	ferns	Adiantaceae	<i>Adiantum aethiopicum</i>			C		19
plants	ferns	Adiantaceae	<i>Adiantum hispidulum</i>			C		23
plants	ferns	Adiantaceae	<i>Pellaea falcata</i>			C		5
plants	ferns	Adiantaceae	<i>Adiantum hispidulum</i> var. <i>hypoglaucum</i>			C		1/1
plants	ferns	Adiantaceae	<i>Adiantum hispidulum</i> var. <i>hispidulum</i>			C		5/2
plants	ferns	Adiantaceae	<i>Chellianthes sieberi</i> subsp. <i>sieberi</i>			C		1/1

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plants	Adiantaceae	<i>Cheilanthes nudiuscula</i>			C		6/4
plants	Adiantaceae	<i>Doryopteris concolor</i>			C		8
plants	Adiantaceae	<i>Adiantum atroviride</i>			C		2/1
plants	Aspleniaceae	<i>Asplenium australasicum</i>			C		3/2
plants	Aspleniaceae	<i>Asplenium</i>			C		2
plants	Blechnaceae	<i>Blechnum orientale</i>	gristle fern		C		1/1
plants	Blechnaceae	<i>Blechnum cartilagineum</i>			C		1/1
plants	Cyatheaceae	<i>Cyathea australis</i>			C		2/2
plants	Davalliaceae	<i>Davallia pyxidata</i>			C		5/2
plants	Dennstaedtiaceae	<i>Pteridium esculentum</i>			C		2/1
plants	Dicksoniaceae	<i>Calochlaena dubia</i>	common bracken		C		2/1
plants	Dryopteridaceae	<i>Lastreopsis tenera</i>			C		2/1
plants	Gleicheniaceae	<i>Dicranopteris linearis</i>			C		1
plants	Gleicheniaceae	<i>Sticherus</i>			C		1
plants	Gleicheniaceae	<i>Sticherus flabellatus</i> var. <i>flabellatus</i>			C		2/2
plants	Lindsaeaceae	<i>Lindsaea ensifolia</i>			C		1
plants	Marsileaceae	<i>Marsilea crenata</i>			C		2/1
plants	Marsileaceae	<i>Marsilea mutica</i>	shiny nardoo		C		1
plants	Nephrolepidaceae	<i>Nephrolepis cordifolia</i>	fishbone fern		C		3
plants	Nephrolepidaceae	<i>Arthropteris tenella</i>	climbing fern		C		2/1
plants	Osmundaceae	<i>Todea barbara</i>	king fern		C		1/1
plants	Polypodiaceae	<i>Pyrrosia confluens</i>			C		1
plants	Polypodiaceae	<i>Pyrrosia rupestris</i>	rock felt fern		C		2
plants	Polypodiaceae	<i>Drynaria sparsisora</i>			C		8/2
plants	Polypodiaceae	<i>Microsorium punctatum</i>			C		13/1
plants	Polypodiaceae	<i>Platyserium bifurcatum</i>			C		1
plants	Polypodiaceae	<i>Pyrrosia confluens</i> var. <i>confluens</i>			C		2/2
plants	Polypodiaceae	<i>Drynaria rigidula</i>			C		4
plants	Pteridaceae	<i>Acrostichum speciosum</i>	mangrove fern		C		3/2
plants	Pteridaceae	<i>Pteris vittata</i>	Chinese bracken		C		1/1
plants	Salviniaceae	<i>Salvinia molesta</i>	salvinia	Y	C		1/1
plants	Schizaeaceae	<i>Schizaea bifida</i>	forked comb fern		C		3/2
plants	Schizaeaceae	<i>Lygodium flexuosum</i>			C		1
plants	Thelypteridaceae	<i>Cyclosorus interruptus</i>			C		2
plants	Acanthaceae	<i>Brunoniella</i>			C		1
plants	Acanthaceae	<i>Ruellia simplex</i>		Y	C		3/3
plants	Acanthaceae	<i>Brunoniella acaulis</i>			C		3/1
plants	Acanthaceae	<i>Brunoniella australis</i>	blue trumpet		C		20
plants	Acanthaceae	<i>Graptophyllum excelsum</i>			NT		10/1
plants	Acanthaceae	<i>Hygrophila angustifolia</i>			C		1
plants	Acanthaceae	<i>Rostellaria adscendens</i> var. <i>hispidula</i>			C		1/1
plants	Acanthaceae	<i>Hammeria hygrophiloides</i>	white karambal		C		2
plants	Acanthaceae	<i>Pseuderanthemum tenellum</i>			C		1/1
plants	Acanthaceae	<i>Rostellaria adscendens</i>			C		6
plants	Acanthaceae	<i>Pseuderanthemum variabile</i>	pastel flower		C		11
plants	Acanthaceae	<i>Brunoniella acaulis</i> subsp. <i>acaulis</i>			C		1/1

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plants	higher dicots	<i>Brunoniella acaulis</i> subsp. <i>ciliata</i>			C		1/1
plants	higher dicots	<i>Graptophyllum spinigerum</i>			C		5/2
plants	higher dicots	<i>Carpobrotus</i>					1
plants	higher dicots	<i>Tetragonia tetragonoides</i>	New Zealand spinach		C		2
plants	higher dicots	<i>Sesuvium portulacastrum</i>	sea purslane		C		8/2
plants	higher dicots	<i>Carpobrotus glaucescens</i>	pigface		C		3/2
plants	higher dicots	<i>Alternanthera</i>			C		1
plants	higher dicots	<i>Amaranthus</i>			C		1
plants	higher dicots	<i>Achyranthes aspera</i>	hairy joyweed		C		12/1
plants	higher dicots	<i>Alternanthera nana</i>	green amaranth	Y	C		5
plants	higher dicots	<i>Amaranthus viridis</i>	lesser joyweed	Y	C		3/2
plants	higher dicots	<i>Alternanthera denticulata</i>	khaki weed	Y			2
plants	higher dicots	<i>Alternanthera pungens</i>	gomphrena weed	Y			12/5
plants	higher dicots	<i>Gomphrena celosioides</i>	joyweed				1
plants	higher dicots	<i>Alternanthera nodiflora</i>	redberry	Y	C		2/1
plants	higher dicots	<i>Deeringia amaranthoides</i>	redshank	Y			1
plants	higher dicots	<i>Amaranthus hybridus</i>	mango	Y			2
plants	higher dicots	<i>Mangifera indica</i>			C		41
plants	higher dicots	<i>Euroschinus falcatus</i>			C		1
plants	higher dicots	<i>Euroschinus falcatus</i> var. <i>angustifolius</i>			C		1
plants	higher dicots	<i>Schinus terebinthifolius</i>		Y			7/7
plants	higher dicots	<i>Euroschinus falcatus</i> var. <i>falcatus</i>			C		4/1
plants	higher dicots	<i>Pleogynium timorense</i>	Burdekin plum		C		61
plants	higher dicots	<i>Cyclosporum leptophyllum</i>		Y			2/2
plants	higher dicots	<i>Centella asiatica</i>			C		4
plants	higher dicots	<i>Alyxia spicata</i>			C		1
plants	higher dicots	<i>Hoya australis</i>			C		25
plants	higher dicots	<i>Nerium oleander</i>	oleander	Y			2/1
plants	higher dicots	<i>Parsonsia rotata</i>	veinless silkpod		C		4
plants	higher dicots	<i>Alyxia magnifolia</i>			C		6/2
plants	higher dicots	<i>Alyxia ruscifolia</i>			C		65/2
plants	higher dicots	<i>Cascabela thevetia</i>	yellow oleander	Y			6/4
plants	higher dicots	<i>Marsdenia rostrata</i>			C		1/1
plants	higher dicots	<i>Parsonsia velutina</i>	hairy silkpod		C		9
plants	higher dicots	<i>Secamone elliptica</i>	bitterbark		C		34/1
plants	higher dicots	<i>Alostonia constricta</i>	pink periwinkle	Y			22/1
plants	higher dicots	<i>Catharanthus roseus</i>			C		8/3
plants	higher dicots	<i>Gymnanthera oblonga</i>	monkey rope		C		4/1
plants	higher dicots	<i>Parsonsia straminea</i>			C		4
plants	higher dicots	<i>Vincetoxicum ovatum</i>			C		11/1
plants	higher dicots	<i>Marsdenia micradenia</i>	gymnema		C		1
plants	higher dicots	<i>Marsdenia microlepis</i>			C		14/1
plants	higher dicots	<i>Marsdenia pleiadensis</i>			C		1
plants	higher dicots	<i>Parsonsia lanceolata</i>	northern silkpod		C		13
plants	higher dicots	<i>Parsonsia ventricosa</i>			C		1
plants	higher dicots	<i>Sarcostemma viminale</i>					10

Kingdom Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	Apocynaceae	<i>Asclepias curassavica</i>	red-head cottonbush	Y	C		11/3
plants	Apocynaceae	<i>Marsdenia viridiflora</i>			V	V	5
plants	Apocynaceae	<i>Parsonsia larcomensis</i>		Y			7/7
plants	Apocynaceae	<i>Rauwolfia tetraphylla</i>			C		1/1
plants	Apocynaceae	<i>Tylophora grandiflora</i>			C		3
plants	Apocynaceae	<i>Vincetoxicum carnosum</i>			C		1/1
plants	Apocynaceae	<i>Parsonsia leichhardtii</i>	black silkpod		C		3
plants	Apocynaceae	<i>Parsonsia paulforsteri</i>			C		18/3
plants	Apocynaceae	<i>Parsonsia plaesiophylla</i>			C		1
plants	Apocynaceae	<i>Cryptostegia grandiflora</i>	rubber vine	Y			35/4
plants	Apocynaceae	<i>Gomphocarpus physocarpus</i>	balloon cottonbush	Y			16/3
plants	Apocynaceae	<i>Parsonsia eucalyptophylla</i>	gargaloo		C		1
plants	Apocynaceae	<i>Tabernaemontana pandacaqui</i>	banana bush		C		1
plants	Apocynaceae	<i>Cynanchum viminale subsp. australe</i>			C		5
plants	Apocynaceae	<i>Cynanchum viminale subsp. brunonianum</i>			C		8/3
plants	Apocynaceae	<i>Marsdenia viridiflora subsp. viridiflora</i>			C		1/1
plants	Apocynaceae	<i>Parsonsia</i>			C		3
plants	Apocynaceae	<i>Carissa ovata</i>	currantbush		C		51/2
plants	Araliaceae	<i>Polyscias elegans</i>	celery wood		C		24
plants	Araliaceae	<i>Schefflera actinophylla</i>	umbrella tree		C		5
plants	Araliaceae	<i>Hydrocotyle acutiloba</i>		Y	C		1/1
plants	Asteraceae	<i>Bidens pilosa</i>			C		20/2
plants	Asteraceae	<i>Blumea mollis</i>		Y	C		1/1
plants	Asteraceae	<i>Gazania rigens</i>		Y	C		1/1
plants	Asteraceae	<i>Cassinia laevis</i>			C		1/1
plants	Asteraceae	<i>Girardinum vulgare</i>	spear thistle	Y			5/2
plants	Asteraceae	<i>Soliva sessilis</i>		Y			1/1
plants	Asteraceae	<i>Bidens bipinnata</i>	bipinnate beggar's ticks	Y			1
plants	Asteraceae	<i>Blumea saxatilis</i>			C		1
plants	Asteraceae	<i>Centipeda minima</i>			C		2
plants	Asteraceae	<i>Pluchea xanthina</i>			C		1/1
plants	Asteraceae	<i>Zinnia peruviana</i>	wild zinnia	Y			1
plants	Asteraceae	<i>Calotis hispidula</i>	bogan flea	Y	C		1
plants	Asteraceae	<i>Carduus thoirmeri</i>	nodding thistle	Y			1
plants	Asteraceae	<i>Eclipta prostrata</i>	white eclipta	Y	C		5/4
plants	Asteraceae	<i>Olearia canescens</i>			C		2
plants	Asteraceae	<i>Schkuhria pinnata</i>		Y			1/1
plants	Asteraceae	<i>Sonchus oleraceus</i>	common sowthistle	Y			12/3
plants	Asteraceae	<i>Tridax procumbens</i>	tridax daisy	Y			17/6
plants	Asteraceae	<i>Calotis cuneifolia</i>	burr daisy		C		1
plants	Asteraceae	<i>Camptactra gracilis</i>			C		1
plants	Asteraceae	<i>Emilia sonchifolia</i>		Y	C		23
plants	Asteraceae	<i>Olearia subspicata</i>			C		1
plants	Asteraceae	<i>Peripleura bicolor</i>			C		1/1
plants	Asteraceae	<i>Peripleura diffusa</i>			C		1
plants	Asteraceae	<i>Vittadinia sulcata</i>	native daisy		C		2

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plants	Asteraceae	<i>Ageratum conyzoides</i>	billygoat weed	Y			9
plants	Asteraceae	<i>Coronidium rupicola</i>			C		2
plants	Asteraceae	<i>Glossocardia bidens</i>	native cobbler's pegs	Y	C		1/1
plants	Asteraceae	<i>Praxelis clematidea</i>			C		1/1
plants	Asteraceae	<i>Vittadinia dissecta</i>			C		1
plants	Asteraceae	<i>Wollastonia biflora</i>			C		2
plants	Asteraceae	<i>Calyptocarpus vialis</i>	creeping cinderella weed	Y			12/4
plants	Asteraceae	<i>Erigeron bonariensis</i>		Y			2/1
plants	Asteraceae	<i>Erigeron sumatrensis</i>		Y			1/1
plants	Asteraceae	<i>Galinisoga parviflora</i>	yellow weed	Y			2
plants	Asteraceae	<i>Lagenophora gracilis</i>			C		5/2
plants	Asteraceae	<i>Peripleura hispida</i>			C		13
plants	Asteraceae	<i>Pterocaulon redolens</i>			C		29/3
plants	Asteraceae	<i>Taraxacum officinale</i>	dandelion	Y			1/1
plants	Asteraceae	<i>Xanthium occidentale</i>		Y			5/1
plants	Asteraceae	<i>Verbesina encelioides</i>	crownsbeard	Y			1/1
plants	Asteraceae	<i>Coronidium lanuginosum</i>			C		7/4
plants	Asteraceae	<i>Pterocaulon serrulatum</i>			C		1
plants	Asteraceae	<i>Sigesbeckia orientalis</i>	Indian weed		C		10/2
plants	Asteraceae	<i>Xerochrysum bracteatum</i>	golden everlasting daisy	Y	C		2/1
plants	Asteraceae	<i>Acanthospermum hispidum</i>	star burr	Y			1
plants	Asteraceae	<i>Gamochoaeta pensylvanica</i>		Y	C		3/1
plants	Asteraceae	<i>Ozothamnus cassinioides</i>			C		2/1
plants	Asteraceae	<i>Sphagnetocola trilobata</i>		Y			5/5
plants	Asteraceae	<i>Bidens alba</i> var. <i>radiata</i>		Y			1/1
plants	Asteraceae	<i>Symphytichum subulatum</i>		Y			2/1
plants	Asteraceae	<i>Chrysocephalum apiculatum</i>	yellow buttons		C		2
plants	Asteraceae	<i>Sphaeromorphaea australis</i>			C		9
plants	Asteraceae	<i>Sphaeromorphaea subintegra</i>			C		1/1
plants	Asteraceae	<i>Synedrellopsis grisebachii</i>	thickhead	Y			3/3
plants	Asteraceae	<i>Crassocephalum crepidioides</i>	Jersey cudweed	Y	C		2/2
plants	Asteraceae	<i>Pseudognaphalium luteoalbum</i>			C		3/2
plants	Asteraceae	<i>Apowollastonia spilanthoides</i>			C		3/3
plants	Asteraceae	<i>Lactuca serriola</i> forma <i>serriola</i>		Y			1/1
plants	Asteraceae	<i>Emilia sonchifolia</i> var. <i>javanica</i>		Y			2/2
plants	Asteraceae	<i>Peripleura hispida</i> var. <i>setosa</i>			C		5/1
plants	Asteraceae	<i>Gynura dymophila</i> var. <i>dymophila</i>			C		1/1
plants	Asteraceae	<i>Olearia canescens</i> subsp. <i>discolor</i>			C		1/1
plants	Asteraceae	<i>Peripleura hispida</i> var. <i>hispida</i>			C		1/1
plants	Asteraceae	<i>Thymophylla tenuioba</i> var. <i>tenuioba</i>		Y	C		1/1
plants	Asteraceae	<i>Acmella grandiflora</i> var. <i>brachygllossa</i>			C		2/2
plants	Asteraceae	<i>Ageratum conyzoides</i> subsp. <i>conyzoides</i>		Y	C		3/3
plants	Asteraceae	<i>Pterocaulon serrulatum</i> var. <i>serrulatum</i>			C		1/1
plants	Asteraceae	<i>Picris angustifolia</i> subsp. <i>carolorum-henricorum</i>			C		4
plants	Asteraceae	<i>Conyza</i>			C		3
plants	Asteraceae	<i>Olearia</i>			C		1

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plants	Asteraceae	<i>Brachycome</i>			C		1
plants	Asteraceae	<i>Helichrysum</i>			C		2
plants	Asteraceae	<i>Ageratum houstonianum</i>	blue billygoat weed	Y			9/1
plants	Asteraceae	<i>Baccharis halimifolia</i>	groundsel bush	Y			4/2
plants	Asteraceae	<i>Brachycome basaltica</i>			C		1/1
plants	Asteraceae	<i>Cassinia quinquefaria</i>			C		1
plants	Asteraceae	<i>Centratherum riparium</i>			C		1/1
plants	Asteraceae	<i>Cyanthillium cinereum</i>			C		27/5
plants	Asteraceae	<i>Hypochoeris albiflora</i>		Y			1/1
plants	Asteraceae	<i>Podolepis longipedata</i>	tall copper-wire daisy		C		1
plants	Asteraceae	<i>Senecio brigalowensis</i>			C		1/1
plants	Asteraceae	<i>Sphaeromorphaea major</i>			C		1/1
plants	Asteraceae	<i>Tithonia diversifolia</i>	Japanese sunflower	Y			1/1
plants	Balsaminaceae	<i>Impatiens walleriana</i>	balsam	Y			1
plants	Basellaceae	<i>Anredera cordifolia</i>	Madeira vine	Y			1/1
plants	Bignoniaceae	<i>Pandorea jasminoides</i>			C		1
plants	Bignoniaceae	<i>Dolichandra unguis-cati</i>	cat's claw creeper	Y			1
plants	Bignoniaceae	<i>Pandorea pandorana</i>	wonga vine		C		32/2
plants	Bignoniaceae	<i>Ehretia</i>			C		1
plants	Boraginaceae	<i>Argusia argentea</i>	octopus bush		C		1
plants	Boraginaceae	<i>Cordia dichotoma</i>			C		1/1
plants	Boraginaceae	<i>Ehretia grahamii</i>			C		3
plants	Boraginaceae	<i>Heliotropium indicum</i>			C		14/5
plants	Boraginaceae	<i>Ehretia membranifolia</i>	weeping koda	Y			1
plants	Boraginaceae	<i>Trichodesma zeylanicum</i>			C		6/1
plants	Boraginaceae	<i>Heliotropium amplexicaule</i>	blue heliotrope	Y			2
plants	Boraginaceae	<i>Trichodesma zeylanicum var. zeylanicum</i>			C		1/1
plants	Boraginaceae	<i>Rapistrum rugosum</i>		Y			1/1
plants	Brassicaceae	<i>Lepidium didymum</i>		Y			1/1
plants	Brassicaceae	<i>Lepidium virginicum</i>	Virginian peppergrass	Y			1/1
plants	Brassicaceae	<i>Cardamine flexuosa</i>	wood bittergrass	Y			1/1
plants	Brassicaceae	<i>Leptidium bonariense</i>	Argentine peppergrass	Y			5/5
plants	Byttneriaceae	<i>Seringia lanceolata</i>			C		1
plants	Cactaceae	<i>Hylocereus undatus</i>	night blooming cactus	Y			1/1
plants	Cactaceae	<i>Opuntia tomentosa</i>	velvety tree pear	Y			1
plants	Cactaceae	<i>Opuntia stricta</i>		Y			36/1
plants	Cactaceae	<i>Opuntia</i>			C		3
plants	Caesalpinaceae	<i>Cassia fistula</i>	Indian laburnum	Y			3
plants	Caesalpinaceae	<i>Senna</i>			C		1
plants	Caesalpinaceae	<i>Chamaecrista rotundifolia var. rotundifolia</i>		Y			4/4
plants	Caesalpinaceae	<i>Chamaecrista nomame var. nomame</i>			C		2/2
plants	Caesalpinaceae	<i>Chamaecrista absus var. absus</i>			C		3/3
plants	Caesalpinaceae	<i>Senna pendula var. glabrata</i>	Easter cassia	Y			7/6
plants	Caesalpinaceae	<i>Chamaecrista rotundifolia</i>		Y			1/1
plants	Caesalpinaceae	<i>Caesalpinia scortechinii</i>	large prickly vine	Y			5
plants	Caesalpinaceae	<i>Peltophorum pterocarpum</i>	yellow poinciana	Y			1/1

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plants	Caesalpiniaceae	<i>Chamaecrista mimosoides</i>	dwarf cassia		C		2
plants	Caesalpiniaceae	<i>Senna septemtrionalis</i>		Y	C		3
plants	Caesalpiniaceae	<i>Chamaecrista concinna</i>	golden shower tree		C		1/1
plants	Caesalpiniaceae	<i>Barklya syringifolia</i>			C		17/1
plants	Caesalpiniaceae	<i>Chamaecrista normame</i>			C		5
plants	Caesalpiniaceae	<i>Senna occidentalis</i>	coffee senna	Y	C		2
plants	Caesalpiniaceae	<i>Senna gaudichaudii</i>			C		8/2
plants	Caesalpiniaceae	<i>Caesalpinia nitens</i>			C		1
plants	Caesalpiniaceae	<i>Caesalpinia bonduc</i>	nicker bean		C		3/1
plants	Caesalpiniaceae	<i>Bauhinia variegata</i>		Y	C		2/1
plants	Caesalpiniaceae	<i>Tamarindus indica</i>		Y	C		1/1
plants	Caesalpiniaceae	<i>Senna surattensis</i>			C		3
plants	Caesalpiniaceae	<i>Cassia brewsteri</i>			C		1
plants	Caesalpiniaceae	<i>Delonix regia</i>	poinciana	Y	C		2/1
plants	Campanulaceae	<i>Lobelia purpurascens</i>	white root		C		1
plants	Campanulaceae	<i>Lobelia stenophylla</i>			C		1/1
plants	Campanulaceae	<i>Lobelia concolor</i>			C		1
plants	Campanulaceae	<i>Lobelia</i>			C		2
plants	Campanulaceae	<i>Wahlenbergia gracilis</i>	sprawling bluebell		C		2/2
plants	Capparaceae	<i>Capparis arborea</i>	brush caper berry		C		25/2
plants	Capparaceae	<i>Capparis ornans</i>		Y	C		17/1
plants	Capparaceae	<i>Capparis loranthifolia</i>			C		1
plants	Capparaceae	<i>Capparis canescens</i>			C		15/1
plants	Capparaceae	<i>Capparis mitchellii</i>			C		1
plants	Capparaceae	<i>Capparis sarmentosa</i>	scrambling caper		C		4
plants	Capparaceae	<i>Capparis</i>			C		9
plants	Caricaceae	<i>Carica papaya</i>	pawpaw	Y	C		2
plants	Caryophyllaceae	<i>Polycarpaea corymbosa</i>		Y	C		1
plants	Caryophyllaceae	<i>Drymaria cordata subsp. cordata</i>			C		1/1
plants	Casuarinaceae	<i>Casuarina cunninghamiana</i>			C		7
plants	Casuarinaceae	<i>Allocasuarina luehmannii</i>	bull oak		C		9/1
plants	Casuarinaceae	<i>Allocasuarina littoralis</i>			C		7/1
plants	Casuarinaceae	<i>Casuarina equisetifolia</i>			C		12
plants	Casuarinaceae	<i>Allocasuarina torulosa</i>			C		16/1
plants	Casuarinaceae	<i>Casuarina glauca</i>	swamp she-oak		C		15/1
plants	Casuarinaceae	<i>Casuarina equisetifolia subsp. incana</i>			C		2/1
plants	Celastraceae	<i>Denhamia</i>			C		4
plants	Celastraceae	<i>Denhamia disperma</i>			C		38/1
plants	Celastraceae	<i>Denhamia oleaster</i>			C		3/1
plants	Celastraceae	<i>Hippocratea barbata</i>	knotvine		C		6
plants	Celastraceae	<i>Celastrus subspicata</i>	large-leaved staffvine		C		1
plants	Celastraceae	<i>Denhamia pittosporoides subsp. pittosporoides</i>			C		1/1
plants	Celastraceae	<i>Denhamia cunninghamii</i>			C		9
plants	Celastraceae	<i>Pleurostylia opposita</i>			C		3/1
plants	Celastraceae	<i>Denhamia pittosporoides</i>			C		27
plants	Celastraceae	<i>Elaeodendron melanocarpum</i>			C		40/2

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plants	Celastraceae	<i>Elaeodendron australe</i> var. <i>australe</i>			C		2
plants	Celastraceae	<i>Siphonodon australis</i>	ivorywood		C		5/1
plants	Chenopodiaceae	<i>Tecticornia indica</i> subsp. <i>leiostachya</i>			C		2
plants	Chenopodiaceae	<i>Tecticornia indica</i> subsp. <i>indica</i>			C		1/1
plants	Chenopodiaceae	<i>Chenopodium</i>			C		2
plants	Chenopodiaceae	<i>Tecticornia</i>			C		1
plants	Chenopodiaceae	<i>Einadia hastata</i>			C		1
plants	Chenopodiaceae	<i>Suaeda australis</i>			C		7/1
plants	Chenopodiaceae	<i>Salsola australis</i>			C		5/2
plants	Chenopodiaceae	<i>Chenopodium murale</i>	green fat-hen	Y	C		1/1
plants	Chenopodiaceae	<i>Tecticornia indica</i>			C		3
plants	Chenopodiaceae	<i>Dysphania littoralis</i>			C		2/2
plants	Chenopodiaceae	<i>Enchylaena tomentosa</i>	red crumbweed	Y	C		3/1
plants	Chenopodiaceae	<i>Dysphania ambrosioides</i>			C		1/1
plants	Chenopodiaceae	<i>Sarcocornia quinqueflora</i>			C		3
plants	Chenopodiaceae	<i>Tecticornia pergranulata</i>			C		2
plants	Chenopodiaceae	<i>Tecticornia halocnemoides</i>			C		1
plants	Chenopodiaceae	<i>Enchylaena tomentosa</i> var. <i>glabra</i>			C		1/1
plants	Chenopodiaceae	<i>Tecticornia pergranulata</i> subsp. <i>queenslandica</i>			C		3/3
plants	Combretaceae	<i>Terminalia porphyrocarpa</i>			C		27/3
plants	Combretaceae	<i>Macropteranthus fitzalanii</i>			C		4
plants	Combretaceae	<i>Macropteranthus leiocaulis</i>			NT		10/4
plants	Combretaceae	<i>Macropteranthus leichhardtii</i>			C		3
plants	Combretaceae	<i>Terminalia</i>	bonewood		C		1
plants	Combretaceae	<i>Dansiea elliptica</i>			NT		5/3
plants	Combretaceae	<i>Lumnitzera racemosa</i>			C		4/1
plants	Convulvulaceae	<i>Ipomoea plebeia</i>	bellvine		C		3
plants	Convulvulaceae	<i>Ipomoea pes-caprae</i> subsp. <i>brasiliensis</i>	goatsfoot		C		7/1
plants	Convulvulaceae	<i>Evolvulus alsinoides</i> var. <i>decumbens</i>			C		2/1
plants	Convulvulaceae	<i>Jacquemontia paniculata</i>			C		7/4
plants	Convulvulaceae	<i>Merremia quinquefolia</i>		Y	C		1/1
plants	Convulvulaceae	<i>Evolvulus alsinoides</i>			C		11
plants	Convulvulaceae	<i>Polymeria calycina</i>			C		2/1
plants	Convulvulaceae	<i>Polymeria pusilla</i>			C		2
plants	Convulvulaceae	<i>Merremia dissecta</i>	pink bindweed	Y	C		3/3
plants	Convulvulaceae	<i>Calystegia</i>			C		1
plants	Convulvulaceae	<i>Ipomoea cairica</i>		Y	C		2/1
plants	Convulvulaceae	<i>Jacquemontia paniculata</i> var. <i>tomentosa</i>			C		2
plants	Convulvulaceae	<i>Ipomoea violacea</i>			C		6
plants	Convulvulaceae	<i>Cuscuta australis</i>	Australian dodder	Y	C		1
plants	Convulvulaceae	<i>Ipomoea quamoclit</i>	star of Bethlehem	Y	C		1/1
plants	Cornaceae	<i>Alangium villosum</i> subsp. <i>tomentosum</i>			C		2
plants	Crassulaceae	<i>Bryophyllum delagoense</i>		Y	C		7/3
plants	Crassulaceae	<i>Bryophyllum x houghtonii</i>		Y	C		5/2
plants	Crassulaceae	<i>Crassula sieberiana</i>			C		1/1
plants	Cucurbitaceae	<i>Cucumis melo</i>			C		1

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plants	higher dicots	<i>Citrullus lanatus</i>		Y			1
plants	higher dicots	<i>Cucumis althaeoides</i>			C		1/1
plants	higher dicots	<i>Diplocyclos palmatus</i>			C		7/1
plants	higher dicots	<i>Cucurbita pepo</i>		Y			1/1
plants	higher dicots	<i>Hibbertia stricta</i>			C		1/1
plants	higher dicots	<i>Hibbertia scandens</i>			C		3/1
plants	higher dicots	<i>Hibbertia linearis var. obtusifolia</i>			C		1
plants	higher dicots	<i>Drosera</i>			C		1
plants	higher dicots	<i>Drosera lunata</i>			C		1/1
plants	higher dicots	<i>Diospyros australis</i>	black plum		C		20
plants	higher dicots	<i>Diospyros</i>			C		1
plants	higher dicots	<i>Diospyros humilis</i>	small-leaved ebony		C		9
plants	higher dicots	<i>Diospyros geminata</i>	scaly ebony		C		62/4
plants	higher dicots	<i>Diospyros fasciculosa</i>	grey ebony		C		21
plants	higher dicots	<i>Elaeocarpus obovatus</i>	blueberry ash		C		9/1
plants	higher dicots	<i>Elaeocarpus eumundi</i>	Eumundi quandong		C		1/1
plants	higher dicots	<i>Monotoca scoparia</i>	prickly broom heath		C		2
plants	higher dicots	<i>Acrotiche aggregata</i>	red cluster heath		C		1
plants	higher dicots	<i>Erythroxylum australe</i>	cocaine tree		C		11
plants	higher dicots	<i>Erythroxylum sp. (Spitlyard Creek L. Pedley 5360)</i>			C		8/2
plants	higher dicots	<i>Excoecaria agallocha</i>	milky mangrove		C		4
plants	higher dicots	<i>Alchornea thozetiana</i>			C		7/1
plants	higher dicots	<i>Euphorbia cyathophora</i>	dwarf poinsettia	Y			8/5
plants	higher dicots	<i>Euphorbia dallachyana</i>		Y			2/1
plants	higher dicots	<i>Euphorbia ophthalmica</i>			C		1/1
plants	higher dicots	<i>Mallotus cloxyloides</i>	green kamala		C		27/1
plants	higher dicots	<i>Mallotus philippensis</i>	red kamala		C		49/2
plants	higher dicots	<i>Claoxylon tenerifolium</i>	Queensland brittlewood		C		6
plants	higher dicots	<i>Euphorbia hyssopifolia</i>		Y			3/3
plants	higher dicots	<i>Excoecaria dallachyana</i>	scrub poison tree		C		9
plants	higher dicots	<i>Jatropha gossypifolia</i>	bellyache bush	Y			2/2
plants	higher dicots	<i>Ricinocarpos ledifolius</i>	scrub wedding bush		C		2
plants	higher dicots	<i>Tragia novae-hollandiae</i>	wedding bush		C		2/1
plants	higher dicots	<i>Homalanthus populifolius</i>	stinging-vine		C		4/1
plants	higher dicots	<i>Euphorbia tannensis subsp. tannensis</i>			C		1/1
plants	higher dicots	<i>Euphorbia mitchelliana var. mitchelliana</i>	zig zag plant	Y			1/1
plants	higher dicots	<i>Pedianthus tithymaloides subsp. smallii</i>	native holly		C		16
plants	higher dicots	<i>Alchornea ilicifolia</i>			C		1/1
plants	higher dicots	<i>Mallotus ficifolius</i>			C		1/1
plants	higher dicots	<i>Mallotus</i>			C		1
plants	higher dicots	<i>Claoxylon</i>			C		1
plants	higher dicots	<i>Euphorbia</i>			C		1
plants	higher dicots	<i>Euphorbia hirta</i>		Y			2
plants	higher dicots	<i>Croton insularis</i>	Queensland cascarilla		C		3/2
plants	higher dicots	<i>Euphorbia bifida</i>			C		10/1
plants	higher dicots				C		1

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plants	Euphorbiaceae	<i>Ricinus communis</i>	castor oil bush	Y			3/3
plants	Euphorbiaceae	<i>Acalypha eremorum</i>	soft acalypha		C		22
plants	Euphorbiaceae	<i>Mallotus discolor</i>	white kamata	Y	C		30
plants	Euphorbiaceae	<i>Acalypha australis</i>					1/1
plants	Euphorbiaceae	<i>Baloghia inophylla</i>	scrub bloodwood		C		10/4
plants	Euphorbiaceae	<i>Croton stigmatosus</i>	white croton	Y	C		3/1
plants	Euphorbiaceae	<i>Euphorbia tirucalli</i>	naked lady				1/1
plants	Euphorbiaceae	<i>Euphorbia tannensis</i>		Y	C		8
plants	Euphorbiaceae	<i>Euphorbia prostrata</i>	narrow-leaved croton		C		2/2
plants	Euphorbiaceae	<i>Croton pheballoides</i>	small-leaved acalypha		C		9
plants	Euphorbiaceae	<i>Acalypha capillipes</i>	macaranga		C		4
plants	Euphorbiaceae	<i>Macaranga tanarius</i>	thick-leaved croton		C		2
plants	Euphorbiaceae	<i>Croton acronychioides</i>			C		11/1
plants	Fabaceae	<i>Cajanus reticulatus</i> var. <i>reticulatus</i>			C		1/1
plants	Fabaceae	<i>Crotalaria medicaginea</i> var. <i>neglecta</i>			C		3/3
plants	Fabaceae	<i>Crotalaria montana</i> var. <i>angustifolia</i>			C		4/4
plants	Fabaceae	<i>Desmodium heterocarpon</i> var. <i>strigosum</i>			C		1/1
plants	Fabaceae	<i>Indigofera australis</i> subsp. <i>australis</i>			C		1/1
plants	Fabaceae	<i>Glycine</i>			C		5
plants	Fabaceae	<i>Desmodium</i>			C		4/1
plants	Fabaceae	<i>Swainsona</i>			C		1
plants	Fabaceae	<i>Crotalaria</i>			C		1
plants	Fabaceae	<i>Alysicarpus</i>			C		1
plants	Fabaceae	<i>Uraria picta</i>			C		1/1
plants	Fabaceae	<i>Vigna marina</i>	dune bean		C		3
plants	Fabaceae	<i>Hovea longipes</i>	brush hovea		C		3
plants	Fabaceae	<i>Canavalia rosea</i>	coastal jack bean		C		3
plants	Fabaceae	<i>Derris involuta</i>	native derris		C		2
plants	Fabaceae	<i>Vigna vexillata</i>			C		1
plants	Fabaceae	<i>Desmodium gunnii</i>			C		1/1
plants	Fabaceae	<i>Glycine tabacina</i>	glycine pea		C		23
plants	Fabaceae	<i>Tephrosia juncea</i>			C		7
plants	Fabaceae	<i>Tephrosia rufula</i>			C		3/2
plants	Fabaceae	<i>Vigna lanceolata</i>			C		1
plants	Fabaceae	<i>Canavalia papuana</i>	wild jack bean		C		1/1
plants	Fabaceae	<i>Canavalia sericea</i>			C		1/1
plants	Fabaceae	<i>Clitoria ternatea</i>	butterfly pea	Y	C		4/4
plants	Fabaceae	<i>Crotalaria brevis</i>			C		6/2
plants	Fabaceae	<i>Desmodium varians</i>	slender tick trefoil		C		3/1
plants	Fabaceae	<i>Flemingia lineata</i>			C		1/1
plants	Fabaceae	<i>Rhynchosia minima</i>			C		4
plants	Fabaceae	<i>Sophora tomentosa</i>			C		3
plants	Fabaceae	<i>Tephrosia filipes</i>			C		1
plants	Fabaceae	<i>Zornia floribunda</i>			C		1
plants	Fabaceae	<i>Zornia muriculata</i>			C		1
plants	Fabaceae	<i>Crotalaria montana</i>			C		21

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plants	Fabaceae	<i>Crotalaria pallida</i>		Y			13
plants	Fabaceae	<i>Desmodium pullenii</i>			C		1/1
plants	Fabaceae	<i>Glycine tomentella</i>	woolly glycine		C		7/1
plants	Fabaceae	<i>Indigofera baileyi</i>			C		1/1
plants	Fabaceae	<i>Indigofera colutea</i>	sticky indigo		C		1/1
plants	Fabaceae	<i>Indigofera hirsuta</i>	hairy indigo		C		14/5
plants	Fabaceae	<i>Indigofera linnaei</i>	Birdsville indigo		C		3/2
plants	Fabaceae	<i>Jacksonia scoparia</i>			C		25/3
plants	Fabaceae	<i>Sesbania cannabina</i>			C		6
plants	Fabaceae	<i>Zornia dyctiocarpa</i>			C		4
plants	Fabaceae	<i>Aeschynomene indica</i>	budda pea		C		2/1
plants	Fabaceae	<i>Cajanus reticulatus</i>			C		1
plants	Fabaceae	<i>Crotalaria calycina</i>			C		2/2
plants	Fabaceae	<i>Desmodium tortuosum</i>	Florida beggar-weed	Y			1/1
plants	Fabaceae	<i>Desmodium triflorum</i>		Y			8
plants	Fabaceae	<i>Galactia tenuiflora</i>			C		7
plants	Fabaceae	<i>Glycine clandestina</i>			C		1
plants	Fabaceae	<i>Medicago polymorpha</i>	burr medic	Y			3/2
plants	Fabaceae	<i>Stylosanthes scabra</i>		Y			9/1
plants	Fabaceae	<i>Swainsona phacoides</i>	dwarf swainsona		C		4/2
plants	Fabaceae	<i>Tephrosia barbata</i>			C		1/1
plants	Fabaceae	<i>Crotalaria goreensis</i>	gambia pea	Y			2/1
plants	Fabaceae	<i>Desmodium gangeticum</i>			C		7/1
plants	Fabaceae	<i>Flemingia parviflora</i>	flemingia		C		12
plants	Fabaceae	<i>Indigofera australis</i>			C		5
plants	Fabaceae	<i>Indigofera linifolia</i>			C		3/3
plants	Fabaceae	<i>Indigofera pratensis</i>			C		1/1
plants	Fabaceae	<i>Isotropis filicaulis</i>			C		3/1
plants	Fabaceae	<i>Pycnospora lutescens</i>	pycnospora	Y			6/2
plants	Fabaceae	<i>Stylosanthes humilis</i>	Townsville stylo	Y			1/1
plants	Fabaceae	<i>Stylosanthes viscosa</i>		Y			1/1
plants	Fabaceae	<i>Tephrosia noctiflora</i>		Y			1/1
plants	Fabaceae	<i>Uraria lagopodioides</i>			C		2
plants	Fabaceae	<i>Alysicarpus vaginalis</i>		Y			1
plants	Fabaceae	<i>Chorizema parviflorum</i>	eastern flame pea		C		2/1
plants	Fabaceae	<i>Crotalaria trichotoma</i>		Y			1/1
plants	Fabaceae	<i>Erythrina vesperitilo</i>			C		13
plants	Fabaceae	<i>Gompholobium pinnatum</i>	poor mans gold		C		1/1
plants	Fabaceae	<i>Hardenbergia violacea</i>			C		12/2
plants	Fabaceae	<i>Indigofera trifoliata</i>			C		1/1
plants	Fabaceae	<i>Crotalaria medicaginea</i>	trefoil rattlepod		C		7
plants	Fabaceae	<i>Desmodium heterocarpon</i>			C		1
plants	Fabaceae	<i>Leptosema oxylobioides</i>			C		1/1
plants	Fabaceae	<i>Aeschynomene brevifolia</i>			C		4/3
plants	Fabaceae	<i>Austrosteenisia blackii</i>	bloodvine		C		19
plants	Fabaceae	<i>Podolobium aciculiferum</i>			C		3/2

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plants	Fabaceae	<i>Stylosanthes guianensis</i>		Y			1
plants	Fabaceae	<i>Tephrosia astragaloides</i>			C		2/2
plants	Fabaceae	<i>Desmodium rhytidophyllum</i>			C		21/1
plants	Fabaceae	<i>Macroptilium lathyroides</i>	pink tephrosia	Y			4/2
plants	Fabaceae	<i>Tephrosia glomeruliflora</i>		Y			1/1
plants	Fabaceae	<i>Rhynchosia acuminatissima</i>			C		6
plants	Fabaceae	<i>Macroptilium atropurpureum</i>	siratro	Y			9/2
plants	Fabaceae	<i>Trifolium repens</i> var. <i>repens</i>	white clover	Y			2/1
plants	Fabaceae	<i>Crotalaria incana</i> subsp. <i>incana</i>		Y			2/2
plants	Fabaceae	<i>Crotalaria pallida</i> var. <i>obovata</i>		Y			6/6
plants	Fabaceae	<i>Tephrosia purpurea</i> var. <i>sericea</i>			C		3
plants	Fabaceae	<i>Galactia tenuiflora</i> var. <i>villosa</i>			C		1/1
plants	Fabaceae	<i>Glycine clandestina</i> var. <i>sericea</i>			C		2/1
plants	Fabaceae	<i>Tephrosia filipes</i> subsp. <i>filipes</i>			C		6/4
plants	Fabaceae	<i>Vigna lanceolata</i> var. <i>lanceolata</i>			C		2
plants	Fabaceae	<i>Vigna vexillata</i> var. <i>angustifolia</i>			C		1
plants	Fabaceae	<i>Zornia dyctiocarpa</i> var. <i>filifolia</i>			C		1/1
plants	Fabaceae	<i>Macrolyoma axillare</i> var. <i>axillare</i>		Y			1/1
plants	Fabaceae	<i>Sophora tomentosa</i> subsp. <i>australis</i>			C		6/1
plants	Fabaceae	<i>Zornia muriculata</i> subsp. <i>angustata</i>			C		2/2
plants	Fabaceae	<i>Zornia muriculata</i> subsp. <i>muriculata</i>		Y			1/1
plants	Fabaceae	<i>Austrosteenisia blackii</i> var. <i>blackii</i>			C		2/2
plants	Flacourtiaceae	<i>Scolopia braunii</i>	flintwood		C		10/1
plants	Flacourtiaceae	<i>Xylosma terrae-reginae</i>	xylosma		C		7/1
plants	Flacourtiaceae	<i>Homalium alnifolium</i>	homalium		C		10/1
plants	Gentianaceae	<i>Centaurium erythraea</i>	common centaury	Y			1
plants	Gentianaceae	<i>Schenkia australis</i>			C		5/4
plants	Goodeniaceae	<i>Goodenia rotundifolia</i>	blue pincushion		C		1
plants	Goodeniaceae	<i>Goodenia hederacea</i>			C		1
plants	Goodeniaceae	<i>Velleia spathulata</i>	wild pansies		C		1/1
plants	Goodeniaceae	<i>Scaevola taccada</i>	Cardwell cabbage		C		4/2
plants	Goodeniaceae	<i>Goodenia glabra</i>			C		2/1
plants	Goodeniaceae	<i>Velleia paradoxa</i>	spur velleia		C		1
plants	Haloragaceae	<i>Haloragis heterophylla</i>	rough raspweed		C		2/1
plants	Haloragaceae	<i>Haloragis stricta</i>			C		3
plants	Lamiaceae	<i>Clerodendrum inerme</i>	coastal lolly bush		C		3/1
plants	Lamiaceae	<i>Lamium amplexicaule</i>	deadnettle	Y			1/1
plants	Lamiaceae	<i>Anisomeles moschata</i>			C		2/2
plants	Lamiaceae	<i>Vitex rotundifolia</i>			C		4/2
plants	Lamiaceae	<i>Vitex lignum-vitae</i>			C		7/2
plants	Lamiaceae	<i>Vitex mellicopea</i>			C		3/1
plants	Lamiaceae	<i>Vitex acuminata</i>	red salvia	Y			2
plants	Lamiaceae	<i>Salvia coccinea</i>			C		12/2
plants	Lamiaceae	<i>Ajuga australis</i>	Australian bugle		C		2/1
plants	Lamiaceae	<i>Vitex trifolia</i>			C		11

Kingdom Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	Lamiaceae	<i>Salvia misella</i>		Y			1/1
plants	Lamiaceae	<i>Clerodendrum</i>			C		1
plants	Lamiaceae	<i>Salvia</i>			C		1/1
plants	Lamiaceae	<i>Vitex trifolia</i> var. <i>subtrisetia</i>			C		2/2
plants	Lamiaceae	<i>Vitex trifolia</i> var. <i>trifolia</i>			C		3/2
plants	Lamiaceae	<i>Leonotis nepetifolia</i>		Y			1
plants	Lamiaceae	<i>Anisomeles malabarica</i>			C		3
plants	Lamiaceae	<i>Glossocarya hemiderma</i>		Y			22
plants	Lamiaceae	<i>Leucas lavandulifolia</i>			C		2/1
plants	Lamiaceae	<i>Pityrodia salviifolia</i>	pityrodia		C		2/1
plants	Lamiaceae	<i>Callicarpa pedunculata</i>	velvet leaf		C		1/1
plants	Lamiaceae	<i>Spartothamnella juncea</i>	native broom		C		1
plants	Lamiaceae	<i>Clerodendrum tomentosum</i>			C		2
plants	Lamiaceae	<i>Clerodendrum floribundum</i>			C		24/1
plants	Lamiaceae	<i>Plectranthus parviflorus</i>			C		5/3
plants	Lecythidaceae	<i>Planchonia careya</i>	cockatoo apple		C		57
plants	Lentibulariaceae	<i>Utricularia gibba</i>	floating bladderwort		C		1/1
plants	Loganiaceae	<i>Strychnos psilosperma</i>	strychnine tree		C		28/2
plants	Loganiaceae	<i>Mitrasacme nudicaulis</i> var. <i>nudicaulis</i>			C		1/1
plants	Loganiaceae	<i>Amyema conspicua</i> subsp. <i>conspicua</i>			C		1
plants	Loranthaceae	<i>Amyema congener</i> subsp. <i>rotundifolia</i>		Y			2/1
plants	Loranthaceae	<i>Dendrophthoe glabrescens</i>			C		2
plants	Loranthaceae	<i>Amylotheca dictyophleba</i>			C		3/2
plants	Loranthaceae	<i>Lysiana spathulata</i>			C		1/1
plants	Loranthaceae	<i>Amyema mackayensis</i>			C		1
plants	Loranthaceae	<i>Lysiana maritima</i>			C		2/2
plants	Loranthaceae	<i>Amyema biniflora</i>			C		1/1
plants	Loranthaceae	<i>Amyema miquelii</i>			C		2
plants	Lythraceae	<i>Ammannia multiflora</i>	jerry-jerry		C		5
plants	Malvaceae	<i>Hibiscus vitifolius</i>			C		1
plants	Malvaceae	<i>Thespesia populnea</i>			C		3/2
plants	Malvaceae	<i>Hibiscus meraukensis</i>	Merauke hibiscus		C		2
plants	Malvaceae	<i>Abutilon grandifolium</i>		Y			1
plants	Malvaceae	<i>Abutilon leucopetalum</i>		Y			4
plants	Malvaceae	<i>Malvastrum americanum</i>			C		13/3
plants	Malvaceae	<i>Hibiscus heterophyllus</i>			C		1/1
plants	Malvaceae	<i>Hibiscus tridactylites</i>			C		4/1
plants	Malvaceae	<i>Malvastrum coromandelianum</i>	prickly malvastrum	Y			2/1
plants	Malvaceae	<i>Abutilon oxycarpum</i> var. <i>oxycarpum</i>		Y			2
plants	Malvaceae	<i>Malvastrum americanum</i> var. <i>americanum</i>		Y			2
plants	Malvaceae	<i>Malvastrum coromandelianum</i> subsp. <i>coromandelianum</i>		Y			2/2
plants	Malvaceae	<i>Sida</i>			C		5
plants	Malvaceae	<i>Abutilon</i>			C		5
plants	Malvaceae	<i>Hibiscus</i>			C		6
plants	Malvaceae	<i>Sida acuta</i>	spinyhead sida	Y			1
plants	Malvaceae	<i>Sida spinosa</i>	spiny sida	Y			2/1

Kingdom Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	higher dicots	<i>Urena lobata</i>	urena weed	Y			1
plants	higher dicots	<i>Sida corrugata</i>			C		1
plants	higher dicots	<i>Sida magnifica</i>		Y	C		1/1
plants	higher dicots	<i>Sida cordifolia</i>	Chinese lantern				24/2
plants	higher dicots	<i>Abutilon auritum</i>			C		13
plants	higher dicots	<i>Sida hackettiana</i>		Y	C		36/2
plants	higher dicots	<i>Sida rhombifolia</i>					24/4
plants	higher dicots	<i>Abutilon albescens</i>			C		2/1
plants	higher dicots	<i>Abutilon oxycarpum</i>	cotton tree		C		4
plants	higher dicots	<i>Hibiscus tiliaceus</i>			C		2
plants	higher dicots	<i>Hibiscus divaricatus</i>			C		14/2
plants	higher dicots	<i>Melia azedarach</i>	white cedar		C		24
plants	higher dicots	<i>Owenia acidula</i>	emu apple		C		1
plants	higher dicots	<i>Dysoxylum gaudichaudianum</i>	ivory mahogany		C		1
plants	higher dicots	<i>Turraea pubescens</i>	native honeysuckle		C		51/2
plants	higher dicots	<i>Nymphoides indica</i>	water snowflake		C		2/1
plants	higher dicots	<i>Acacia fasciculifera</i>	scaly bark		C		29/2
plants	higher dicots	<i>Vachellia bidwillii</i>			C		7/1
plants	higher dicots	<i>Archidendropsis thozetiana</i>			C		25/4
plants	higher dicots	<i>Acacia excelsa subsp. excelsa</i>			C		1/1
plants	higher dicots	<i>Acacia crassa subsp. longicoma</i>			C		9/5
plants	higher dicots	<i>Acacia spirorbis subsp. solandri</i>			C		1/1
plants	higher dicots	<i>Neptunia gracilis forma gracilis</i>			C		4
plants	higher dicots	<i>Acacia leiocalyx subsp. leiocalyx</i>			C		10/1
plants	higher dicots	<i>Acacia julifera subsp. curvinervia</i>			C		1
plants	higher dicots	<i>Acacia disparima subsp. disparima</i>			C		32/3
plants	higher dicots	<i>Acacia penninervis var. longiracemosa</i>			C		1
plants	higher dicots	<i>Leucaena leucocephala subsp. leucocephala</i>		Y			3/3
plants	higher dicots	<i>Acacia</i>			C		2
plants	higher dicots	<i>Acacia decora</i>	pretty wattle		C		13
plants	higher dicots	<i>Acacia excelsa</i>			C		1
plants	higher dicots	<i>Acacia falcata</i>	sickle wattle		C		1
plants	higher dicots	<i>Acacia implexa</i>	lightwood		C		1/1
plants	higher dicots	<i>Acacia conferta</i>			C		17
plants	higher dicots	<i>Acacia julifera</i>			C		14
plants	higher dicots	<i>Acacia maidenii</i>	Maiden's wattle		C		14
plants	higher dicots	<i>Acacia salicina</i>	doolan		C		7/1
plants	higher dicots	<i>Albizia lebbek</i>	Indian siris		C		3/2
plants	higher dicots	<i>Acacia amblygona</i>	fan-leaf wattle		C		2
plants	higher dicots	<i>Acacia fimbriata</i>	Brisbane golden wattle		C		1
plants	higher dicots	<i>Acacia leiocalyx</i>			C		24
plants	higher dicots	<i>Acacia concurrens</i>			C		1
plants	higher dicots	<i>Acacia flavescens</i>	toothed wattle		C		3
plants	higher dicots	<i>Acacia junceifolia</i>			C		1
plants	higher dicots	<i>Acacia leptocarpa</i>	north coast wattle		C		5/1
plants	higher dicots	<i>Acacia macradenia</i>	zig-zag wattle		C		1

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plants	Mimosaceae	<i>Acacia aulacocarpa</i>			C		95
plants	Mimosaceae	<i>Acacia falciformis</i>	broad-leaved hickory		C		5
plants	Mimosaceae	<i>Acacia holosericea</i>			C		3/1
plants	Mimosaceae	<i>Acacia melanoxylon</i>	blackwood		C		1
plants	Mimosaceae	<i>Acacia sparsiflora</i>			C		1
plants	Mimosaceae	<i>Acacia podalyriifolia</i>	Queensland silver wattle		C		1
plants	Molluginaceae	<i>Glinus oppositifolius</i>			C		2/2
plants	Moraceae	<i>Ficus</i>			C		17
plants	Moraceae	<i>Ficus virens</i>			C		3
plants	Moraceae	<i>Ficus fraseri</i>	white sandpaper fig		C		1
plants	Moraceae	<i>Ficus obliqua</i>			C		17
plants	Moraceae	<i>Ficus coronata</i>			C		1
plants	Moraceae	<i>Ficus henneana</i>			C		1
plants	Moraceae	<i>Ficus opposita</i>			C		37/1
plants	Moraceae	<i>Ficus racemosa</i>			C		1
plants	Moraceae	<i>Ficus benjamina</i>			C		1
plants	Moraceae	<i>Trophis scandens</i>			C		12
plants	Moraceae	<i>Ficus watkinsiana</i>	green-leaved Moreton Bay fig		C		2
plants	Moraceae	<i>Streblus brunonianus</i>	whalebone tree		C		16/1
plants	Moraceae	<i>Maclura cochinchinensis</i>	cockspur thorn		C		4/1
plants	Moraceae	<i>Ficus virens var. virens</i>			C		1
plants	Moraceae	<i>Ficus microcarpa var. hillii</i>			C		1
plants	Moraceae	<i>Ficus racemosa var. racemosa</i>			C		9
plants	Moraceae	<i>Trophis scandens subsp. scandens</i>			C		45
plants	Moraceae	<i>Ficus rubiginosa forma glabrescens</i>			C		3/3
plants	Moraceae	<i>Embelia australiana</i>	embelia		C		6
plants	Myrsinaceae	<i>Myrsine variabilis</i>			C		28/2
plants	Myrsinaceae	<i>Aegiceras</i>			C		1
plants	Myrsinaceae	<i>Aegiceras corniculatum</i>	river mangrove		C		3/1
plants	Myrtaceae	<i>Eucalyptus major</i>	mountain grey gum		C		2/2
plants	Myrtaceae	<i>Eugenia uniflora</i>	Brazilian cherry tree	Y	C		1/1
plants	Myrtaceae	<i>Gossia bidwillii</i>			C		21/2
plants	Myrtaceae	<i>Melaleuca nodosa</i>			C		1
plants	Myrtaceae	<i>Backhousia kingii</i>			C		2/1
plants	Myrtaceae	<i>Eucalyptus crebra</i>			C		88/3
plants	Myrtaceae	<i>Gossia acmenoides</i>	narrow-leaved red ironbark		C		5
plants	Myrtaceae	<i>Melaleuca citrina</i>			C		1
plants	Myrtaceae	<i>Melaleuca nervosa</i>	scrub cherry		C		45/2
plants	Myrtaceae	<i>Syzygium australe</i>	long-fruited bloodwood		C		5
plants	Myrtaceae	<i>Corymbia polycarpa</i>	Queensland peppermint		C		3
plants	Myrtaceae	<i>Eucalyptus exserta</i>			C		58/1
plants	Myrtaceae	<i>Eucalyptus fibrosa</i>			C		2
plants	Myrtaceae	<i>Lithomyrtus obtusa</i>			C		1
plants	Myrtaceae	<i>Corymbia trachyphloia subsp. trachyphloia</i>			C		1
plants	Myrtaceae	<i>Eucalyptus tereticornis subsp. tereticornis</i>			C		4/4
plants	Myrtaceae	<i>Melaleuca dealbata</i>	swamp tea-tree		C		9

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plants	Myrtaceae	<i>Osbornia octodonta</i>	myrtle mangrove		C		3/1
plants	Myrtaceae	<i>Corymbia citriodora</i>	spotted gum		C		28/1
plants	Myrtaceae	<i>Corymbia intermedia</i>	pink bloodwood		C		29/1
plants	Myrtaceae	<i>Corymbia torelliana</i>	cadaghi		C		3/2
plants	Myrtaceae	<i>Melaleuca bracteata</i>			C		1
plants	Myrtaceae	<i>Melaleuca viminalis</i>			C		5
plants	Myrtaceae	<i>Rhodamnia spongiosa</i>			C		3/2
plants	Myrtaceae	<i>Syzygium luehmanni</i>			C		1
plants	Myrtaceae	<i>Corymbia tessellaris</i>	Moreton Bay ash		C		66
plants	Myrtaceae	<i>Eucalyptus moluccana</i>	gum-topped box		C		14/1
plants	Myrtaceae	<i>Corymbia clarksoniana</i>			C		47/2
plants	Myrtaceae	<i>Eucalyptus acmenoides</i>			C		5/1
plants	Myrtaceae	<i>Eucalyptus melliodora</i>	yellow box		C		1/1
plants	Myrtaceae	<i>Eugenia reinwardtiana</i>	beach cherry		C		1
plants	Myrtaceae	<i>Lophostemon confertus</i>	brush box		C		17/2
plants	Myrtaceae	<i>Melaleuca fluviatilis</i>			C		9
plants	Myrtaceae	<i>Melaleuca leucadendra</i>	broad-leaved tea-tree		C		1
plants	Myrtaceae	<i>Melaleuca viridiflora</i>			C		5
plants	Myrtaceae	<i>Corymbia erythrophloia</i>	variable-barked bloodwood		C		10/2
plants	Myrtaceae	<i>Eucalyptus platyphylla</i>	poplar gum		C		3/1
plants	Myrtaceae	<i>Lophostemon suaveolens</i>	swamp box		C		56
plants	Myrtaceae	<i>Melaleuca linariifolia</i>	snow-in summer		C		10
plants	Myrtaceae	<i>Eucalyptus tereticornis</i>	swamp paperbark		C		81/1
plants	Myrtaceae	<i>Melaleuca quinquenervia</i>			C		7/1
plants	Myrtaceae	<i>Melaleuca trichostachya</i>			C		1/1
plants	Myrtaceae	<i>Eucalyptus drepanophylla</i>			C		1
plants	Myrtaceae	<i>Leptospermum polygalifolium</i>	tantoon		C		2/1
plants	Myrtaceae	<i>Eucalyptus fibrosa subsp. fibrosa</i>			C		1
plants	Myrtaceae	<i>Psidium guajava</i>	guava	Y	C		2/1
plants	Myrtaceae	<i>Leptospermum</i>			C		2
plants	Myrtaceae	<i>Corymbia citriodora subsp. citriodora</i>			C		12/1
plants	Myrtaceae	<i>Melaleuca</i>			C		11
plants	Myrtaceae	<i>Eucalyptus</i>			C		5
plants	Nyctaginaceae	<i>Boerhavia pubescens</i>			C		1/1
plants	Nyctaginaceae	<i>Bougainvillea glabra</i>			C		1/1
plants	Nyctaginaceae	<i>Pisonia aculeata</i>	thorny pisonia	Y	C		1
plants	Nyctaginaceae	<i>Boerhavia</i>			C		2
plants	Nyctaginaceae	<i>Boerhavia burbridgeana</i>			C		1/1
plants	Ochnaceae	<i>Ochna serrulata</i>	ochna	Y	C		3/3
plants	Oleaceae	<i>Jasminum</i>			C		1
plants	Oleaceae	<i>Olea paniculata</i>			C		15
plants	Oleaceae	<i>Jasminum didymum</i>			C		5
plants	Oleaceae	<i>Notelaea microcarpa</i>			C		12
plants	Oleaceae	<i>Ligustrum australianum</i>			C		8/2
plants	Oleaceae	<i>Jasminum simplicifolium</i>			C		35
plants	Oleaceae	<i>Jasminum didymum subsp. didymum</i>			C		23

Kingdom Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	Oleaceae	<i>Jasminum didymum</i> subsp. <i>racemosum</i>			C		25/1
plants	Oleaceae	<i>Notelaea microcarpa</i> var. <i>microcarpa</i>			C		3
plants	Oleaceae	<i>Jasminum simplicifolium</i> subsp. <i>australiense</i>			C		19
plants	Onagraceae	<i>Ludwigia octovalvis</i>	willow primrose		C		6/2
plants	Onagraceae	<i>Ludwigia peploides</i> subsp. <i>montevideensis</i>			C		3/1
plants	Onagraceae	<i>Ludwigia perennis</i>			C		1/1
plants	Onagraceae	<i>Ludwigia</i>			C		4
plants	Orobanchaceae	<i>Buchnera gracilis</i>			C		1/1
plants	Oxalidaceae	<i>Oxalis corniculata</i>		Y	C		3/1
plants	Oxalidaceae	<i>Oxalis perennans</i>			C		3/1
plants	Oxalidaceae	<i>Oxalis</i>			C		5/1
plants	Passifloraceae	<i>Passiflora aurantia</i>		Y	C		3
plants	Passifloraceae	<i>Passiflora suberosa</i>	corky passion flower				95/2
plants	Passifloraceae	<i>Passiflora foetida</i>		Y			26/7
plants	Passifloraceae	<i>Passiflora subpeltata</i>	white passion flower	Y			4/1
plants	Pentapetaceae	<i>Melhania</i>			C		1
plants	Pentapetaceae	<i>Melhania oblongifolia</i>			C		3/1
plants	Petiveriaceae	<i>Monococcus echinophorus</i>			C		2
plants	Petiveriaceae	<i>Rivina humilis</i>	burr bush	Y			27/6
plants	Phyllanthaceae	<i>Phyllanthus microcladus</i>			C		9/1
plants	Phyllanthaceae	<i>Phyllanthus virgatus</i>			C		28/3
plants	Phyllanthaceae	<i>Bridelia</i>			C		2
plants	Phyllanthaceae	<i>Phyllanthus fuernrohrii</i>			C		1
plants	Phyllanthaceae	<i>Bridelia leichhardtii</i>			C		32/2
plants	Phyllanthaceae	<i>Glochidion lobocarpum</i>			C		28
plants	Phyllanthaceae	<i>Synostemon albiflorus</i>			C		6
plants	Phyllanthaceae	<i>Actephila sessilifolia</i>			C		3/2
plants	Phyllanthaceae	<i>Poranthera microphylla</i>	small poranthera		C		1
plants	Phyllanthaceae	<i>Flueggea</i>			C		3
plants	Phyllanthaceae	<i>Bridelia exaltata</i>			C		1
plants	Phyllanthaceae	<i>Flueggea leucopyrus</i>			C		9
plants	Phyllanthaceae	<i>Breynia oblongifolia</i>			C		77/2
plants	Phytolaccaceae	<i>Phytolacca octandra</i>	inkweed	Y			1/1
plants	Picrodendraceae	<i>Petalostigma pubescens</i>	quinine tree		C		68/1
plants	Picrodendraceae	<i>Dissiliaria muelleri</i>	Mueller's redheart		C		11/4
plants	Pittosporaceae	<i>Auranticarpa rhombifolia</i>			C		11
plants	Pittosporaceae	<i>Pittosporum ferrugineum</i>			C		20
plants	Pittosporaceae	<i>Pittosporum revolutum</i>	yellow pittosporum		C		12/1
plants	Pittosporaceae	<i>Pittosporum spinescens</i>			C		30/3
plants	Pittosporaceae	<i>Pittosporum ferrugineum</i> subsp. <i>linifolium</i>			C		2/2
plants	Pittosporaceae	<i>Bursaria incana</i>			C		3/1
plants	Pittosporaceae	<i>Pittosporum venulosum</i>	sweet pittosporum		C		6
plants	Pittosporaceae	<i>Pittosporum undulatum</i>			C		1
plants	Pittosporaceae	<i>Pittosporum</i>			C		1
plants	Plantaginaceae	<i>Stemodia glabella</i>			C		1/1
plants	Plantaginaceae	<i>Bacopa floribunda</i>			C		2/1

Kingdom Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	Plantaginaceae	<i>Plantago debilis</i>	shade plantain		C		1/1
plants	Plantaginaceae	<i>Scoparia dulcis</i>	scoparia	Y	C		4/1
plants	Plantaginaceae	<i>Bacopa monnieri</i>		Y	C		1/1
plants	Plantaginaceae	<i>Mecardonia procumbens</i>	native plumbago		C		3/2
plants	Plumbaginaceae	<i>Plumbago zeylanica</i>	club mangrove		C		1/1
plants	Plumbaginaceae	<i>Aegialitis annulata</i>			C		6/2
plants	Plumbaginaceae	<i>Limonium solanderi</i>			C		4/3
plants	Polygalaceae	<i>Polygala triflora</i>	match heads		C		1/1
plants	Polygalaceae	<i>Comesperma esulifolium</i>			C		1/1
plants	Polygalaceae	<i>Polygala linearifolia</i>			C		1
plants	Polygonaceae	<i>Persicaria decipiens</i>	slender knotweed		C		2/1
plants	Polygonaceae	<i>Persicaria attenuata</i>			C		2/2
plants	Polygonaceae	<i>Antigonon leptopus</i>		Y	C		3/3
plants	Polygonaceae	<i>Persicaria</i>			C		1/1
plants	Polygonaceae	<i>Polygonum</i>			C		3
plants	Polygonaceae	<i>Portulaca oleracea</i>	pigweed	Y	C		1
plants	Portulacaceae	<i>Portulaca pilosa</i>		Y	C		2
plants	Portulacaceae	<i>Calandrinia</i>			C		1/1
plants	Portulacaceae	<i>Portulaca</i>			C		1
plants	Portulacaceae	<i>Banksia integrifolia subsp. compar</i>			C		1/1
plants	Portulacaceae	<i>Banksia integrifolia</i>			C		1
plants	Proteaceae	<i>Grevillea helmsiae</i>	beefwood		C		1/1
plants	Proteaceae	<i>Grevillea striata</i>			C		1/1
plants	Proteaceae	<i>Grevillea robusta</i>			C		2
plants	Proteaceae	<i>Grevillea</i>			C		1
plants	Putranjivaceae	<i>Drypetes deplanchei</i>	grey boxwood		C		80
plants	Rhamnaceae	<i>Alphitonia excelsa</i>	soap tree		C		95/1
plants	Rhamnaceae	<i>Rhamnella vitiensis</i>			C		7/1
plants	Rhamnaceae	<i>Ventilago pubiflora</i>			C		9/2
plants	Rhamnaceae	<i>Pomaderris canescens</i>			C		2/2
plants	Rhamnaceae	<i>Emmenosperma cunninghamii</i>			C		1
plants	Rhamnaceae	<i>Pomaderris sp. (Mt Larcom J.Brushe JB259)</i>			C		2/2
plants	Rhamnaceae	<i>Pomaderris</i>		Y	C		1/1
plants	Rhamnaceae	<i>Cerlops tagal</i>	yellow mangrove		C		2
plants	Rhizophoraceae	<i>Bruguiera gymnorhiza</i>	large-fruited orange mangrove		C		2
plants	Rhizophoraceae	<i>Rhizophora stylosa</i>	spotted mangrove		C		7/1
plants	Rhizophoraceae	<i>Cerriops australis</i>			C		1/1
plants	Rosaceae	<i>Rubus probus</i>	loquat	Y	C		1/1
plants	Rosaceae	<i>Eriobotrya japonica</i>			C		2/1
plants	Rosaceae	<i>Rubus x novus</i>			C		1/1
plants	Rubiaceae	<i>Psychotria</i>			C		1
plants	Rubiaceae	<i>Psychotria odorata forma australiana</i>			C		8
plants	Rubiaceae	<i>Psychotria odorata forma buxifolia</i>			C		6
plants	Rubiaceae	<i>Timonius timon var. timon</i>			C		5/1
plants	Rubiaceae	<i>Cyclophyllum coprosmoides</i>			C		27
plants	Rubiaceae	<i>Coelospermum reticulatum</i>			C		74/3

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plants	Rubiaceae	<i>Psychotria loniceroides</i>	hairy psychotria		C		9
plants	Rubiaceae	<i>Hodgkinsonia ovatiflora</i>	golden ash		C		3
plants	Rubiaceae	<i>Gynochthodes canthoides</i>			C		3
plants	Rubiaceae	<i>Triflorensia ixoroides</i>			C		7
plants	Rubiaceae	<i>Triflorensia cameronii</i>			C		2
plants	Rubiaceae	<i>Spermacoe multicaulis</i>			C		14/3
plants	Rubiaceae	<i>Spermacoe brachystema</i>			C		2/1
plants	Rubiaceae	<i>Richardia brasiliensis</i>	white eye	Y	C		3/1
plants	Rubiaceae	<i>Psychotria daphnoides</i>			C		11/1
plants	Rubiaceae	<i>Pavetta australiensis</i>			C		7
plants	Rubiaceae	<i>Oldenlandia subulata</i>			C		2/2
plants	Rubiaceae	<i>Ixora queenslandica</i>			C		18/1
plants	Rubiaceae	<i>Naucllea orientalis</i>	Leichhardt tree		C		3
plants	Rubiaceae	<i>Mitracarpus hirtus</i>		Y	C		1/1
plants	Rubiaceae	<i>Knoxia sumatrensis</i>			C		3/3
plants	Rubiaceae	<i>Psychodra oleifolia</i>			C		6
plants	Rubiaceae	<i>Psychodra odorata</i>			C		24
plants	Rubiaceae	<i>Psychotria daphnoides var. pubescens</i>			C		1/1
plants	Rubiaceae	<i>Psychodra lamprophylla forma lamprophylla</i>			C		1
plants	Rubiaceae	<i>Pavetta australiensis var. australiensis</i>			C		4/2
plants	Rubiaceae	<i>Cyclophyllum coprosmoides var. spathulatum</i>			C		1/1
plants	Rubiaceae	<i>Oldenlandia mitrasacmoides subsp. trachymenoides</i>			C		3/3
plants	Rubiaceae	<i>Psychodra</i>			C		1/1
plants	Rubiaceae	<i>Psychodra odorata subsp. australiana</i>			C		2/2
plants	Rubiaceae	<i>Spermacoe</i>			C		1
plants	Rubiaceae	<i>Aidia racemosa</i>			C		33/8
plants	Rubiaceae	<i>Ixora beckleri</i>	brown coffeewood		C		2
plants	Rubiaceae	<i>Timonius timon</i>			C		1
plants	Rubiaceae	<i>Dentella repens</i>	dentella		C		3/2
plants	Rubiaceae	<i>Pomax umbellata</i>			C		3/2
plants	Rutaceae	<i>Sarcamelicope simplicifolia subsp. simplicifolia</i>	yellow aspen		C		3
plants	Rutaceae	<i>Citrus x limon</i>		Y	C		1
plants	Rutaceae	<i>Zanthoxylum brachyacanthum</i>			C		3
plants	Rutaceae	<i>Dinosperma erythrococtum</i>			C		5/1
plants	Rutaceae	<i>Dinosperma melanophloia</i>			C		7/4
plants	Rutaceae	<i>Bouchardata neurococca</i>	union nut		C		2/1
plants	Rutaceae	<i>Murraya ovatifoliolata</i>			C		8/2
plants	Rutaceae	<i>Acronychia imperforata</i>	beach acronychia		C		13/1
plants	Rutaceae	<i>Flindersia schottiana</i>	bumpy ash		C		2
plants	Rutaceae	<i>Acronychia pauciflora</i>	soft acronychia		C		7/3
plants	Rutaceae	<i>Flindersia australis</i>	crow's ash		C		11/1
plants	Rutaceae	<i>Bosistoa medicinalis</i>			C		19/13
plants	Rutaceae	<i>Geijera salicifolia</i>	brush wilga		C		34/2
plants	Rutaceae	<i>Acronychia</i>			C		1
plants	Rutaceae	<i>Medicosma</i>			C		1
plants	Rutaceae	<i>Zieria</i>			C		1/1

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plants	Rutaceae	<i>Coatesia paniculata</i>			C		7/1
plants	Rutaceae	<i>Bostioea transversa</i>	three-leaved bosistoa		C	V	12/11
plants	Rutaceae	<i>Murraya paniculata</i>			C		20
plants	Rutaceae	<i>Micromelum minutum</i>	clusterberry		C		26/2
plants	Rutaceae	<i>Acronychia laevis</i>	glossy acronychia		C		24
plants	Rutaceae	<i>Zieria actites</i>			E		6/6
plants	Rutaceae	<i>Murraya paniculata</i> cv. <i>Exotica</i>		Y			1
plants	Santalaceae	<i>Exocarpos cupressiformis</i>	native cherry		C		1/1
plants	Santalaceae	<i>Exocarpos latifolius</i>			C		52
plants	Sapindaceae	<i>Cupaniopsis</i> sp. (Watalgan A.R.Bean 8611)			C		13/13
plants	Sapindaceae	<i>Dodonaea lanceolata</i> var. <i>subsessilifolia</i>			C		3/3
plants	Sapindaceae	<i>Dodonaea viscosa</i> subsp. <i>burmanniana</i>			C		2/1
plants	Sapindaceae	<i>Jagera pseudorhus</i> var. <i>pseudorhus</i>			C		3/1
plants	Sapindaceae	<i>Cupaniopsis anacardioides</i>	tuckerroo		C		75
plants	Sapindaceae	<i>Rhysotoechia bifoliolata</i>			C		5
plants	Sapindaceae	<i>Elatostachys xylocarpa</i>	white tamarind		C		26/2
plants	Sapindaceae	<i>Cupaniopsis wadsworthii</i>			C		23/2
plants	Sapindaceae	<i>Alectryon diversifolius</i>	scrub boonaree		C		14/3
plants	Sapindaceae	<i>Cupaniopsis shirleyana</i>	wedge-leaf tuckerroo		V	V	3/1
plants	Sapindaceae	<i>Elatostachys nervosa</i>	green tamarind		C		1
plants	Sapindaceae	<i>Alectryon subdentatus</i>			C		25/2
plants	Sapindaceae	<i>Alectryon subcinereus</i>			C		1
plants	Sapindaceae	<i>Cupaniopsis simulata</i>			C		1/1
plants	Sapindaceae	<i>Alectryon tomentosus</i>			C		18/2
plants	Sapindaceae	<i>Dodonaea tenuifolia</i>			C		1/1
plants	Sapindaceae	<i>Dodonaea lanceolata</i>			C		13
plants	Sapindaceae	<i>Atalaya salicifolia</i>			C		16/6
plants	Sapindaceae	<i>Atalaya multiflora</i>	broad-leaved whitewood		C		6/2
plants	Sapindaceae	<i>Arytera divaricata</i>	coogera		C		12
plants	Sapindaceae	<i>Alectryon connatus</i>	grey birds-eye		C		48
plants	Sapindaceae	<i>Jagera pseudorhus</i>			C		51
plants	Sapindaceae	<i>Harpullia pendula</i>			C		8
plants	Sapindaceae	<i>Atalaya calcicola</i>			C		7/3
plants	Sapindaceae	<i>Harpullia hillei</i>			C		11
plants	Sapindaceae	<i>Dodonaea viscosa</i>			C		5
plants	Sapindaceae	<i>Atalaya collina</i>			E	E	12/11
plants	Sapindaceae	<i>Rhysotoechia bifoliolata</i> subsp. <i>bifoliolata</i>			C		1/1
plants	Sapindaceae	<i>Dodonaea</i>			C		8
plants	Sapindaceae	<i>Cupaniopsis</i>			C		4/2
plants	Sapindaceae	<i>Atalaya rigida</i>			C		17/14
plants	Sapindaceae	<i>Planchonella cotinifolia</i>			C		2
plants	Sapotaceae	<i>Pleioluma queenslandica</i>			C		2/1
plants	Sapotaceae	<i>Sersalisia sericea</i>			C		36/1
plants	Sapotaceae	<i>Planchonella cotinifolia</i> var. <i>pubescens</i>			C		17
plants	Sapotaceae	<i>Planchonella pohlmanniana</i>			C		10/1
plants	Scrophulariaceae	<i>Myoporum</i>			C		1

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plants	Scrophulariaceae	<i>Eremophila debilis</i>	winter apple		C		16/1
plants	Scrophulariaceae	<i>Myoporum acuminatum</i>	coastal boobiala		C		8
plants	Scrophulariaceae	<i>Myoporum boninense subsp. australe</i>			C		1/1
plants	Scrophulariaceae	<i>Ailanthus triphyssa</i>	white siris		C		2
plants	Simaroubaceae	<i>Samadera bidwillii</i>			V	V	3/3
plants	Solanaceae	<i>Solanum ellipticum</i>	potato bush		C		4
plants	Solanaceae	<i>Solanum nodiflorum</i>		Y			8/3
plants	Solanaceae	<i>Physalis angulata</i>		Y			2/2
plants	Solanaceae	<i>Datura stramonium</i>	common thomapple	Y			1
plants	Solanaceae	<i>Nicotiana glauca</i>	tree tobacco	Y			1/1
plants	Solanaceae	<i>Solanum torvum</i>	devil's fig	Y			7/3
plants	Solanaceae	<i>Solanum nigrum</i>		Y			8
plants	Solanaceae	<i>Physalis</i>		Y			1
plants	Solanaceae	<i>Solanum</i>		Y	C		2
plants	Solanaceae	<i>Capsicum frutescens</i>		Y			2
plants	Solanaceae	<i>Lycianthes shanesii</i>			C		1/1
plants	Solanaceae	<i>Solanum furturaceum</i>			C		3
plants	Solanaceae	<i>Solanum stelligerum</i>			C		7/1
plants	Solanaceae	<i>Solanum seaforthianum</i>	devil's needles	Y			27/1
plants	Solanaceae	<i>Solanum nigrum subsp. nigrum</i>	Brazilian nightshade	Y			1
plants	Solanaceae	<i>Physalis peruviana</i>		Y			6/1
plants	Sparmanniaceae	<i>Corchorus reynoldsiae</i>			C		2/2
plants	Sparmanniaceae	<i>Triumfetta rhomboidea</i>	chinese burr	Y			13/2
plants	Sparmanniaceae	<i>Corchorus trilobularis</i>			C		1/1
plants	Sparmanniaceae	<i>Grewia</i>			C		1
plants	Sparmanniaceae	<i>Grewia latifolia</i>	dysentery plant		C		24/1
plants	Sparmanniaceae	<i>Triumfetta repens</i>			C		2
plants	Sparmanniaceae	<i>Grewia retusifolia</i>			C		4/1
plants	Sparmanniaceae	<i>Stackhousia monogyna</i>	creamy candles		C		2
plants	Sterculiaceae	<i>Brachychiton</i>			C		1
plants	Sterculiaceae	<i>Argyrodendron trifoliolatum</i>			C		2
plants	Sterculiaceae	<i>Sterculia quadrifida</i>	booyong		C		33
plants	Sterculiaceae	<i>Brachychiton australis</i>	peanut tree		C		12
plants	Symplocaceae	<i>Symplocos stawellii</i>	broad-leaved bottle tree		C		2/1
plants	Thymelaeaceae	<i>Wikstroemia indica</i>	tie bush		C		4/2
plants	Thymelaeaceae	<i>Pimelea linifolia</i>			C		1
plants	Ulmaceae	<i>Trema tomentosa</i>			C		13/1
plants	Ulmaceae	<i>Celtis paniculata</i>	native celtis	Y			19
plants	Ulmaceae	<i>Aphananthe philippinensis</i>			C		5
plants	Urticaceae	<i>Dendrocnide photinophylla</i>	shiny-leaved stinging tree		C		7
plants	Verbenaceae	<i>Verbena</i>			C		1/1
plants	Verbenaceae	<i>Lantana montevidensis</i>	creeping lantana	Y			26/5
plants	Verbenaceae	<i>Verbena bonariensis</i>	purpletop	Y			1
plants	Verbenaceae	<i>Verbena incompta</i>		Y			2/2
plants	Verbenaceae	<i>Phyla nodiflora</i>	carpetweed		C		4/1
plants	Verbenaceae	<i>Phyla canescens</i>		Y			1/1

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plants	Verbenaceae	<i>Lantana</i>	lantana		C		1
plants	Verbenaceae	<i>Lantana camara</i>	Jamaica snakeweed	Y			76/4
plants	Verbenaceae	<i>Stachytarpheta jamaicensis</i>		Y			14/5
plants	Verbenaceae	<i>Verbena litoralis</i> var. <i>litoralis</i>		Y			3/3
plants	Violaceae	<i>Hybanthus stellarioides</i>			C		7/2
plants	Violaceae	<i>Hybanthus enneaspermus</i>			C		2/1
plants	Violaceae	<i>Hybanthus monopetalus</i>			C		1
plants	Violaceae	<i>Viola hederacea</i>	flat mistletoe		C		1/1
plants	Viscaceae	<i>Viscum articulatum</i>			C		1/1
plants	Viscaceae	<i>Notothixos incanus</i>	slender grape		C		1
plants	Vitaceae	<i>Cayratia clematidea</i>	shining grape		C		18/1
plants	Vitaceae	<i>Tetrasigma nitens</i>			C		1
plants	Vitaceae	<i>Cissus reniformis</i>			C		17
plants	Vitaceae	<i>Cissus oblonga</i>	hairy grape		C		46/2
plants	Vitaceae	<i>Cayratia acris</i>			C		12/1
plants	Vitaceae	<i>Cissus repens</i>			C		1
plants	Vitaceae	<i>Clematicissus opaca</i>			C		17
plants	Aytoniaceae	<i>Asterella drummondii</i>			C		2/2
plants	Frullaniaceae	<i>Frullania</i>			C		1/1
plants	Annonaceae	<i>Melodorum leichhardtii</i>			C		35
plants	Annonaceae	<i>Polyalthia nitidissima</i>	polyalthia		C		27
plants	Aristolochiaceae	<i>Aristolochia elegans</i>	calico-flower	Y			6/1
plants	Avicenniaceae	<i>Avicennia marina</i> subsp. <i>australasica</i>			C		2
plants	Avicenniaceae	<i>Avicennia marina</i>			C		3
plants	Hernandiaceae	<i>Gyrocarpus americanus</i>			C		3
plants	Hernandiaceae	<i>Gyrocarpus americanus</i> subsp. <i>americanus</i>			C		5/1
plants	Hernandiaceae	<i>Hernandia bivalvis</i>	cudgerie		NT		9/4
plants	Lauraceae	<i>Cassytha</i>			C		23
plants	Lauraceae	<i>Cryptocarya</i>			C		1
plants	Lauraceae	<i>Cassytha pubescens</i>	downy devil's twine		C		11
plants	Lauraceae	<i>Endiandra discolor</i>	domatia tree		C		1/1
plants	Lauraceae	<i>Litsea fawcettiana</i>			C		4/1
plants	Lauraceae	<i>Cassytha filiformis</i>	dodder laurel		C		7/1
plants	Lauraceae	<i>Cryptocarya bidwillii</i>	yellow laurel		C		5
plants	Lauraceae	<i>Cryptocarya triplinervis</i>			C		25
plants	Lauraceae	<i>Cryptocarya triplinervis</i> var. <i>pubens</i>			C		2/1
plants	Lauraceae	<i>Cryptocarya triplinervis</i> var. <i>triplinervis</i>			C		1/1
plants	Linderniaceae	<i>Lindernia crustacea</i>			C		5/1
plants	Menispermaceae	<i>Stephania japonica</i> var. <i>discolor</i>	pearl vine		C		2/1
plants	Menispermaceae	<i>Sarcopetalum harveyanum</i>			C		1
plants	Menispermaceae	<i>Stephania japonica</i>	wiry grape		C		15
plants	Menispermaceae	<i>Pleogyne australis</i>	snakevine	Y			31/1
plants	Menispermaceae	<i>Tinospora similacina</i>			C		8
plants	Menispermaceae	<i>Hypserpa decumbens</i>			C		7
plants	Monimiaceae	<i>Wilkiea macrophylla</i>	large-leaved wilkiea		C		5/2
plants	Nymphaeaceae	<i>Nymphaea gigantea</i>			C		1/1

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plants	Nymphaeaceae	<i>Nymphaea caerulea</i>		Y			3/1
plants	Nymphaeaceae	<i>Nymphaea</i>			C		1
plants	Papaveraceae	<i>Argemone ochroleuca subsp. ochroleuca</i>	Mexican poppy	Y			2/2
plants	Papaveraceae	<i>Argemone mexicana</i>	prickly poppy	Y			1/1
plants	Papaveraceae	<i>Argemone ochroleuca</i>		Y			1
plants	Piperaceae	<i>Peperomia blanda var. floribunda</i>			C		4/1
plants	Piperaceae	<i>Piper hederaceum</i>			C		1
plants	Piperaceae	<i>Peperomia blanda</i>			C		1
plants	Piperaceae	<i>Peperomia</i>			C		5
plants	Ranunculaceae	<i>Clematis glycinoides</i>			C		1
plants	Agavaceae	<i>Agave americana var. americana cv. Marginata</i>		Y			1/1
plants	Agavaceae	<i>Agave vivipara var. vivipara</i>		Y			1/1
plants	Agavaceae	<i>Furcraea foetida</i>		Y			2/2
plants	Agavaceae	<i>Agave americana</i>		Y			2
plants	Agavaceae	<i>Furcraea selloa</i>		Y			1/1
plants	Agavaceae	<i>Proiphys cunninghamii</i>		Y			2/2
plants	Amaryllidaceae	<i>Crinum pedunculatum</i>	Moreton Bay lily		C		2/1
plants	Amaryllidaceae	<i>Crinum</i>	river lily		C		5
plants	Amaryllidaceae	<i>Syngonium podophyllum</i>		Y			1/1
plants	Araceae	<i>Lemna</i>					2
plants	Araceae	<i>Typhonium brownii</i>			C		1/1
plants	Araceae	<i>Gymnostachys anceps</i>	black arum lily		C		6/1
plants	Araceae	<i>Livistona decora</i>	settler's flax		C		5
plants	Araceae	<i>Syagrus romanzoffiana</i>	Queen palm	Y			2
plants	Asparagaceae	<i>Asparagus plumosus</i>	feathered asparagus fern	Y			1
plants	Asparagaceae	<i>Asparagus africanus</i>	ornamental asparagus	Y			2
plants	Asparagaceae	<i>Asparagus aethiopicus cv. Sprengeri</i>	basket asparagus fern	Y			1/1
plants	Colchicaceae	<i>Iphigenia indica</i>			C		1
plants	Commelinaceae	<i>Commelina ensifolia</i>	scurvy grass		C		2
plants	Commelinaceae	<i>Aneilema acuminatum</i>			C		5/1
plants	Commelinaceae	<i>Murdannia graminea</i>	murdannia		C		11/2
plants	Commelinaceae	<i>Commelina diffusa</i>	wandering jew		C		4
plants	Commelinaceae	<i>Commelina</i>			C		3
plants	Commelinaceae	<i>Aneilema</i>			C		1
plants	Cyperaceae	<i>Cyperus alopecuroides</i>			C		2
plants	Cyperaceae	<i>Lepidosperma laterale</i>			C		2/1
plants	Cyperaceae	<i>Fimbristylis dichotoma</i>	common fringe-rush		C		17/5
plants	Cyperaceae	<i>Eleocharis dietrichiana</i>			C		1/1
plants	Cyperaceae	<i>Fimbristylis aestivalis</i>			C		4
plants	Cyperaceae	<i>Fimbristylis ferruginea</i>			C		3/3
plants	Cyperaceae	<i>Fimbristylis microcarya</i>			C		1/1
plants	Cyperaceae	<i>Fimbristylis pauciflora</i>			C		1/1
plants	Cyperaceae	<i>Fimbristylis tristachya</i>			C		1/1
plants	Cyperaceae	<i>Scleria novae-hollandiae</i>			C		2
plants	Cyperaceae	<i>Eleocharis philippinensis</i>			C		2/1
plants	Cyperaceae	<i>Fimbristylis bisumbellata</i>			C		5

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plants	monocots	Cyperaceae	<i>Fimbristylis polytrichoides</i>			C		5/1
plants	monocots	Cyperaceae	<i>Cyperus conicus</i> var. <i>conicus</i>			C		1/1
plants	monocots	Cyperaceae	<i>Fimbristylis quinqueangularis</i>			C		2/1
plants	monocots	Cyperaceae	<i>Cyperus polystachyos</i> var. <i>polystachyos</i>			C		1/1
plants	monocots	Cyperaceae	<i>Cyperus dietrichiae</i> var. <i>brevibracteatus</i>			C		2
plants	monocots	Cyperaceae	<i>Cyperus difformis</i>	rice sedge		C		4/1
plants	monocots	Cyperaceae	<i>Cyperus exaltatus</i>	tall flatsedge		C		1
plants	monocots	Cyperaceae	<i>Cyperus flaccidus</i>			C		7
plants	monocots	Cyperaceae	<i>Cyperus scariosus</i>			C		2/2
plants	monocots	Cyperaceae	<i>Isolepis fluitans</i>	floating club rush		C		1
plants	monocots	Cyperaceae	<i>Schoenus falcatus</i>			C		1/1
plants	monocots	Cyperaceae	<i>Abildgaardia ovata</i>			C		5/2
plants	monocots	Cyperaceae	<i>Cyperus cyperoides</i>			C		2
plants	monocots	Cyperaceae	<i>Cyperus leiocaulon</i>			C		2/2
plants	monocots	Cyperaceae	<i>Cyperus squarrosus</i>			C		1/1
plants	monocots	Cyperaceae	<i>Cyperus tenuispica</i>	bearded flatsedge		C		1
plants	monocots	Cyperaceae	<i>Cyperus brevifolius</i>	Mullumbimby couch	Y	C		1
plants	monocots	Cyperaceae	<i>Scleria</i>			C		14
plants	monocots	Cyperaceae	<i>Fimbristylis</i>			C		1
plants	monocots	Cyperaceae	<i>Baumea juncea</i>			C		12
plants	monocots	Cyperaceae	<i>Carex inversa</i>	bare twigrush		C		1/1
plants	monocots	Cyperaceae	<i>Gahnia aspera</i>	knob sedge		C		1
plants	monocots	Cyperaceae	<i>Cyperus fulvus</i>			C		37/3
plants	monocots	Cyperaceae	<i>Cyperus scaber</i>			C		3/3
plants	monocots	Cyperaceae	<i>Cyperus enervis</i>			C		1
plants	monocots	Cyperaceae	<i>Cyperus papyrus</i>	papyrus	Y	C		1
plants	monocots	Cyperaceae	<i>Cyperus gracilis</i>			C		10
plants	monocots	Cyperaceae	<i>Cyperus rotundus</i>	nutgrass	Y	C		1
plants	monocots	Cyperaceae	<i>Fuirena ciliaris</i>			C		3
plants	monocots	Cyperaceae	<i>Baumea articulata</i>	jointed twigrush		C		1
plants	monocots	Cyperaceae	<i>Carex breviculmis</i>			C		1
plants	monocots	Cyperaceae	<i>Cyperus aquatilis</i>			C		1/1
plants	monocots	Cyperaceae	<i>Abildgaardia vaginata</i>			C		1/1
plants	monocots	Cyperaceae	<i>Scleria mackaviensis</i>			C		18
plants	monocots	Cyperaceae	<i>Cyperus polystachyos</i>			C		5/1
plants	monocots	Cyperaceae	<i>Cyperus involucreatus</i>		Y	C		4/4
plants	monocots	Cyperaceae	<i>Fimbristylis nutans</i>			C		1
plants	monocots	Cyperaceae	<i>Cyperus concinnus</i>			C		1/1
plants	monocots	Cyperaceae	<i>Cyperus perangustus</i>			C		4
plants	monocots	Cyperaceae	<i>Cyperus tetraclarpus</i>			C		1/1
plants	monocots	Dioscoreaceae	<i>Dioscorea transversa</i>	native yam		C		18
plants	monocots	Dracaenaceae	<i>Sansevieria trifasciata</i> var. <i>trifasciata</i>		Y	C		1/1
plants	monocots	Eriocaulaceae	<i>Eriocaulon scariosum</i>			C		1/1
plants	monocots	Hemerocallidaceae	<i>Dianella caerulea</i>			C		30
plants	monocots	Hemerocallidaceae	<i>Dianella brevipedunculata</i>			C		9/1

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plants	Hemerocallidaceae	<i>Geitonoplesium cymosum</i>					31
plants	Hemerocallidaceae	<i>Dianella longifolia</i>	scrambling lily		C		7/2
plants	Hemerocallidaceae	<i>Dianella</i>			C		19
plants	Hemerocallidaceae	<i>Dianella rara</i>			C		7/4
plants	Hemerocallidaceae	<i>Dianella caerulea var. vannata</i>			C		1
plants	Hemerocallidaceae	<i>Dianella revoluta</i>			C		9
plants	Hydrocharitaceae	<i>Hydrilla verticillata</i>	hydrilla		C		1/1
plants	Hydrocharitaceae	<i>Ottelia ovalifolia</i>	swamp lily		C		1
plants	Hydrocharitaceae	<i>Halophila ovalis</i>			C		2
plants	Hypoxidaceae	<i>Hypoxis pratensis var. pratensis</i>	yellow autumn lily		C		1/1
plants	Johnsniaceae	<i>Tricoryne elatior</i>			C		3/1
plants	Juncaceae	<i>Juncus</i>			C		4
plants	Juncaceae	<i>Juncus kraussii</i>	sea rush		C		1/1
plants	Juncaceae	<i>Juncus continuus</i>			C		2
plants	Juncaceae	<i>Juncus polyanthemus</i>			C		3/1
plants	Juncaginaceae	<i>Cycnogeton procerus</i>			C		1
plants	Juncaginaceae	<i>Triglochin striata</i>	streaked arrowgrass		C		1/1
plants	Laxmanniaceae	<i>Lomandra longifolia</i>			C		23/1
plants	Laxmanniaceae	<i>Lomandra leucocephala subsp. leucocephala</i>			C		2/2
plants	Laxmanniaceae	<i>Eustrephus latifolius</i>	wombat berry		C		68/1
plants	Laxmanniaceae	<i>Lomandra multiflora subsp. multiflora</i>			C		6/4
plants	Laxmanniaceae	<i>Lomandra confertifolia subsp. pallida</i>			C		16/3
plants	Laxmanniaceae	<i>Cordyline manners-suttoniae</i>			C		1/1
plants	Laxmanniaceae	<i>Lomandra confertifolia</i>			C		7
plants	Laxmanniaceae	<i>Lomandra multiflora</i>			C		7
plants	Laxmanniaceae	<i>Thysanotus tuberosus</i>			C		1
plants	Laxmanniaceae	<i>Lomandra</i>			C		5
plants	Laxmanniaceae	<i>Lomandra gracilis</i>			C		1
plants	Laxmanniaceae	<i>Thysanotus tuberosus subsp. tuberosus</i>			C		1/1
plants	Orchidaceae	<i>Chiloglottis diphylla</i>			C		1/1
plants	Orchidaceae	<i>Sarcocochilus dilatatus</i>	brown sarcochilus		C		1/1
plants	Orchidaceae	<i>Cymbidium canaliculatum</i>			C		4
plants	Orchidaceae	<i>Bulbophyllum minutissimum</i>	grain-of-wheat orchid		C		1/1
plants	Orchidaceae	<i>Caladenia carnea var. carnea</i>			C		1/1
plants	Orchidaceae	<i>Pterostylis revoluta</i>	autumn greenhood		C		1/1
plants	Orchidaceae	<i>Geodorum densiflorum</i>	pink nodding orchid		C		6/1
plants	Orchidaceae	<i>Dockrillia schoenina</i>	pencil orchid		C		1
plants	Orchidaceae	<i>Dendrobium speciosum</i>			C		1
plants	Orchidaceae	<i>Acianthus fornicatus</i>	pixie caps		C		1/1
plants	Orchidaceae	<i>Dockrillia bowmanii</i>	scrub pencil orchid		C		4
plants	Orchidaceae	<i>Dendrobium discolor</i>			C		2/1
plants	Orchidaceae	<i>Pterostylis nutans</i>			C		1/1
plants	Orchidaceae	<i>Dipodium punctatum</i>			C		1
plants	Orchidaceae	<i>Dockrillia mortii</i>			C		1
plants	Orchidaceae	<i>Corybas barbaeae</i>	helmet orchid		C		1/1
plants	Orchidaceae	<i>Caladenia carnea</i>			C		2/2

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plants	Orchidaceae	<i>Dendrobium</i>			C		9
plants	Orchidaceae	<i>Dipodium</i>			C		1
plants	Orchidaceae	<i>Caladenia</i>			C		2/1
plants	Pandanaceae	<i>Pandanus tectorius</i>			C		1/1
plants	Pandanaceae	<i>Pandanus</i>			C		1
plants	Phylodraceae	<i>Philydrum lanuginosum</i>	frogsmouth		C		2
plants	Poaceae	<i>Eremochloa bimaclata</i>	poverty grass		C		4/2
plants	Poaceae	<i>Heteropogon contortus</i>	black speargrass		C		71/2
plants	Poaceae	<i>Heteropogon triticeus</i>	giant speargrass		C		2
plants	Poaceae	<i>Opilsimerus imbecillis</i>			C		1
plants	Poaceae	<i>Schizachyrium fragile</i>	firegrass		C		2
plants	Poaceae	<i>Sporobolus natalensis</i>		Y	C		1/1
plants	Poaceae	<i>Sporobolus virginicus</i>	sand couch		C		13
plants	Poaceae	<i>Alloteropsis semialata</i>	cockatoo grass		C		14/4
plants	Poaceae	<i>Aristida caput-medusae</i>			C		1
plants	Poaceae	<i>Aristida queenslandica</i>			C		1
plants	Poaceae	<i>Arundinella nepalensis</i>	reedgrass		C		19
plants	Poaceae	<i>Chrysopogon sylvaticus</i>			C		1/1
plants	Poaceae	<i>Cleistochloa subjuncea</i>			C		1/1
plants	Poaceae	<i>Sorghum nitidum forma aristatum</i>			C		1/1
plants	Poaceae	<i>Dinebra decipiens var. decipiens</i>			C		4/3
plants	Poaceae	<i>Dinebra decipiens var. peacockii</i>			C		12/1
plants	Poaceae	<i>Megathyrsus maximus var. maximus</i>			C		6/2
plants	Poaceae	<i>Chloris divaricata var. divaricata</i>	slender chloris	Y	C		12
plants	Poaceae	<i>Megathyrsus maximus var. coloratus</i>		Y	C		4/1
plants	Poaceae	<i>Setaria pumila subsp. subtesselata</i>		Y	C		2/1
plants	Poaceae	<i>Bothriochloa bladhii subsp. bladhii</i>		Y	C		2
plants	Poaceae	<i>Megathyrsus maximus var. pubigulumis</i>		Y	C		5/2
plants	Poaceae	<i>Microlaena stipoides var. stipoides</i>		Y	C		17/4
plants	Poaceae	<i>Cynodon nilembuensis var. nilembuensis</i>		Y	C		2
plants	Poaceae	<i>Dichanthium sericeum subsp. sericeum</i>		Y	C		1/1
plants	Poaceae	<i>Eragrostis minor</i>	smaller stinkgrass	Y	C		2/2
plants	Poaceae	<i>Hyparrhenia rufa</i>		Y	C		2
plants	Poaceae	<i>Ottochloa nodosa</i>			C		13/1
plants	Poaceae	<i>Sporobolus laxus</i>	kangaroo grass		C		2/1
plants	Poaceae	<i>Themeda triandra</i>	purple plumegrass		C		1
plants	Poaceae	<i>Triaraphis mollis</i>			C		48/4
plants	Poaceae	<i>Urochloa foliosa</i>			C		2
plants	Poaceae	<i>Aristida calycina</i>			C		2/2
plants	Poaceae	<i>Aristida contorta</i>	bunched kerosene grass		C		2
plants	Poaceae	<i>Cenchrus setaceus</i>		Y	C		1/1
plants	Poaceae	<i>Digitaria brownii</i>			C		1/1
plants	Poaceae	<i>Digitaria diffusa</i>	wiry panic		C		1/1
plants	Poaceae	<i>Eriolasia stricta</i>	slender cupgrass		C		18
plants	Poaceae	<i>Eriochloa procerata</i>	coolati grass		C		8
plants	Poaceae	<i>Hyparrhenia hirta</i>		Y	C		6/1
							1

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plants	Poaceae	<i>Sorghum halepense</i>	Johnson grass	Y			2/1
plants	Poaceae	<i>Spinifex sericeus</i>	beach spinifex		C		6/1
plants	Poaceae	<i>Aristida holathera</i>			C		1
plants	Poaceae	<i>Aristida personata</i>			C		1/1
plants	Poaceae	<i>Bromus catharticus</i>	prairie grass	Y			1/1
plants	Poaceae	<i>Cenchrus echinatus</i>	Mossman River grass	Y			17/5
plants	Poaceae	<i>Chloris ventricosa</i>	tall chloris		C		2
plants	Poaceae	<i>Chrysopogon fallax</i>			C		20/1
plants	Poaceae	<i>Digitaria bicornis</i>	summer grass		C		2/2
plants	Poaceae	<i>Digitaria ciliaris</i>		Y			1/1
plants	Poaceae	<i>Digitaria eriantha</i>		Y			1
plants	Poaceae	<i>Echinochloa colona</i>	awnless barnyard grass	Y			2/1
plants	Poaceae	<i>Eragrostis brownii</i>	Brown's lovegrass		C		5/2
plants	Poaceae	<i>Eragrostis curvula</i>		Y			2/2
plants	Poaceae	<i>Bothriochloa decipiens</i> var. <i>decipiens</i>			C		12/2
plants	Poaceae	<i>Aristida queenslandica</i> var. <i>dissimilis</i>			C		12/4
plants	Poaceae	<i>Aristida queenslandica</i> var. <i>queenslandica</i>			C		5
plants	Poaceae	<i>Calyptochloa gracillima</i> subsp. <i>gracillima</i>		Y			2
plants	Poaceae	<i>Digitaria</i>			C		2
plants	Poaceae	<i>Eriochloa</i>			C		3
plants	Poaceae	<i>Ischaemum</i>			C		2
plants	Poaceae	<i>Poa annua</i>	annual poa	Y			1/1
plants	Poaceae	<i>Eragrostis</i>			C		10
plants	Poaceae	<i>Opilismenus</i>			C		5
plants	Poaceae	<i>Sorghum arundinaceum</i>	Rhodesian Sudan grass	Y			3/3
plants	Poaceae	<i>Sporobolus africanus</i>	Parramatta grass	Y			1/1
plants	Poaceae	<i>Sporobolus elongatus</i>			C		3/2
plants	Poaceae	<i>Themeda quadrivalvis</i>	grader grass	Y			3/3
plants	Poaceae	<i>Chionachne cyathopoda</i>	river grass		C		1/1
plants	Poaceae	<i>Cymbopogon bombycinus</i>	silky oilgrass	Y			4
plants	Poaceae	<i>Eragrostis interrupta</i>			C		5
plants	Poaceae	<i>Eragrostis leptocarpa</i>	drooping lovegrass		C		1/1
plants	Poaceae	<i>Eragrostis parviflora</i>	weeping lovegrass		C		3
plants	Poaceae	<i>Eragrostis tenuifolia</i>	elastic grass	Y			2/1
plants	Poaceae	<i>Entolasia marginata</i>	bordered panic		C		1/1
plants	Poaceae	<i>Eragrostis elongata</i>			C		8/1
plants	Poaceae	<i>Imperata cylindrica</i>	blady grass		C		25/2
plants	Poaceae	<i>Megathyrsus maximus</i>		Y			8
plants	Poaceae	<i>Melinis minutiflora</i>	molasses grass	Y			1
plants	Poaceae	<i>Paspalidium distans</i>	shotgrass		C		21/4
plants	Poaceae	<i>Paspalidium gracile</i>	slender panic		C		2
plants	Poaceae	<i>Bothriochloa bladhii</i>			C		3
plants	Poaceae	<i>Cymbopogon refractus</i>	barbed-wire grass		C		24/1
plants	Poaceae	<i>Digitaria longiflora</i>			C		1/1
plants	Poaceae	<i>Digitaria parviflora</i>			C		9
plants	Poaceae	<i>Digitaria violascens</i>	bastard summergrass	Y			1

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plants	Poaceae	<i>Enneapogon avenaceus</i>			C		1
plants	Poaceae	<i>Eragrostis lacunaria</i>	purple lovegrass		C		1/1
plants	Poaceae	<i>Ottochloa gracillima</i>	padmelon grass		C		8/1
plants	Poaceae	<i>Phragmites australis</i>	common reed		C		1/1
plants	Poaceae	<i>Chloris</i>			C		4
plants	Poaceae	<i>Cynodon</i>			C		2
plants	Poaceae	Poaceae			C		1
plants	Poaceae	<i>Aristida</i>			C		27
plants	Poaceae	<i>Paspalum</i>			C		3
plants	Poaceae	<i>Paspalidium</i>			C		8
plants	Poaceae	<i>Bothriochloa</i>			C		1
plants	Poaceae	<i>Chloris gayana</i>	rhodes grass	Y			2/1
plants	Poaceae	<i>Melinis repens</i>	red natal grass	Y			36/4
plants	Poaceae	<i>Panicum simile</i>			C		10
plants	Poaceae	<i>Aristida ramosa</i>	purple wiregrass		C		1
plants	Poaceae	<i>Aristida spuria</i>			C		1
plants	Poaceae	<i>Aristida vagans</i>			C		4
plants	Poaceae	<i>Chloris inflata</i>	purple top rhodes	Y			10/4
plants	Poaceae	<i>Chloris virgata</i>	feathertop rhodes grass	Y			2/1
plants	Poaceae	<i>Eleusine indica</i>	crowfoot grass	Y			3/3
plants	Poaceae	<i>Panicum effusum</i>					17/2
plants	Poaceae	<i>Sehima nervosum</i>			C		2/2
plants	Poaceae	<i>Setaria surgens</i>			C		7/1
plants	Poaceae	<i>Sorghum nitidum</i>			C		6
plants	Poaceae	<i>Sorghum x almum</i>		Y			2/1
plants	Poaceae	<i>Urochloa mutica</i>		Y			2/1
plants	Poaceae	<i>Chloris truncata</i>			C		1/1
plants	Poaceae	<i>Cynodon dactylon</i>		Y			4
plants	Poaceae	<i>Digitaria tumida</i>		Y			1/1
plants	Poaceae	<i>Echinochloa crus-galli</i>	barnyard grass	Y			1/1
plants	Poaceae	<i>Enneapogon lindleyanus</i>			C		5/1
plants	Poaceae	<i>Enteropogon unispiceus</i>			C		7
plants	Poaceae	<i>Paspalidium disjunctum</i>			C		2
plants	Poaceae	<i>Paspalum scrobiculatum</i>			C		4
plants	Poaceae	<i>Sporobolus pyramidalis</i>	ditch millet		C		5/1
plants	Poaceae	<i>Urochloa mosambicensis</i>	sabi grass	Y			1
plants	Poaceae	<i>Urochloa subquadriflora</i>	hooky grass	Y			4
plants	Poaceae	<i>Ancistrachne uncinulata</i>			C		25/1
plants	Poaceae	<i>Eragrostis leptostachya</i>			C		7
plants	Poaceae	<i>Eragrostis spartinoidea</i>			C		22/1
plants	Poaceae	<i>Polyopogon monspeliensis</i>	annual beardgrass	Y			1
plants	Poaceae	<i>Capillipedium spicigerum</i>	spicytop		C		6
plants	Poaceae	<i>Dactyloctenium aegyptium</i>	coast button grass	Y			6/2
plants	Poaceae	<i>Enneapogon robustissimus</i>			C		2/2
plants	Poaceae	<i>Capillipedium parviflorum</i>	scented top		C		3/2
plants	Poaceae	<i>Digitaria divaricatissima</i>	spreading umbrella grass		C		1/1

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plants	Poaceae	<i>Diplachne fusca</i> var. <i>fusca</i>			C		2/2
plants	Poaceae	<i>Eriochloa pseudoacrotricha</i>			C		3/1
plants	Poaceae	<i>Schizachyrium pachyarthron</i>			C		1/1
plants	Poaceae	<i>Hyparrhenia rufa</i> subsp. <i>rufa</i>		Y			8/7
plants	Poaceae	<i>Cynodon dactylon</i> var. <i>dactylon</i>		Y			2
plants	Poaceae	<i>Aristida calycina</i> var. <i>calycina</i>			C		5/3
plants	Poaceae	<i>Eragrostis sororia</i>			C		5/2
plants	Poaceae	<i>Opilismenus aemulus</i>	creeping shade grass		C		11/1
plants	Poaceae	<i>Paspalidium gausum</i>			C		1
plants	Poaceae	<i>Paspalum dilatatum</i>		Y			2/1
plants	Poaceae	<i>Paspalum vaginatum</i>	paspalum		C		1/1
plants	Poaceae	<i>Setaria sphacelata</i>	saltwater couch	Y			1
plants	Poaceae	<i>Aristida gracilipes</i>			C		5
plants	Poaceae	<i>Digitaria ammophila</i>	silky umbrella grass		C		1/1
plants	Poaceae	<i>Digitaria didactyla</i>	Queensland blue couch	Y			4/1
plants	Poaceae	<i>Digitaria ramularis</i>			C		1/1
plants	Pontederiaceae	<i>Monochoria cyanea</i>		Y			2
plants	Pontederiaceae	<i>Eichhornia crassipes</i>	water hyacinth		C		2/2
plants	Potamogetonaceae	<i>Stuckenia pectinata</i>			C		1/1
plants	Potamogetonaceae	<i>Potamogeton octandrus</i>			C		1/1
plants	Potamogetonaceae	<i>Potamogeton crispus</i>	curly pondweed		C		1/1
plants	Ripogonaceae	<i>Ripogonum brevifolium</i>	small-leaved supplejack		C		3
plants	Smilacaceae	<i>Smilax glyciphylla</i>	sweet sarsaparilla		C		3/1
plants	Smilacaceae	<i>Smilax australis</i>	barbed-wire vine		C		28
plants	Strelitziaceae	<i>Strelitzia</i>			C		1/1
plants	Typhaceae	<i>Typha domingensis</i>			C		3/2
plants	Typhaceae	<i>Typha</i>			C		4
plants	Typhaceae	<i>Typha orientalis</i>	broad-leaved cumbungi		C		1
plants	Xanthorrhoeaceae	<i>Xanthorrhoea</i>			C		8/1
plants	Xanthorrhoeaceae	<i>Xanthorrhoea fulva</i>			C		2/2
plants	Xanthorrhoeaceae	<i>Xanthorrhoea pumilio</i>	swamp grasstree		C		2/1
plants	Xanthorrhoeaceae	<i>Xanthorrhoea johnsonii</i>		Y			3
plants	Xanthorrhoeaceae	<i>Xanthorrhoea latifolia</i>			C		1
plants	Xanthorrhoeaceae	<i>Xanthorrhoea latifolia</i> subsp. <i>latifolia</i>			C		28/1
plants	Xyridaceae	<i>Xyris complanata</i>	yellow-eye		C		2/1
plants	Zosteraceae	<i>Zostera capricorni</i>	eelgrass		C		1
plants	Fissidentaceae	<i>Fissidens asplenoides</i>			C		1/1
plants	Funariaceae	<i>Entosthodon apophysatus</i>			C		1/1
plants	Hypopterygiaceae	<i>Hypopterygium tamarisci</i>			C		1/1
plants	Orthotrichaceae	<i>Macromitrium aurescens</i>			C		1/1
plants	Orthotrichaceae	<i>Macromitrium diaphanum</i>			C		1/1
plants	Ptychomitriaceae	<i>Ptychomitrium muelleri</i>			C		1/1
plants	Indet.	<i>Indet.</i>			C		12
protists	Cyanophyceae	<i>Kyrtuthrix maculans</i>			C		1/1
protists	Phaeophyceae	<i>Sargassum opacum</i>			C		1/1
protists	Phaeophyceae	<i>Sporochnus comosus</i>			C		1/1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
protists	brown algae	Phaeophyceae	<i>Mesospora schmidtii</i>			C		1/1
protists	green algae	Chlorophyceae	<i>Trentophila odorata</i>			C		1/1
protists	red algae	Rhodophyceae	<i>Gracilaria edulis</i>			C		1/1

CODES

- I - Y indicates that the taxon is introduced to Queensland and has naturalised.
 - Q - Indicates the Queensland conservation status of each taxon under the *Nature Conservation Act 1992*. The codes are Extinct in the Wild (PE), Endangered (E), Vulnerable (V), Near Threatened (NT), Least Concern (C) or Not Protected ().
 - A - Indicates the Australian conservation status of each taxon under the *Environment Protection and Biodiversity Conservation Act 1999*. The values of EPBC are Conservation Dependent (CD), Critically Endangered (CE), Endangered (E), Extinct (EX), Extinct in the Wild (XW) and Vulnerable (V).
- Records – The first number indicates the total number of records of the taxon for the record option selected (i.e. All, Confirmed or Specimens). This number is output as 99999 if it equals or exceeds this value. The second number located after the / indicates the number of specimen records for the taxon. This number is output as 999 if it equals or exceeds this value.

Appendix D

Local Statement of Integrity (Adaptive Strategies)



Priority Port Master Planning
Addendum to evidence base - Priority Port of Gladstone

Local Statement of Integrity

DOCUMENT TRACKING

PREPARED BY:	Tom Kaveney (Adaptive Strategies)
VERSION:	Final v2
DATE:	2017

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INTRODUCTION

The Queensland Government is currently advancing master planning for the priority ports of Gladstone, Abbot Point, Townsville, and Hay Point/Mackay in accordance with the *Sustainable Ports Development Act* (Ports Act).

Master planning for priority ports is one of the port-related actions of the Reef 2050 Long-Term Sustainability Plan, and is mandated under the Ports Act. Priority port master planning has a timeframe up to 2050 to align with the Reef 2050 Long-Term Sustainability Plan (DSD 2016a).

Through port master planning, the Queensland Government is seeking to effectively manage the land and marine areas needed for the efficient development and operation of the priority ports, while ensuring that the Outstanding Universal Value of the Great Barrier Reef (GBR) World Heritage Area is an intrinsic consideration in port development, management and governance (DSD 2016a).

The overarching purpose of master planning for each of Queensland’s priority ports is to:

- Define a long term strategic vision, objectives and desired outcomes for each port master planned area
- Identify the state interests in relation to the priority ports and articulate how those interests are to be considered in all planning decisions made within each port master planned area
- Present an environmental management framework (EMF) that states priority management measures for managing potential impacts on environmental values in the master planned area and surrounding areas in accordance with principles of ecologically sustainable development (ESD).

The Port of Gladstone is located within the GBR World Heritage Area and is Queensland’s largest multi-cargo port and the fifth largest coal export terminal in the world (by throughput). The port is located within a diverse region containing a range of urban communities, major industrial precincts and environmental values of international importance. There is significant opportunity for continued growth in the import and export of a range of commodities to Australia and the world, with the Port of Gladstone playing a pivotal role in the future growth of the national port trade.

PURPOSE

As part of the master planning process, the Department of State Development (DSD) has developed an evidence base to support and inform the preparation of the master plan and port overlay for the Priority Port of Gladstone. The evidence base collates information on the economic, environmental, community and cultural aspects of the priority Port of Gladstone. The evidence base supports the master planning process and includes:

- Evidence Base Report for the Proposed Gladstone Port Master Planned Area (AECOM 2016)
- Priority Port of Gladstone master planning – Infrastructure and Supply Chain Requirements Assessment (PSA Consulting 2016)
- Priority Port of Gladstone master planning – Risk Assessment (Aurecon 2016).

To identify and describe the local expression of the OUV of the GBR that occur within the master planned area and surrounds, the ‘Method for identifying the local expression of OUV within the Great Barrier Reef World Heritage Area’ (Adaptive Strategies 2017) has been applied.

The methodology also calls for a ‘Local Statement of Integrity’ to be produced as a means of providing clarity and understanding of how the proposed master plan relates to the Integrity of the World Heritage Area.

INTEGRITY OF WORLD HERITAGE PROPERTIES

All World Heritage properties are required to meet the conditions of integrity. This is defined by the Operational Guidelines for the Implementation of the World Heritage Convention (UNESCO 2016) as “a measure of the wholeness and intactness of the natural and/or cultural heritage and its features.” An assessment of the integrity of a property is required to determine the extent to which the property:

- includes all elements necessary to express its OUV
- is of adequate size to ensure the complete representation of the features and processes which convey the property’s significance
- suffers from adverse effects of development and/or neglect.

The Operational Guidelines (UNESCO 2016) provide the following advice and criteria in relation to Integrity:

“For properties nominated under criteria (i) to (vi), the physical fabric of the property and/or its significant features should be in good condition, and the impact of deterioration processes controlled. A significant proportion of the elements necessary to convey the totality of the value conveyed by the property should be included. Relationships and dynamic functions present in cultural landscapes, historic towns or other living properties essential to their distinctive character should also be maintained.

For all properties nominated under criteria (vii) - (x), bio-physical processes and landform features should be relatively intact. However, it is recognized that no area is totally pristine and that all natural areas are in a dynamic state, and to some extent involve contact with people. Human activities, including those of traditional societies and local communities, often occur in natural areas. These activities may be consistent with the Outstanding Universal Value of the area where they are ecologically sustainable.

In addition, for properties nominated under criteria (vii) to (x), a corresponding condition of integrity has been defined for each criterion.

Properties proposed under criterion (vii) should be of Outstanding Universal Value and include areas that are essential for maintaining the beauty of the property. For example, a property whose scenic value depends on a waterfall, would meet the conditions of integrity if it includes adjacent catchment and downstream areas that are integrally linked to the maintenance of the aesthetic qualities of the property.

Properties proposed under criterion (viii) should contain all or most of the key interrelated and interdependent elements in their natural relationships. For example, an "ice age" area would meet the conditions of integrity if it includes the snow field, the glacier itself and samples of cutting patterns, deposition and colonization (e.g. striations, moraines, pioneer stages of plant succession, etc.); in the case of volcanoes, the magmatic series should be complete and all or most of the varieties of effusive rocks and types of eruptions be represented.

Properties proposed under criterion (ix) should have sufficient size and contain the necessary elements to demonstrate the key aspects of processes that are essential for the long term conservation of the ecosystems and the biological diversity they contain. For example, an area of tropical rain forest would meet the conditions of integrity if it includes a certain amount of variation in elevation above sea level, changes in topography and soil types, patch systems and naturally regenerating patches; similarly a coral reef should include, for example, seagrass, mangrove or other adjacent ecosystems that regulate nutrient and sediment inputs into the reef.

Properties proposed under criterion (x) should be the most important properties for the conservation of biological diversity. Only those properties which are the most biologically diverse and/or representative are likely to meet this criterion. The properties should contain habitats for maintaining the most diverse fauna and flora characteristic of the bio-geographic province and ecosystems under consideration. For example, a tropical savannah would meet the conditions of integrity if it includes a complete assemblage of co-evolved herbivores and plants; an island ecosystem should include habitats for maintaining endemic biota; a property containing wide ranging species should be large enough to include the most critical habitats essential to ensure the survival of viable populations of those species; for an area containing migratory species, seasonal breeding and nesting sites, and migratory routes, wherever they are located, should be adequately protected.”

CONSIDERATIONS WHEN ASSESSING INTEGRITY

The retrospective Statement of Outstanding Universal Value for the GBR World Heritage Area (UNESCO 2012) notes that in relation to integrity:

“The ecological integrity of the GBR is enhanced by the unparalleled size and current good state of conservation across the property. At the time of inscription it was felt that to include virtually the entire Great Barrier Reef within the property was the only way to ensure the integrity of the coral reef ecosystems in all their diversity.

A number of natural pressures occur, including cyclones, crown-of-thorns starfish outbreaks, and sudden large influxes of freshwater from extreme weather events. As well there is a range of human uses such as tourism, shipping and coastal developments including ports. There are also some disturbances facing the GBR that are legacies of past actions prior to the inscription of the property on the World Heritage list.

At the scale of the GBR ecosystem, most habitats or species groups have the capacity to recover from disturbance or withstand ongoing pressures. The property is largely intact and includes the fullest possible representation of marine ecological, physical and chemical processes from the coast to the deep abyssal waters enabling the key interdependent elements to exist in their natural relationships.

Some of the key ecological, physical and chemical processes that are essential for the long-term conservation of the marine and island ecosystems and their associated biodiversity occur outside the boundaries of the property and thus effective conservation programs are essential across the adjoining catchments, marine and coastal zones.”

The emphasis on size, condition and existing human activities are important elements when considering integrity. The Operational Guidelines (UNESCO 2012) note that: “...it is recognized that no area is totally pristine and that all natural areas are in a dynamic state, and to some extent involve contact with people. Human activities, including those of traditional societies and local communities, often occur in natural areas. These activities may be consistent with the Outstanding Universal Value of the area where they are ecologically sustainable.”

In the case of the GBR this aspect is particularly important given the large size of the property; its location adjacent to and including human settlements and the pre-existing presence of human settlements, infrastructure and urban, recreational and industrial activities within the property prior to its listing. Accordingly an important aspect of integrity is the state and condition of the property at the time of listing.

Additionally, the ‘Method for identifying the local expression of OUV within the Great Barrier Reef World Heritage Area’ (Adaptive Strategies 2016) recommends that the following criteria and considerations may help inform a ‘Local Statement of Integrity’.

Table 1: Consideration for developing a Local Statement of Integrity

UNESCO CRITERIA	CONSIDERATIONS
<p>Includes all elements necessary to express its Outstanding Universal Value</p>	<ul style="list-style-type: none"> - Will the relevant local area continue to support the significantly contributing environmental features of OUV in a sustainable and representative manner? - Will the diversity of the WH property be altered or diminished. - Will the significantly contributing features be maintained and protected to ensure the property continues to represent high levels of biological diversity?
<p>Is of adequate size to ensure the complete representation of the features and processes which convey the property’s significance</p>	<ul style="list-style-type: none"> - Is the overall size of the WH property being altered or changed in a material way? - Will the boundary of the WH property be altered as a result of proposed planning and development? - Will the overall significance of the property be altered in any way? - Will the overall size and ecosystem functions within the WH property be altered in any way?
<p>Suffers from adverse effects of development and/or neglect</p>	<ul style="list-style-type: none"> - Will proposed plans and development result in an unmanaged level of impact or neglect to the local environmental features that significantly contribute to OUV? - Will significant contributing features be maintained and managed. - Will any impacts to significantly contributing features of natural beauty be assessed, minimised and managed as development proceeds?

OUTSTANDING UNIVERSAL VALUE AT THE PRIORITY PORT OF GLADSTONE

To understand the integrity of the World Heritage Area at the priority Port of Gladstone it is first necessary to understand how OUV is expressed locally.

Using the methodology developed to determine the local expression of OUV (Adaptive Strategies 2017) an analysis has been undertaken to identify the presence and local expression of OUV within the priority Port of Gladstone master planned area and surrounding areas (Aurecon 2017). The report of this analysis forms part of the evidence base to the master plan (refer Addendum to evidence Base -Part A). The findings of this analysis are summarised below.

The analysis determined the level of contribution of local environmental attributes to the OUV of the World Heritage Area. The assessment of contribution utilised information on local presence and assessed the importance in the context of the World Heritage listing criteria. From this a determination of contribution to OUV has been made at one of three levels:

Minor contribution: The attribute is present however it occurs in low abundance or singularly and:

- is not essential to the sustainability of the attribute (e.g. substantial breeding population)
- is not recognised as a key feature of the GBR World Heritage Area
- is not included in the retrospective statement of OUV
- is not iconic, unique or a high quality example of the attribute.

Moderate contribution: The attribute occurs in moderate abundance or across a moderately large area but are not the prime occurrence or representation of the attribute within the GBR. The attribute does however represent a feature for which the GBR was listed as World Heritage.

Significant contribution: The attribute represents locally important examples of the attribute relative to the nature of the attribute across the GBR. Such an attribute may be specifically referred to within the retrospective statement of OUV or defined by other legislation, planning instrument or values assessment (e.g. GBR Outlook Report). The occurrence of the attribute locally is a prime example of the features mentioned in the retrospective statement of OUV.

Table 2: Contribution of local attributes to the OUV within the master planned area and surrounds (Aurecon 2017)

Category	Local attribute	Relevant OUV criteria and contribution classifications ¹				Key environment values
		vii ²	viii ³	ix ⁴	x ⁵	
Coral reefs	Fringing reefs	Min	Min	Min	Min	Fringing coral reefs
	Inshore turbid reefs	-	Min	Min	Min	Inshore turbid coral reefs
	Coral species diversity and extent	Min	Min	Min	Min	Various coral species
Marine water quality	Marine water quality	-	-	Mod	Mod	Marine water quality
Fish	Fish species and diversity	Min	-	Min	Min	Colosseum Inlet Fish Habitat Area Proposed Calliope River Fish Habitat Area Coral reefs, seagrass meadows, mangrove communities, hard and soft benthic substrates, beach habitats, estuaries, creeks and rivers
Marine megafauna	Dugong	-	-	-	Mod	Dugong species Seagrass meadows
	Species of whales	-	-	-	Min	Minke whales Sperm whales Humpback whales
	Migrating whales	Min	-	-	-	Humpback whales and calving habitat
	Species of dolphins	Min	-	-	Sig	Australian humpback dolphins
Marine turtles	Breeding colonies of marine turtles	Mod	-	-	Mod	Flatback turtle rookery on Curtis Island

	Green turtle breeding	Min	-	-	Min	Nesting beaches on Facing and Curtis Islands
	Marine turtle rookeries	Mod	-	-	Mod	
	Nesting turtles	Min	-	-	-	
Seagrass and macroalgae	Seagrass	Min	Min	Mod	Mod	Seagrass meadows
	Beds of <i>Halimeda</i> algae	-	-	Min	-	Beds of <i>Halimeda</i> algae
Shorebirds and migratory seabirds	Seabirds	Min	-	Min	Min	Potential foraging habitat
	Shorebirds and migratory birds	-	-	-	Sig	Threatened migratory shorebird species Shorebird habitat and important roost sites (note these vary from year to year)
Flora, fauna and ecological communities	Threatened and endangered flora and fauna species (including threatened ecological communities)	Min	-	-	Mod	Coastal Saltmarsh Threatened Ecological Community
	Vegetated mountains	Min	-	-	-	Mount Larcom
	Mangroves	Min	Min	Min	Min	Various mangrove sp.
	Mangrove species diversity	-	-	-	Min	Various mangrove sp.
	Vast mangrove forests	Mod	-	-	-	Mangrove sequences at The Narrows
Continental islands	Continental islands and green vegetated islands	Mod	Mod	-	-	Curtis Island
	Plant species diversity and endemism (species being unique to a defined geographic location)	-	-	-	Sig	Curtis Island
	Vegetation of the continental islands	-	-	Sig	Sig	Curtis Island
Geomorphology	Beaches	Min	-	-	-	Curtis Island beaches Facing Island beaches Boyn Island Beach
	Dune systems	Min	Min	-	-	Parabolic dunes Curtis Island
	River deltas	Min	Min	Min	Min	Marine tidal sand deltas (Curtis Island, Boyne River, Colosseum Inlet)
	Connectivity: cross-shelf, longshore and vertical	-	Min	Min	Min	The Narrows tidal passage
Cultural heritage values	Traditional Owner interaction with the natural environment	-	-	Mod	-	Indigenous cultural heritage sites and values
Marine fauna	Diversity supporting marine fauna species (global conservation significance)	Min	-	Min	Mod	A diverse range of marine fauna species

Total species diversity	Total species diversity	Mod	-	Mod	Mod	A diverse range of marine, intertidal and terrestrial flora and fauna species
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- 1 Min - Minor
- Mod - Moderate
- Sig - Significant
- 2 vii - Aesthetic values and superlative natural phenomena
- 3 viii - Ongoing geological processes
- 4 ix - Ecological and biological processes
- 5 x - Biodiversity conservation

LOCAL STATEMENT OF INTEGRITY FOR THE PRIORITY PORT OF GLADSTONE

The GBR was inscribed on the World Heritage List in 1981 in recognition of its Outstanding Universal Value. The World Heritage Committee listed the GBR for the following natural criteria:

Criterion (vii) – contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance.

Criterion (viii) – be outstanding examples representing major stages of earth’s history, including the record of life, significant ongoing geological processes in the development of landforms, or significant geomorphic or physiographic features.

Criterion (ix) – be outstanding examples representing significant ongoing ecological and biological processes in the evolution and development of terrestrial, freshwater, coastal and marine ecosystems and communities of plants and animals.

Criterion (x) – contain the most important and significant natural habitats for in situ conservation of biological diversity, including those containing threatened species of OUV from the point of view of science or conservation.

At the time of listing the GBR was recognized for its unparalleled size and current good state of conservation across the property. At the time of inscription it was felt that to include virtually the entire Great Barrier Reef within the property was the only way to ensure the integrity of the coral reef ecosystems in all their diversity. Despite ongoing pressures the GBR maintains these values to the present day.

The GBR was nominated on the basis of management for conservation and reasonable multiple use, and the inscription recognises long standing uses, such as: port operations; shipping; commercial, recreational and Indigenous fisheries; recreation; tourism; and activities on islands, coastal lands and catchments within, adjacent to or discharging into the waters of the GBR.

The Port of Gladstone is located within the Great Barrier Reef World Heritage Area and is Queensland’s largest multi-cargo port and the fifth largest coal export terminal in the world (by throughput). The port is located within a diverse region containing a range of urban communities, major industrial precincts and environmental values of international importance. The port was established in the 19th century and was a major trading port at the time the GBR was included in the list of World Heritage properties (1981). There is significant opportunity for continued growth in the import and export of a range of commodities to Australia and the world, with the Port of Gladstone playing a pivotal role in the future growth of the national port trade.

Under the Ports Act, the Port of Gladstone is defined as one of four priority ports in Queensland.

The GBR World Heritage Area includes waters seaward of the low water mark, including those within the Port of Gladstone. However the port is located outside of the Queensland and Commonwealth marine park boundaries.

The area of the priority port within the World Heritage Area constitutes 0.1% of the total 348,000 square kilometres of the GBR World Heritage Area.

While the area is a long established operating industrial area and port as well as a large city, the priority port master planned area and surrounds contain many natural environmental features of varying value and condition. An evaluation and assessment (Aurecon 2017) of the local attributes of the OUV expressed within and surrounding the priority Port of Gladstone has determined that:

- four local attributes provide a significant contribution
- eleven local attributes provide a moderate contribution
- twenty-two local attributes provide a minor contribution.

For the purposes of maintaining integrity of the property all of these attributes have relevance, however, it is primarily those that contribute significantly that will be most important in terms of maintaining the OUV of the GBR. A detailed analysis of all attributes and their contribution to OUV forms part of the evidence base to the Priority Port of Gladstone draft master plan (refer Addendum to Evidence Base -Part A, Appendix B).

The four significant contributing attributes identified are:

Species of dolphins (Australian humpback dolphins)

There are seven species of dolphin that have the potential to utilise habitat within the area, which contributes significantly to the dolphin species biodiversity of the GBR. On the basis of the limited population information available for the Australian humpback dolphin, the area is considered to be an important location within the GBR for this species. Furthermore, the Australian humpback dolphin populations are at risk of undetectable population declines (where less than 20% decline annually) (GBRMPA 2014).

Shorebirds and migratory birds (threatened migratory shorebird species and shorebird habitat)

Important habitat for migratory shorebirds is present at a number of locations within the area (e.g. Friend Point, Port Central and surrounds, and Facing Island). There are currently no shorebird population estimates available specifically for the GBR. However it is considered that due to the presence of important habitat within the area and in the surrounding areas, and the proportion of the Queensland populations of migratory shorebirds, that the area contributes significantly to the shorebird attribute of the OUV of the GBR.

Plant species diversity and endemism (Curtis Island)

Curtis Island is identified as having among the most diverse terrestrial flora in the GBR (Lucas et al. 1997), with approximately 590 flora species. The continental island flora species diversity and endemism represented on Curtis Island is also supported by the remnant vegetation values on the other continental islands in the area (e.g. Facing Island, She Oak Island, Diamantina Island).

Vegetation of the continental islands (Curtis Island)

As outlined above, Curtis Island and the other continental islands contain remnant vegetation communities. Curtis Island alone represents more than 57% of the total island flora species diversity recorded within the whole of the GBR Marine Park.

Maintaining these attributes along with the ecosystem process that support them is essential to maintaining the local integrity of the World Heritage Area.

POTENTIAL FOR ALTERATION OR LOSS OF INTEGRITY

The potential for the integrity of the World Heritage Area to be altered or lost locally due to the proposed priority port master planning outcomes is considered extremely low. The basis for this is outlined below against the key consideration relating to integrity.

Includes all elements necessary to express its Outstanding Universal Value

- The Port of Gladstone was established well before the GBR was included on the list of World Heritage properties. The ports maritime areas were recognised as forming part of the World Heritage Area at time of listing.
- The function and use of the port areas will remain substantially the same.
- Master planning outcomes will not alter ecosystem functions and connections; existing environmental approval process will ensure impacts are appropriately considered.
- Attributes making a significant contribution to the local expression of OUV will be maintained and protected, in most instances this will result in an improvement in protection and possible net benefit.
- The overall diversity of the property will not be affected.

Is of adequate size to ensure the complete representation of the features and processes which convey the property's significance

- The World Heritage boundary is established at the low water mark. The master plan will not alter the World Heritage boundary in any substantial manner. Small areas of land reclamation may occur primarily to ensure capital dredge material is reused and is not disposed of at sea.
- The extent of the priority port within the World Heritage Area will not increase from the current 0.1%.

Suffers from adverse effects of development and/or neglect

- Land and maritime use of the area is not altering significantly – specific areas have been designated for port related activities, avoiding where possible environmental values.

- A specific environmental management precinct has been identified. The purpose of this precinct is to limit development and manage environmental values including those terrestrial/island based attributes that contribute to OUV. The precinct includes:
 - Mount Larcom
 - Aldoga reserve
 - Facing Island
 - Part of Curtis Island
 - Other inshore islands (noting large parts of Curtis Island are not included within the priority port master planned area)
- A large marine precinct will be established. The purpose of this precinct is to limit port and industry development, and provide for non-port related marine activities. This precinct includes marine areas adjoining the marine infrastructure precinct which are not critical to the operation or growth of the port and includes intertidal or marine waters. Development in this precinct includes small scale maritime infrastructure, boat ramps, pontoons and coastal protection structures, coastal rescue services, commercial, recreational and residential uses. Development must be appropriately designed and located to manage potential impacts on environmental values within and surrounding the master planned area. Material placement areas used for the creation of environmental benefits such as artificial wetlands could be undertaken within this precinct. Many of the systems habitats that support OUV attributes occur in this precinct.
- The master plan does not alter the need to conduct detailed environmental impact assessment for any proposed development. Any development that may impact significantly on World Heritage values will still be required to be assessed and approved by the Commonwealth Minister for the Environment under the *Environment Protection and Biodiversity Conservation Act 1999*. Impacts to the integrity of the World Heritage Area would form part of any such assessment.
- The master plan includes an Environmental Management Framework to manage and monitor environmental values and adaptively control any related impacts. Additionally, a set of Priority Management Measures has been developed to improve environmental outcomes as part of the master planning process. A number of these Priority Management Measures specifically relate to the maintenance of OUV. The Priority Management Measures proposed are:

Priority Management Measures	
1	Aboriginal cultural heritage notification Prior to undertaking any ground disturbance activities within the master planned area, proponents who are not already required to undertake notification under the provisions of the <i>Aboriginal Cultural Heritage Act 2003</i> , an Indigenous Land Use Agreement registered under the <i>Native Title Act 1993</i> , or an agreement with an Aboriginal Party made in accordance with the <i>Native Title Act 1993</i> and other agreements under the <i>Aboriginal Cultural Heritage Act 2003</i> will notify the relevant Aboriginal party prior to the works being undertaken.
2	Environmental values monitoring and reporting program Prepare an environmental values monitoring and reporting program for the environmental values within and surrounding the master planned area
3	Environmental assessment guideline Prepare an environmental assessment guideline for developments likely to have a significant adverse impact on the environmental values that contribute to the OUV of the GBR World Heritage Area to ensure that environmental assessment processes are appropriately and consistently applied across the master planned area for matters relating to the OUV of the GBR World Heritage Area and all other environmental values
4	Land management plan guideline Prepare and implement a land management plan guideline to ensure that the OUV of the GBR World Heritage Area and all other environmental values are consistently identified and managed within the environmental management precinct of the master planned area
5	Facing Island land management plan Prepare and implement a land management plan for the Facing Island land management plan area in accordance with the land management plan guideline
6	Inshore islands land management plan Prepare and implement a land management plan for the Inshore islands land management plan area in accordance with the land management plan guideline
7	Mount Larcom landform land management plan Prepare and implement a land management plan for the Mount Larcom landform land management plan area in

Priority Management Measures	
	accordance with the land management plan guideline
8	Aldoga reserve land management plan Prepare and implement a land management plan for the Aldoga reserve land management plan area in accordance with the land management plan guideline
9	Curtis Island land management plan Prepare and implement a land management plan for the Curtis Island land management plan area in accordance with the land management plan guideline

REFERENCES

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Part B

Environmental values
monitoring and reporting
programs





Part B

Environmental values monitoring and reporting programs

B1 Evidence base background

The evidence base risk assessment provided a summary of the existing operational environmental management programs operating within and surrounding the master planned area (refer Table 4.3 in risk assessment report (Aurecon 2016)).

During the master planning process a detailed list and mapping of the existing environmental value monitoring and reporting programs within and surrounding the master planned area was undertaken to inform the need and drafting content of a priority management measure relating to ongoing environmental values monitoring and reporting.


B2 Existing environmental values monitoring and reporting programs

For the purpose of identifying and documenting the existing environmental values monitoring and reporting programs within and surrounding the master planned area, programs that commenced or operational on or after 2013 have been summarised in Table B1.

The justification for selecting 2013 as the most appropriate year to use as the start date for the summary table of existing background environmental values monitoring and reporting programs is provided below.

- Between 2010 and 2012 there were a number of major flood events and the construction of major projects within Gladstone which resulted in environmental value monitoring programs that were assessing the impacts and compliance, including:
 - Major flood events in 2010 and 2011, and early 2013
 - Dredging and reclamation works associated with the Western Basin Dredging and Disposal Project
 - Construction works and significant marine vessel movements within the port associated with the three liquefied natural gas (LNG) plants on Curtis Island and the Wiggins Island Coal Terminal

While these monitoring programs provide useful information on the impacts of the flood events and major projects on the environmental values, the findings are not as relevant to master planning as the key objectives of the review of existing programs is to identify potential monitoring gaps, and the existing programs which will be part of an adequacy assessment, for input into the future development of the environmental values monitoring and reporting program (ie the PMM).

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- Survey and monitoring programs conducted for various environmental impact statement (EIS) studies within the Gladstone region between 2008 and 2012 is considered to be of secondary importance for input into the master planning process due to the short term monitoring periods for the majority of these EISs
 - Some environmental value monitoring data has a period of limited validity in accordance with relevant guidelines (eg five years for sediment quality for National Assessment Guidelines for Dredging (NAGD) 2009), and DoEE and EHP requirements for assessing the current environmental values that require management. Therefore in addition to the above, the value of including these monitoring programs in the summary table will have minimal benefit to the master planning process (eg in identifying current monitoring gaps).

It is recognised that some monitoring programs included in the summary table reference dates prior to 2013, for example seagrass condition monitoring for some seagrass meadows has occurred annually since 2009, and the 2002 seagrass survey provides additional areas which have the potential to support seagrass meadows.

In summary, the 2013 year was selected as it represents a time of transition after the major flood events and major project construction within the Port of Gladstone. As a result the programs from 2013 to date (and to 2018 when the PMM environmental values monitoring and reporting program is likely to be developed) represents the most appropriate period to determine the future monitoring program needs for the master planned area and surrounds.

Table B1 provides a comprehensive list of the existing or recently completed environmental values monitoring and reporting programs of relevance to the master planning process.

Figures 1 to 13 illustrate the monitoring catchment (study area) and/or sampling locations for the relevant monitoring program where spatial data is available.

B3 Input into the development of the environmental values monitoring and reporting program priority management measure

The review and assessment of the environmental values monitoring and reporting programs within and surrounding the master planned area, provides input into the future development of PPM 2 which includes the preparation of an environmental values monitoring and reporting program for the environmental values within and surrounding the master planned area.

Relevant considerations for the preparation of the environmental values monitoring and reporting program include:

- A gap analysis of environmental values monitoring and reporting programs be undertaken in 2018 at the conclusion of the majority of the Gladstone Ports Corporation Ecosystem Research and Monitoring Program (ERMP) and Biodiversity Offset Strategy (BOS) studies
- The adequacy of existing and planned environmental values monitoring and reporting programs to support assessment of the effectiveness of the master plan and port overlay
- Review and amend the environmental values monitoring and reporting program table included in this part of the addendum to the evidence base report be undertaken in 2018 at the conclusion of the majority of the Gladstone Ports Corporation ERMP and BOS studies
- Update of the OUV of the GBRWHA reporting and local expression contributions for the master planned area and surrounding areas
- Consultation with key technical experts to assist in the development of specific environmental value monitoring programs, timeframes and key locations.



B4 References

Aurecon 2016 Priority Port of Gladstone master planning – Risk assessment, Prepared for the Queensland Department of State Development, Aurecon, Brisbane

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Table B1 Priority Port of Gladstone master planning - environmental values monitoring and reporting programs from approximately 2013 (as at January 2017)

ID	Program name	Monitoring type	Objective	Responsible entity	Funding source	Timeframe and/or end date	Frequency	Monitoring parameters	Spatial scope	Figure reference	Program outputs	Requirement	Data availability	Additional information (refer attached information links table)
Overarching environmental monitoring programs														
V1	Port Curtis Integrated Monitoring Program (PCIMP)	Overarching program - various	The PCIMP objective is to develop a long term mid to far field ambient monitoring program, focussing on water and sediment quality in Port Curtis.	<p>Independent chair and spokesperson: Professor Owen Nevin (CQUniversity)</p> <p>Industry consortium: Representatives include industry, government, research institutions and other stakeholders.</p> <p>Overseen by: Management Committee with guidance from the Technical Sub-Committee (PCIMP TSC)</p> <p>Sponsors and members: RioTinto Alcan, QGC, APLNG, GLNG, QAL, NRG, WICET, GPC, QER, Orica, Boyne Smelters, GRC, Cement Australia and CQU</p>	<ul style="list-style-type: none"> Shared funding model Sponsoring members share the cost of monitoring equally PCIMP has previously funded two Port Curtis Ecosystem Health Report Cards. 	2001 to present Ongoing, no end date specified	Quarterly	<p>Regular monitoring including:</p> <ul style="list-style-type: none"> Water quality (currently quarterly) Sediment quality (currently biannually) Oyster biomonitoring (currently biannually) <p>Previous assessments for:</p> <ul style="list-style-type: none"> Intertidal health (eg oil spill assessments) Seagrass health and sediment assessments 	Water quality, sediment and oyster deployment sites located in 13 zones in marine and estuarine environments (including reference sites).	Figure 1: Port Curtis Integrated Program water quality and sediment quality monitoring	<ul style="list-style-type: none"> Two Port Curtis ecosystem health report cards have been released: Port Curtis Ecosystem Health Report Card 2007 (Storey et al. 2007) Port Curtis Ecosystem Health Report Card 2008-2010 (Vision Environment 2011) 	Voluntary	<ul style="list-style-type: none"> Annual reports are not available to the public Some individual monitoring reports are available on the PCIMP website PCIMP data is now provided to the Gladstone Healthy Harbour Partnership (GHHP) to contribute to the GHHP report card (refer V3) Data is available on the web but requires authorised member access 	PCIMP website
V2	Ecosystem Research and Monitoring Program (ERMP)	Overarching program - various	The ERMP is an over-arching program which funds various projects to examine short, medium and long term impacts on a range of ecological values in Port Curtis and Port-Alma.	GPC	GPC ERMP	2011 to 2021	Project specific	Project specific	ERMP survey area (Port Curtis and Port-Alma)	Figure 3a and Figure 3b: ERMP and BOS study area	Project specific	Compliance with Commonwealth controlled action approval (EPBC 2009/4904) for the Western Basin Dredging and Disposal Project (WBDDP)	<ul style="list-style-type: none"> It is a condition of the ERMP that the findings, including related data, of any or all of these studies are made publicly available upon request by any interested parties. 	<ul style="list-style-type: none"> GPC ERMP reports

Table B1 - Priority Port of Gladstone master planning - environmental values monitoring and reporting programs from approximately 2013 (as at January 2017)

ID	Program name	Monitoring type	Objective	Responsible entity	Funding source	Timeframe and/or end date	Frequency	Monitoring parameters	Spatial scope	Figure reference	Program outputs	Requirement	Data availability	Additional information (refer attached information links table)
V3	Gladstone Healthy Harbour Program (GHP)	Overarching program - various	The GHP is an overarching program established to help improve decision-making (underpinned by robust marine science incorporating environmental, social, cultural and economic dimensions) about resource allocation and environmental management of the Port of Gladstone.	<p>CEO: Paul Birch (Fitzroy Basin Association [FBA])</p> <p>Projects overseen by an Independent Science Panel (ISP)</p> <p>Consortium comprising:</p> <ul style="list-style-type: none"> •Industry •Research and monitoring agencies •Community groups •Traditional Owners •Commonwealth and State government representatives <p>GHP partners:</p> <ul style="list-style-type: none"> Australian Government, Australian Institute of Marine Science, Australian Pacific LNG, Boyne Smelters, CQG Consulting, Central Queensland University, CSIRO, Dhrou Woolloom, Fitzroy Basin Association, Gidarjil Development Centre, Gladstone Area Water Board, GPC, Gladstone Regional Council, Gladstone Region Environmental Advisory Network, Griffith University, NRG, Orica, QGC, Queensland Alumina Limited, Queensland government, QER, Rio Tinto Alcan, Santos GLNG Project, The University of Queensland, and WICET 	Government and member funded	Established Nov 2013 Ongoing, no end date specified	<ul style="list-style-type: none"> •Project specific health report cards •Annual health report cards 	<ul style="list-style-type: none"> •Environmental indicators (eg water quality) •Social indicators •Economic indicators •Cultural indicators •Iconic species 	Port of Gladstone and surrounds	NA - Refer Evidence Base Report Plate 3	Gladstone Harbour Report Card	Government and industry program	<ul style="list-style-type: none"> •The GHP has limitations in the collection of some data as the GHP is reliant on a number of different external parties for data collection •Water quality and sediment data is provided to GHP by PCIMP for reporting. This data is not publicly available. •Gladstone Harbour Report Cards and Technical Reports provide interpretation of data and are available on the GHP website •The GHP shares information about Gladstone Harbour through the GHP e-Portal, an online information management resource accessible to stakeholders and the general community. 	<ul style="list-style-type: none"> •Gladstone Healthy Harbour Partnership website •GHP publications •GHP 2015 report card •GHP ePortal

Table B1 - Priority Port of Gladstone master planning - environmental values monitoring and reporting programs from approximately 2013 (as at January 2017)

ID	Program name	Monitoring type	Objective	Responsible entity	Funding source	Timeframe and/or end date	Frequency	Monitoring parameters	Spatial scope	Figure reference	Program outputs	Requirement	Data availability	Additional information (refer attached information links table)
V4	Maintenance dredging: Long term monitoring and management plan for sea disposal of dredged material	Overarching program - various	<ul style="list-style-type: none"> A working management document to be used for the strategic management during maintenance dredging, sea dumping (at East Banks dredged material placement area (DMPA)) and associated works to ensure all reasonable and practicable measures will be implemented to prevent and/or minimise the likelihood of environmental harm being caused during the works Supports GPC's Sea Dumping Permit 	GPC	GPC	2013 to 2018	<ul style="list-style-type: none"> Annual maintenance dredging campaign Various surveys 	<ul style="list-style-type: none"> Various (refer E1, E9, E21, E27, S2, S3, WQ4) 	<ul style="list-style-type: none"> East Banks offshore DMPA Maintenance dredging areas, sensitive receptors, and reference areas 	Spatial data not available	Compliance reporting to Department of Environment and Heritage (EHP) and Commonwealth Department of Environment and Energy (DoEE)	Compliance with GPC Sea Dumping Permit	<ul style="list-style-type: none"> Reports prepared for compliance purposes and for internal use by GPC Timeframe associated with current approved plan only 	<ul style="list-style-type: none"> GPC Long term monitoring and management plan for sea disposal of dredged material 2013-2018 GPC dredging monitoring
V5	Biodiversity offset strategy (BOS)	Overarching program - various	<ul style="list-style-type: none"> To meet conditions under Commonwealth controlled action approval to offset residual significant impacts to the values of the Great Barrier Reef World Heritage Area and National Heritage Place, and Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) listed threatened and migratory species. Various projects under the BOS have been developed to meet these conditions. Not all projects under the BOS have environmental monitoring components. 	GPC	GPC	2012 to 2020	Continuous	<ul style="list-style-type: none"> Various programs: <ul style="list-style-type: none"> Coral mapping and restoration (project underway, refer E8) Declared fish habitat area (FHA) investigations in the Central Queensland region (project underway) Habitat enhancement and restoration project (project underway) Acquisition of high value ecological land to protect from development (project underway) Upper to lower catchment water quality monitoring and improvement of water quality in the Boyne or Calliope Rivers (project underway) 	Port Curtis and Port Alma	Figure 3a and Figure 3b: ERMP and BOS study area	Various reports	Condition under Commonwealth controlled action approval (EPBC 2009/4904) for WBDDP	Reports are made available on GPC website	BOS website

Table B1 - Priority Port of Gladstone master planning - environmental values monitoring and reporting programs from approximately 2013 (as at January 2017)

ID	Program name	Monitoring type	Objective	Responsible entity	Funding source	Timeframe and/or end date	Frequency	Monitoring parameters	Spatial scope	Figure reference	Program outputs	Requirement	Data availability	Additional information (refer attached information links table)
V6	Reef 2050 Integrated Monitoring and Reporting Program Strategy (RIMRep)	Overarching program - various	<p>A component of the Reef 2050 Long-Term Sustainability Plan (Reef 2050 Plan) to coordinate and integrate existing monitoring, modelling and reporting programs across disciplines within the Great Barrier Reef. Program currently being developed.</p> <p>Objectives include:</p> <ul style="list-style-type: none"> • Enable the early detection of trends and changes in the Reef's environment, inform the assessment of key threats and future risks and drive adaptive management. • Inform the evaluation of management effectiveness, including efforts to maintain and enhance ecosystem health, marine biodiversity and coastal habitats, water quality, heritage values and social and economic benefits derived from the environment. • Ensure investments are focused on actions that will effectively deliver measurable results • Inform regional stakeholders and the national and international communities on whether the Reef 2050 Plan is on track to addressing key threats and delivering its vision 	Great Barrier Reef Marine Park Authority (GBRMPA)	To be determined (TBD)	2015 to 2019	TBD	TBD	TBD	Spatial data not available	Results of the program incorporated into five-yearly Great Barrier Reef Outlook Report	Government commitment	Reports to be five-yearly and available on GBRMPA website	<ul style="list-style-type: none"> • Great Barrier Reef Marine Park Authority website • Reef 2050 Integrated Monitoring and Reporting Program
V7	Gas Industry Social and Environmental Research Alliance (GISERA): An integrated study of the Gladstone marine system	Overarching program - various	<p>The overarching goal of the GISERA marine environmental research program has been to make possible a more accurate prediction and understanding of impacts and trends in water quality as well as ecological responses in primary producers (seagrass) and grazers (turtles) that have been assessed as being vulnerable due to expansion of development in the Port of Gladstone. Another aim of the GISERA marine research program was to develop tools that can be used to determine management options that may lead to the reduction of impacts on these key ecological assets in the future, well beyond Port Curtis and the current phase of development.</p>	GISERA	<ul style="list-style-type: none"> • GISERA • Commonwealth Scientific and Industrial Research Organisation (CSIRO) 	2012 to 2014	Various	<ul style="list-style-type: none"> • Biophysical properties of Gladstone Harbour: • Seagrass distribution • Turtle movement and habitat use 	Port Curtis	Spatial data not available	<ul style="list-style-type: none"> • Results of the program reported in CSIRO published report 'An integrated study of the Gladstone marine system' • Hydrodynamic/biochemical model of Port Curtis; predicting water quality and seagrass growth • Turtle behaviour – habitat use and risk modelling 	Voluntary	Report is publicly available on the CSIRO research publications repository	<ul style="list-style-type: none"> • GISERA website • An integrated study of the Gladstone marine system report • An integrated study of the Gladstone marine system report overview

Table B1 Priority Port of Gladstone master planning - environmental values monitoring and reporting programs from approximately 2013 (as at January 2017)

ID	Program name	Monitoring type	Objective	Responsible entity	Funding source	Timeframe and/or end date	Frequency	Monitoring parameters	Spatial scope	Figure reference	Program outputs	Requirement	Data availability	Additional information (refer attached information links table)
Individual environmental monitoring programs														
AQ1	Gladstone air quality monitoring network	Air quality	<ul style="list-style-type: none"> Measure local hazardous air pollutants from industrial emissions and air movement to: Assess the impact of air emissions on the ambient air quality in the Gladstone area Assess the potential risks to human health associated with those emissions Develop a baseline to inform future decision making (eg development approvals and regulatory compliance activities) 	Department of Science, Technology and Innovation (DSITI)	Government	1991 to present Ongoing, no end date specified	Continuous	<ul style="list-style-type: none"> Meteorological data Nitrogen oxides Sulfur dioxide Particulate matter less than 10um in aerodynamic diameter (PM10) Particulate matter less than 2.5um in aerodynamic diameter (PM2.5) Visibility-reducing particles (aerosols) Air toxics (organic pollutants) Ozone Heavy metals and organic compounds (note: not all parameters monitored at all sites or all times) 	<ul style="list-style-type: none"> Current monitoring sites located at: <ul style="list-style-type: none"> Boyne Island (est. 2008) South Gladstone (est. 1992) Auckland Point (est. 2009) Memorial Park (est. 2009) Clinton (est. 2008) Boat Creek (est. 2008) Fisherman's Landing (est. 2016) Targimie (Swans Road) (est. 1991) Aldoga (est. 1999) 	Figure 7: Air quality monitoring	<ul style="list-style-type: none"> Data previously used for: <ul style="list-style-type: none"> Benchmarking atmospheric emissions Community health assessment Health risk assessment final reports Clean and healthy air for Gladstone reports Project final report contributes to National Environment Protection Measure for Ambient Air Quality (Air NEPM) annual reporting of Queensland's air quality against the standards 	<ul style="list-style-type: none"> Compliance with EA conditions 	<ul style="list-style-type: none"> Hourly air quality data for Gladstone available on EHP website Monitoring reports are publicly available on Queensland government website and library catalogue Data also available for decommissioned monitoring sites 	<ul style="list-style-type: none"> Gladstone Air Quality monitoring network EHP Gladstone region air quality reports page EHP hourly air quality data Queensland government library catalogue
AQ2	GPC air quality monitoring program	Air quality	<ul style="list-style-type: none"> Ensure compliance with Environmental Authority (EA) conditions Assess and control dust generation impacts on the community 	GPC	GPC	<ul style="list-style-type: none"> Start date unknown Ongoing, no end date specified 	<ul style="list-style-type: none"> Continuous - complaint driven Monthly Continuous 	<ul style="list-style-type: none"> Mass deposition rate of insoluble solids Mass deposition rate of ash Mass deposition rate of total solids Combustible matter Compositional analysis (%) Particulate identification Mass deposition rate of combustible materials PM10 Total suspended particulate matter 	<ul style="list-style-type: none"> Approximately 11 compliance sites and 14 voluntary sites located at various locations around Gladstone community Approximately 11 compliance sites and 14 voluntary sites located at various locations around Gladstone community 12 real time monitors are positioned around RG Tanna Coal Terminal, Barney Point Coal Terminal and in community locations 	<ul style="list-style-type: none"> Spatial data not available 	<ul style="list-style-type: none"> Internal GPC data and compliance reporting 	<ul style="list-style-type: none"> Compliance with EA conditions Additional voluntary monitoring 	<ul style="list-style-type: none"> Internal GPC data Data can be provided upon request Internal GPC data GPC may make some data publicly available in future on the website Internal GPC data Not publicly available 	<ul style="list-style-type: none"> GPC air quality monitoring site

Table B1 - Priority Port of Gladstone master planning - environmental values monitoring and reporting programs from approximately 2013 (as at January 2017)

ID	Program name	Monitoring type	Objective	Responsible entity	Funding source	Timeframe and/or end date	Frequency	Monitoring parameters	Spatial scope	Figure reference	Program outputs	Requirement	Data availability	Additional information (refer attached information links table)
E1	Maintenance dredging: Long term monitoring and management plan for sea disposal of maintenance dredged material	Ecology – benthic macroinvertebrates	Monitor/assess the impacts of sea disposal from maintenance dredging on benthic fauna	GPC	GPC	2013 to 2018	Every 5 years	<ul style="list-style-type: none"> •Grab sampling (infauna) •Soft sediment and seagrass survey 	Sites within and adjacent to the East Banks DMPA	Spatial data not available	Compliance reporting to EHP and DoEE	Compliance with GPC Sea Dumping Permit	Reports prepared for compliance purposes and for internal use by GPC	<ul style="list-style-type: none"> •GPC Long term monitoring and management plan for sea disposal of maintenance dredge material 2013 to 2018 •GPC dredging monitoring
E2	GPC Channel Duplication EIS (CD EIS) baseline surveys	Ecology – benthic macroinvertebrates	<ul style="list-style-type: none"> •Conduct baseline benthic macroinvertebrate assessments at subtidal locations to assess potential impacts from the GPC Channel Duplication Project •Update broad-scale baseline assessments, last reported in 2002, of benthic macroinvertebrate communities in deep water areas of Port Curtis and adjacent offshore areas •Characterise the benthic macroinvertebrate (epifauna) communities within the survey area •Discuss the implications of the survey results for overall diversity of the survey area and provide information to aid in the decision towards appropriate dredged material placement options 	GPC	GPC	Nov 2013	Once-off	Benthic macroinvertebrate community density categories	Sled-net and video capture sites from Western Basin to offshore areas of the GBRMP	Figure 10: Benthic fauna monitoring	Report	Baseline data for CD EIS	EIS not publicly available yet	NA
E3	GPC Channel Duplication EIS baseline surveys	Ecology – benthic macroinvertebrates	<ul style="list-style-type: none"> Conduct baseline macroinvertebrate and sediment analyses in the vicinity of the potential Project impact area against which future monitoring data can be compared to support identification and management of Project impacts 	GPC	GPC	2014 to 2015	Once-off	<ul style="list-style-type: none"> •Taxa abundance •Taxa richness •Taxa diversity •Taxa evenness •Particle size distribution (PSD) •Total organic carbon (TOC) 	16 transects from the Western Basin to offshore areas of the GBRMP	Figure 10: Benthic fauna monitoring	Report	Baseline data for CD EIS	EIS not publicly available yet	NA

Table B1 Priority Port of Gladstone master planning - environmental values monitoring and reporting programs from approximately 2013 (as at January 2017)

ID	Program name	Monitoring type	Objective	Responsible entity	Funding source	Timeframe and/or end date	Frequency	Monitoring parameters	Spatial scope	Figure reference	Program outputs	Requirement	Data availability	Additional information (refer attached information links table)
E4	GPC Channel Duplication EIS baseline surveys	Ecology – benthic macroinvertebrates	Conduct baseline macroinvertebrate and sediment analyses in the vicinity of the potential Project impact area against which future monitoring data can be compared to support identification and management of Project impacts	GPC	GPC	Feb 2015	Once-off	<ul style="list-style-type: none"> •Taxa abundance •Taxa richness •Benthic macroinvertebrate community composition •PSD 	60 grab samples from sites between South Trees Island and Facing Island to sites in the Outer Harbour	Figure 10: Benthic fauna monitoring	Report	Baseline data for CD EIS	EIS not publicly available yet	NA
E5	GPC Channel Duplication EIS baseline surveys	Ecology – benthic macroalgae	<ul style="list-style-type: none"> •Conduct baseline benthic macroalgal assessments at subtidal locations to assess potential impacts from the GPC Channel Duplication Project •Update broad-scale baseline assessments, last reported in 2002, of benthic macroalgal communities in deep water areas of Port Curtis and adjacent offshore areas •Characterise the benthic macroalgal communities within the survey area •Discuss the implications of the survey results for overall diversity of the survey area and provide information to aid in the decision towards appropriate dredged material placement options 	GPC	GPC	Nov 2013	Once-off	Algae identified into five functional groups via sled-net and video capture	Western Basin to offshore areas of the GBRMP	Figure 10: Benthic fauna monitoring	Report	Baseline data for CD EIS	EIS not publicly available yet	NA
E6	Western Basin Dredging and Disposal Project – Benthic Photosynthetically Active Radiation (BPAR) at seagrass meadows	Ecology – BPAR	Monitoring of BPAR as part of light-based management approach to protect seagrass meadows during dredging and dredged material placement	GPC	GPC	2013 to 2016	Quarterly	<ul style="list-style-type: none"> •Total daily irradiance •Temperature 	<ul style="list-style-type: none"> •Seven sites in WBDDP survey area and two reference sites •Temporary sites added for other projects (eg CD EIS) 	Figure 6: Seagrass monitoring	Report	<ul style="list-style-type: none"> •Compliance with Commonwealth controlled action approval (EPBC 2009/4904) for WBDDP •Baseline data for CD EIS 	<ul style="list-style-type: none"> •Internal GPC data •Some reports made available by GPC 	GPC environmental reports page

Table B1 Priority Port of Gladstone master planning - environmental values monitoring and reporting programs from approximately 2013 (as at January 2017)

ID	Program name	Monitoring type	Objective	Responsible entity	Funding source	Timeframe and/or end date	Frequency	Monitoring parameters	Spatial scope	Figure reference	Program outputs	Requirement	Data availability	Additional information (refer attached information links table)
E7	GHPH	Ecology – coral	<ul style="list-style-type: none"> Select appropriate locations at which to establish permanent monitoring sites Assess and report the condition of coral communities that have adapted to survival in Gladstone Harbour to allow the inclusion of coral community condition in the GHPH 2015 Report Card 	GHPH	Government and member funded	Jul 2015	Once-off	<ul style="list-style-type: none"> % coral cover % macroalgae cover Density of juvenile coral 	<ul style="list-style-type: none"> Inner harbour reefs around Turtle Island Mid harbour reefs around North Entrance and west side of Facing Island Seal Rocks reefs 	Figure 8: Reef monitoring	Report	Voluntary	<ul style="list-style-type: none"> Reports made available on GHPH website 	<ul style="list-style-type: none"> GHPH publications GHPH coral investigations
E8	Biodiversity offset strategy (BOS)	Ecology – coral	Characterisation of the ecological condition of reefs in Port Curtis and to identify priority reef areas that may be suitable for any future habitat restoration and enhancement projects	GPC	GPC BOS	May 2014	Once-off	<ul style="list-style-type: none"> Benthos type % benthos cover Taxonomic richness Community types 	<ul style="list-style-type: none"> Inner harbour reefs around Turtle Island Mid harbour reefs around the North Entrance and west side of Facing Island Reefs on the east side of Facing Island Seal Rocks reefs 	Figure 8: Reef monitoring	Report	Commitment under BOS	<ul style="list-style-type: none"> Data available upon request by any interested parties Reports made available on GPC website 	<ul style="list-style-type: none"> BOS website BOS reports
E9	Maintenance dredging: Long term monitoring and management plan for sea disposal of maintenance dredged material	Ecology – coral	Assess the impact, if any, on reef habitats in order to validate hydrodynamic modelling predictions of turbid plumes during maintenance dredging	GPC	GPC	2013 to 2018	Every 5 years	<ul style="list-style-type: none"> Reef condition survey (not limited to): % cover of major taxa Taxa richness % of coral bleaching 	<ul style="list-style-type: none"> TBD. Previous surveys have focussed on reefs around Facing Island. 	Spatial data not available	Compliance reporting to EHP and DoEE	Compliance with GPC Sea Dumping Permit	<ul style="list-style-type: none"> Reports prepared for compliance purposes and for internal use by GPC 	<ul style="list-style-type: none"> GPC long term monitoring and management plan for sea disposal of maintenance dredge material 2013-2018
E10	GPC Channel Duplication EIS baseline surveys	Ecology – coral	Conduct baseline reef surveys in the vicinity of the potential Project impact area against which future monitoring data can be compared to support identification and management of Project impacts	GPC	GPC	2014 to 2015	Once-off	<ul style="list-style-type: none"> Substrate of area Benthos type % lifeforms % benthos cover Health assessment (eg disease, bleaching) Dominant substrate classification 	<ul style="list-style-type: none"> Sable Chief Rocks Gatcombe Head/Oyster Rocks 	Figure 8: Reef monitoring	Report	Baseline data for CD EIS	EIS not publicly available yet	NA
E11	Great Barrier Reef Marine Park Authority (GBRMPA) site inspection	Ecology – coral	Conduct reef health impact surveys at the Facing Island Reef (Sable Chief Rocks) coral reef site in close proximity to the Port of Gladstone	GBRMPA	GBRMPA	Sept 2013	Once-off	<ul style="list-style-type: none"> Benthos type % lifeforms % benthos cover Health assessment (eg disease, bleaching) 	Sable Chief Rocks	Figure 8: Reef monitoring	Report	Voluntary	<ul style="list-style-type: none"> Internal report for GBRMPA, GPC and the Australian Institute of Marine Science (AIMS) 	NA

Table B1 - Priority Port of Gladstone master planning - environmental values monitoring and reporting programs from approximately 2013 (as at January 2017)

ID	Program name	Monitoring type	Objective	Responsible entity	Funding source	Timeframe and/or end date	Frequency	Monitoring parameters	Spatial scope	Figure reference	Program outputs	Requirement	Data availability	Additional information (refer attached information links table)
E12	GPC dredging reef monitoring - Changes in benthic communities on fringing coral reefs around Facing Island	Ecology – coral	Investigate coral reef dynamics during the Gladstone Port dredging program	GPC	GPC	2011 to 2013	Once-off	<ul style="list-style-type: none"> Benthos type % lifeforms % benthos cover 	<ul style="list-style-type: none"> Reefs on Facing Island including: <ul style="list-style-type: none"> Gatcombe Head East Point Ledge Sable Chief Rocks Reef North Point Reef Rundle Island (control site off Curtis Island) 	Figure 8: Reef monitoring	Report	Compliance with Commonwealth controlled action approval (EPBC 2009/4904) for WBDDP	<ul style="list-style-type: none"> Reports are made available on GPC website 	<ul style="list-style-type: none"> GPC coral studies
E13	ERMP	Ecology – dolphins	Increase understanding of the status of Australian snubfin and Australian humpback dolphins	GPC and the ERMPAP	GPC ERMP	2014 to 2017	Annually	<ul style="list-style-type: none"> Photo-identification Population genetics Toxicology analysis Dietary information 	<ul style="list-style-type: none"> Port Curtis and Port Alma 	<ul style="list-style-type: none"> Figure 3a and Figure 3b: ERMP and BOS study area Figure 13: Inshore dolphin monitoring 	Annual report	Commitment under ERMP	<ul style="list-style-type: none"> Data available upon request by any interested parties Reports made available on GPC website 	<ul style="list-style-type: none"> GPC ERMP reports
E14	ERMP	Ecology – dugong	Increase understanding of habitat use by Dugongs in the Port Curtis and Port Alma region. Examine the movement, behaviour and habitat use and determine any temporal changes in their utilisation of these habitats.	GPC and the ERMPAP	GPC ERMP	2014 to 2017	Quarterly	<ul style="list-style-type: none"> GPS/acoustic tagging of Dugong on opportunistic basis in association with tagging of green turtles Monitoring of Dugong feeding trails in association with low tide helicopter surveys of seagrass 	<ul style="list-style-type: none"> Port Curtis and Port Alma 	<ul style="list-style-type: none"> Figure 3a and Figure 3b: ERMP and BOS study area 	Annual report	Commitment under ERMP	<ul style="list-style-type: none"> Data available upon request by any interested parties Reports made available on GPC website 	<ul style="list-style-type: none"> GPC ERMP reports
E15	GPC Channel Duplication EIS baseline surveys	Ecology – fish	Conduct baseline fish surveys in the vicinity of the potential Project impact area against which future monitoring data can be compared to support identification and management of project impacts.	GPC	GPC	2014 to 2015	Once-off	<ul style="list-style-type: none"> Species abundance Fish density Species richness Diversity Species evenness 	<ul style="list-style-type: none"> Estuarine survey locations: <ul style="list-style-type: none"> Southwest Facing Island (including Gatcombe Heads) Sand Islet Wild Cattle Creek Boyne River Lilleys Inlet South Trees Inlet Fisherman's Landing The Narrows/ Targime Creek Boat Creek South Reef survey locations: <ul style="list-style-type: none"> Oyster Rocks Gatcombe Heads (East Point) Sable Chief Rocks Jenny Lind Banks Seal Rocks 	Figure 9: Fish monitoring	Report	Baseline data for CD EIS	<ul style="list-style-type: none"> EIS not publicly available yet 	NA

Table B1 Priority Port of Gladstone master planning - environmental values monitoring and reporting programs from approximately 2013 (as at January 2017)

ID	Program name	Monitoring type	Objective	Responsible entity	Funding source	Timeframe and/or end date	Frequency	Monitoring parameters	Spatial scope	Figure reference	Program outputs	Requirement	Data availability	Additional information (refer attached information links table)
E16	Gladfish recreational fish monitoring program	Ecology – fish	<ul style="list-style-type: none"> Support increased understanding of long-term trends in recreational fishing in Gladstone Harbour, The Narrows and adjacent waterways through sourcing additional data for the Infish database Promote sustainable fishing practices in Gladstone Harbour, The Narrows and adjacent waterways Determine trends in recreational fishing 	<ul style="list-style-type: none"> Infish Gladfish Suntag 	QGC	2011 to 2014	Continuous	<ul style="list-style-type: none"> Fish growth and movement Stock assessments Stock predictions (Barramundi) Assessing recruitment Assessing local/regional fishing Fish survival Fish health 	<ul style="list-style-type: none"> Suntag recreational fish tagging grids: Gladstone Harbour Calliope River Boyne River Curtis Island Lake Awoonga 	Figure 9: Fish monitoring	Report	Voluntary	<ul style="list-style-type: none"> Data is reliant on citizen science Several reports available to public on the web Database is available on the web but requires authorised access 	<ul style="list-style-type: none"> Gladfish website Gladfish case study report Infish website
E17	Qfish fisheries catch data	Ecology – fish	<ul style="list-style-type: none"> Collect long term datasets of commercial fishing catch and effort to manage and report on the status of Queensland fisheries Provide data to undertake ecological and stock assessments of Queensland fisheries 	Department of Agriculture and Fisheries (DAF)	Government	1990 to present Ongoing, no end date specified	Continuous	<ul style="list-style-type: none"> Species catch Fishing effort Fishing method 	Commercial fishery 30 minute reporting grids: <ul style="list-style-type: none"> S30 T30 	Figure 9: Fish monitoring	<ul style="list-style-type: none"> Reports Survey database online 	Government program	<ul style="list-style-type: none"> Data is reliant on commercial fishery reporting Data is uploaded regularly on public available database 	Qfish website
E18	GPC Channel Duplication EIS baseline surveys	Ecology – flora	Conduct baseline flora surveys in the vicinity of the potential project impact area against which future monitoring data can be compared to support identification and management of Project impacts.	GPC	GPC	Mar 2015	Once-off	<ul style="list-style-type: none"> Species of plant Height estimate Species density Qualitative description of plant health (visual assessment) Flora species and vegetation communities and their conservation status under the EPBC Act, Nature Conservation Act and Vegetation Management Act Likely occurrence of conservation significant flora species based on habitat characteristics 	<ul style="list-style-type: none"> Shoreline from Western Basin Reclamation area to Friend Point Shoreline areas at Port Central and Parsons Point 	Figure 12: Flora monitoring	EIS chapter	Baseline data for CD EIS	EIS not publicly available yet	NA
E19	EHP StrandNet wildlife stranding database	Ecology – marine megafauna	Collect long term datasets of marine megafauna strandings and deaths in Queensland waters against which future data can be compared to and to allow identification of trends.	EHP	Government	1996 to present Ongoing, no end date specified	Continuous	<ul style="list-style-type: none"> Reports of sick, injured, dying and dead marine fauna including: <ul style="list-style-type: none"> Cetaceans Dugong Marine turtles Pinnipeds Incidental information on sharks, rays, seabirds and other marine animals. 	Queensland waters	Spatial data not available	Reports are released semi-regularly	Government program	<ul style="list-style-type: none"> Data can be requested from EHP and provided by EHP discretion Strandings reports available on EHP website 	EHP marine wildlife strandings annual reports

Table B1 - Priority Port of Gladstone master planning - environmental values monitoring and reporting programs from approximately 2013 (as at January 2017)

ID	Program name	Monitoring type	Objective	Responsible entity	Funding source	Timeframe and/or end date	Frequency	Monitoring parameters	Spatial scope	Figure reference	Program outputs	Requirement	Data availability	Additional information (refer attached information links table)
E20	Ballast water and biofouling monitoring	Ecology – pests	Monitor presence of pest species	Department of Agriculture and Water Resources	Department of Agriculture and Water Resources	Dates not specified	Not specified	Shipping (ballast water and hull fouling)	Port Curtis	Spatial data not available	Internal government data	Government program	Internal government data	Australian government marine pests information
E21	Maintenance dredging: Long term monitoring and management plan for sea disposal of maintenance dredged material	Ecology – pests	Assess the existing status and potential impacts of introduced marine pests during the 2013 to 2018 maintenance dredging and sea disposal campaign	GPC	GPC	2015	Once-off	Presence of marine pests within the Port of Gladstone	Areas to be dredged, DMPA and adjacent areas	Spatial data not available	Report prepared to support GPC Sea Dumping Permit	Compliance with GPC Sea Dumping Permit	Internal GPC data	•GPC long term monitoring and management plan for sea disposal of dredged material 2013 to 2018 •GPC dredging monitoring
E22	Port of Gladstone baseline seagrass surveys	Ecology – seagrass	<ul style="list-style-type: none"> Describe seagrass communities within Port Curtis and the Rodds Bay dugong protection area (DPA) Establish a baseline from which monitoring programs could be developed Provide GIS database and maps within and adjacent to areas requiring dredging in the Port and potential dredged material placement areas Discuss the implications of the survey results for protection of dugongs in the Rodds Bay DPA and during Port development and operational programs 	GPC	GPC	2002 to 2014	<ul style="list-style-type: none"> Project specific or as required by GPC Surveys undertaken in 2002, 2009, 2013 and 2014 	<ul style="list-style-type: none"> Seagrass characteristics including: <ul style="list-style-type: none"> Seagrass percent cover Species composition Above-ground biomass Percent algal cover Depth below mean sea level (dbMSL) (subtidal meadows) Sediment type Time and position (latitude and longitude) Spatial data input into GIS 	<ul style="list-style-type: none"> Port limits Extended into GBRMP for some years. 	Figure 6: Seagrass monitoring	Report	<ul style="list-style-type: none"> Baseline data required to inform future port planning and seagrass monitoring programs (2002 available on the web (eg Seagrass-Watch required for CD site) Internal GPC data Some reports made available by GPC Some reports available on the web (eg Seagrass-Watch required for CD site) 	<ul style="list-style-type: none"> GPC environmental reports page Seagrass-Watch 	
E23	Western Basin Dredging and Disposal Project – annual long term seagrass monitoring	Ecology – seagrass	<ul style="list-style-type: none"> Routinely monitor the condition of key Port Curtis seagrass meadows (and Rodds Bay reference sites) to complement existing seagrass studies, in light of existing and future potential development of Gladstone and the Port. 	GPC	GPC	2002 to 2018	Annually	<ul style="list-style-type: none"> Seagrass community types Changes in biomass Meadow area Species composition Seagrass condition index 	13 seagrass meadows between The Narrows and Boyne River mouth, Rodds Bay (reference sites)	Figure 6: Seagrass monitoring	Various reports	<ul style="list-style-type: none"> Compliance with Commonwealth controlled action approval (EPBC 2009/4904) for WBDDP. Some monitoring voluntary 	<ul style="list-style-type: none"> Internal GPC data Some reports made available by GPC 	GPC environmental reports page

Table B1 Priority Port of Gladstone master planning - environmental values monitoring and reporting programs from approximately 2013 (as at January 2017)

ID	Program name	Monitoring type	Objective	Responsible entity	Funding source	Timeframe and/or end date	Frequency	Monitoring parameters	Spatial scope	Figure reference	Program outputs	Requirement	Data availability	Additional information (refer attached information links table)
E24	Western Basin Dredging and Disposal Project – biannual seagrass monitoring	Ecology – seagrass	Document the spatial extent and biomass of intertidal and shallow subtidal seagrass meadows and assess seasonal dynamics (growing and senescence) prior to, during and after the WBDDP. Also complement light and temperature data recorded at seagrass meadows.	GPC	GPC	2009 to 2015	Biannually	<ul style="list-style-type: none"> Seagrass community types Changes in biomass Meadow area Species composition Seagrass condition index 	WBDDP survey area (The Narrows to Boyne River mouth)	Figure 6: Seagrass monitoring	Report	<ul style="list-style-type: none"> Internal GPC data Some reports made available by GPC 	<ul style="list-style-type: none"> GPC environmental reports page 	
E25	ERMP	Ecology – seagrass	<p>Monitor changes in the density of <i>Zostera muelleri</i> seed banks during the pre-dredging, dredging and post-dredging phases of the Western Basin Dredging and Disposal Project (WBDDP).</p> <p>Monitor changes in the proportion of viable <i>Z. muelleri</i> seeds in the seed bank before and after the growing season and the post-dredging phase of the WBDDP.</p>	GPC and the ERM/PAP	GPC ERMP	2011 to 2017	Quarterly	Collection and analysis of sediment cores collected from 2011 at seagrass monitoring transects	Port Curtis	Figure 6: Seagrass monitoring	Annual report	<ul style="list-style-type: none"> Data available upon request by any interested parties Reports made available on GPC website 	<ul style="list-style-type: none"> GPC ERMP GPC ERMP reports 	
E26	Western Basin Dredging and Disposal Project – seagrass condition monitoring	Ecology – seagrass	Monitoring of seagrass condition at permanent transects to act as sentinel or sensitive receptor sites during the WBDDP to monitor variations in seagrass condition throughout the year.	GPC	GPC	2009 to 2016	Quarterly	<ul style="list-style-type: none"> Abundance and community composition (seagrass health) Elemental content of plants (seagrass tissue nutrients) Meadow reproductive status (seagrass resilience) Sexual above-ground productivity and asexual growth (seagrass productivity) 	<ul style="list-style-type: none"> WBDDP survey area Rodds Bay (reference sites) Temporary sites added for other projects (eg The Narrows LNG pipeline crossing, CD EIS) 	Figure 6: Seagrass monitoring	Report of findings	<ul style="list-style-type: none"> Compliance with Commonwealth action approval (EPBC 2009/4904) for WBDDP Baseline data for CD EIS and The Narrows pipeline crossing project 	<ul style="list-style-type: none"> Internal GPC data Some reports made available by GPC 	<ul style="list-style-type: none"> GPC environmental reports page
E27	Maintenance dredging: Long term monitoring and management plan for sea disposal of maintenance dredged material	Ecology – seagrass	Monitor/assess the impact, if any, on seagrass meadows as a result of maintenance dredging and sea disposal	GPC	GPC	2013 to 2018	Annually (completed as part of WBDDP requirements)	Refer GPC and WBDDP seagrass monitoring programs (refer E6, E22, E23, E24, E26)	Seagrass meadows in Port Curtis	Figure 6: Seagrass monitoring	Compliance reporting to EHP and DoEE	<ul style="list-style-type: none"> Compliance with GPC Sea Dumping Permit 	<ul style="list-style-type: none"> Some monitoring completed as part of the other seagrass monitoring programs. Reports prepared for compliance purposes and for internal use by GPC. 	<ul style="list-style-type: none"> GPC Long term monitoring and management plan for sea disposal of maintenance dredge material 2013-2018

Table B1 - Priority Port of Gladstone master planning - environmental values monitoring and reporting programs from approximately 2013 (as at January 2017)

ID	Program name	Monitoring type	Objective	Responsible entity	Funding source	Timeframe and/or end date	Frequency	Monitoring parameters	Spatial scope	Figure reference	Program outputs	Requirement	Data availability	Additional information (refer attached information links table)
E28	Gas Industry Social and Environmental Research Alliance (GISERA): An integrated study of the Gladstone marine system	Ecology – seagrass	<ul style="list-style-type: none"> The seagrass component of the integrated study of the Gladstone marine system (refer V7) was designed to complement existing seagrass monitoring of the cover, biomass and extent of seagrass meadows conducted through the WBDDP and as part of the Gladstone Port's long term seagrass monitoring objectives Measurements of seagrass depth were designed to help parameterise the seagrass growth model (Chapter III of GISERA). An integrated study of the Gladstone marine system' report ensuring a realistic depiction of potential seagrass growth in Port Curtis A detailed survey of Pelican Banks was conducted to better correlate turtle habitat use and seagrass distribution 	GISERA	GISERA (CSIRO, Australia Pacific LNG, QGC)	2012 to 2014	Annually	<ul style="list-style-type: none"> Physical variables: latitude and longitude, depth, conductivity, temperature, pH, secchi disc depth, Photosynthetically Active Radiation, turbidity, chlorophyll a, blue green algae, DO Seagrass biomass Seagrass depth ranges Seagrass fine-scale distribution (Pelican Banks and to the west of Facing Island only) 	<ul style="list-style-type: none"> 25 sampling sites at seagrass meadows from The Narrows, Wiggins Island, Pelican Banks and Boyne Island (2012) 41 sampling sites at seagrass meadows from The Narrows, Wiggins Island, Pelican Banks and Boyne Island and coastal waters (2013) Meadows at Pelican Banks and to the west of Facing Island (finescale survey) 	<ul style="list-style-type: none"> Spatial data not available Figure 6: Seagrass monitoring (for WBDDP seagrass monitoring) 	<ul style="list-style-type: none"> Results reported in Chapters 2 and 3 of CSIRO published report 'An integrated study of the Gladstone marine system' (Babcock et al. 2015) Hydrodynamic/biogeochemical model of Port Curtis, predicting water quality and seagrass growth 	Voluntary	<ul style="list-style-type: none"> Report is publicly available on the CSIRO research publications repository 	<ul style="list-style-type: none"> GISERA homepage An integrated study of the Gladstone marine system report An integrated study of the Gladstone marine system report overview
E29	ERMP	Ecology – shorebirds	<ul style="list-style-type: none"> Determine the capacity of the study area to support migratory shorebirds and determine the size of the potentially impacted population. 	GPC and the ERMPAP	GPC ERMP	2015 to 2017	Annually	<ul style="list-style-type: none"> Mapping of tidal flat distribution and exposure Measure benthic prey availability Estimates of shorebird populations the area can support Identify priority areas for management Identify local movements of shorebirds in the area Describe how shorebirds move around the study area Identify patterns of flow of shorebirds to the study area Size of management units 	Port Curtis and Port Alma	Figure 5: Shorebird monitoring	Annual report	Commitment under ERMP	<ul style="list-style-type: none"> Data available upon request by any interested parties Reports made available on GPC website 	<ul style="list-style-type: none"> GPC ERMP reports
E30	ERMP	Ecology – shorebirds	Identify changes in the abundances and distribution of shorebirds over 10 years.	GPC and the ERMPAP	GPC ERMP	2011 to 2012 2013 to 2018 2019 to 2020	Five surveys per year Annually (summer survey) Five surveys per year	<ul style="list-style-type: none"> Population censuses of species present Mapping of feeding and roosting sites Habitat utilisation relative to the lunar/tide cycles and season Identification of critical characteristics of important habitat 	Port Curtis and Port Alma	Figure 5: Shorebird monitoring and Figure 3b: ERMP and BOS study area	Annual report	Commitment under ERMP	<ul style="list-style-type: none"> Data available upon request by any interested parties Reports made available on GPC website 	<ul style="list-style-type: none"> GPC ERMP reports

Table B1 Priority Port of Gladstone master planning - environmental values monitoring and reporting programs from approximately 2013 (as at January 2017)

ID	Program name	Monitoring type	Objective	Responsible entity	Funding source	Timeframe and/or end date	Frequency	Monitoring parameters	Spatial scope	Figure reference	Program outputs	Requirement	Data availability	Additional information (refer attached information links table)
E31	GPC Channel Duplication EIS baseline surveys	Ecology – shorebirds	Conduct baseline shorebird surveys in the vicinity of the potential project impact area against which future monitoring data can be compared to support identification and management of project impacts.	GPC	GPC	2014 to 2015	Once-off	<ul style="list-style-type: none"> Time and date GPS location (latitude/longitude) Observers Stage of tide (i.e. high rising and high falling) Wind direction Habitat type and quality Disturbances Observed individuals: <ul style="list-style-type: none"> Number of individuals observed Age class of group (if possible) 	<ul style="list-style-type: none"> Shoreline from Western Basin reclamation area to Friend Point Shoreline areas at Port Central and Parsons Point Shoreline at Boyne Island 	Figure 5: Shorebird monitoring	EIS chapter	Baseline data for CD EIS	EIS not publicly available yet	NA
E32	Arrow Energy LNG Plant EIS supplementary baseline surveys	Ecology – shorebirds	Conduct a baseline shorebird assessment to detail potential impacts on migratory shorebirds from the proposed Arrow Energy LNG Plant and associated infrastructure	Arrow energy	Arrow Energy	2012 to 2013	Five surveys	<ul style="list-style-type: none"> Time and date Weather Stage of tide (ie high rising and high falling) GPS location Shorebird behaviour (eg roosting or foraging) Wind direction and speed Disturbances Number of each shorebird species Additional avifauna observations 	<ul style="list-style-type: none"> 23 roosting and/or foraging sites located around: <ul style="list-style-type: none"> Southwestern extent of Curtis Island around Hamilton Point and Boatshed Point Witt Island Picnic Island Fisherman's Landing Wiggins Island Calliope River 	Figure 5: Shorebird monitoring	<ul style="list-style-type: none"> Arrow LNG Plant Supplementary EIS chapter Technical report 	Baseline data for Arrow LNG Plant Supplementary EIS	Supplementary EIS and shorebird technical study are publicly available from the Department of State Development (DSD) website	Arrow LNG Plant Supplementary EIS shorebird technical study
E33	ERMP	Ecology – tidal wetlands (mangroves/saltmarsh/saltpans)	Monitor the survival and recovery of shorelines, specifically tidal wetlands (mangroves/saltmarsh/saltpans).	GPC and the ERMPAP	GPC ERMP	2014 to 2021	Annually	<ul style="list-style-type: none"> High resolution maps of tidal wetlands Normalised Difference Vegetation Index (NDVI) mapping of tidal wetland Shoreline condition monitoring using oblique aerial image data acquisition Shoreline condition monitoring using boat based video image data acquisition and community volunteers 	<ul style="list-style-type: none"> Port Curtis and Port Alma 	Figure 3a and Figure 3b: ERMP and BOS study area	Annual report	Commitment under ERMP	<ul style="list-style-type: none"> Data available upon request by any interested parties Reports made available on GPC website Public access and data entry portal for display of current and past mapping 	<ul style="list-style-type: none"> GPC ERMP GPC ERMP reports
E34	ERMP	Ecology – turtles (foraging)	Increase understanding of Green turtle habitat usage in the Port Curtis and Port Alma region.	GPC and the ERMPAP	GPC ERMP	2014 to 2017	Annually	<ul style="list-style-type: none"> Green turtle tracking using satellite tags to examine the movement, behaviour and habitat use 	<ul style="list-style-type: none"> Port Curtis and Port Alma 	Figure 3a and Figure 3b: ERMP and BOS study area	Annual report	Commitment under ERMP	<ul style="list-style-type: none"> Data available upon request by any interested parties Reports made available on GPC website 	<ul style="list-style-type: none"> GPC ERMP GPC ERMP reports
E35	ERMP	Ecology – turtles (foraging)	Increase the understanding of the Green turtle population in Port Curtis.	GPC and the ERMPAP	GPC ERMP	2016 to 2020	Four surveys per year	<ul style="list-style-type: none"> Determine the composition by size, sex, growth rates, survivorship, recruitment, and general health of the Green turtle population in Port Curtis 	<ul style="list-style-type: none"> Port Curtis and Port Alma 	Figure 3a and Figure 3b: ERMP and BOS study area	Annual report	Commitment under ERMP	<ul style="list-style-type: none"> Data available upon request by any interested parties Reports made available on GPC website 	<ul style="list-style-type: none"> GPC ERMP GPC ERMP reports

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ID	Program name	Monitoring type	Objective	Responsible entity	Funding source	Timeframe and/or end date	Frequency	Monitoring parameters	Spatial scope	Figure reference	Program outputs	Requirement	Data availability	Additional information (refer attached information links table)
E36	Gas Industry Social and Environmental Research Alliance (GISERA): An integrated study of the Gladstone marine system	Ecology – turtles (foraging)	<ul style="list-style-type: none"> The turtle component of integrated study of the Gladstone marine system (refer V7) was designed to better understand the risk of boat strike from commercial vessels operating in the Port of Gladstone This data was an input into risk modelling of Green turtle populations in relation to shipping movements in the Port of Gladstone to inform potential management decisions in relation to risk minimisation 	GISERA	GISERA (CSIRO, Australia Pacific LNG, QGC)	2013 to 2014		Green turtle tracking using acoustic and satellite tags to examine the movement, behaviour and habitat use	Tagging at Pelican Banks and Wiggins Island	Spatial data not available	<ul style="list-style-type: none"> Results reported in Chapters 4 and 5 of CSIRO published report An integrated study of the Gladstone marine system' Turtle behaviour – habitat use and risk modelling 	Voluntary	Report is publicly available on the CSIRO research publications repository	<ul style="list-style-type: none"> GISERA homepage An integrated study of the Gladstone marine system report An integrated study of the Gladstone marine system report overview
E37	ERMP	Ecology – turtles (interesting)	Increase understanding of Flatback turtle habitat usage in the Port Curtis and Port Alma region	GPC and the ERMPAP	GPC ERMP	2013 to 2017	Annually	Flatback turtle tracking using satellite tags to examine movement, behaviour and habitat use	Port Curtis and Port Alma	Figure 3a and Figure 3b. ERMP and BOS study area	Annual report	Commitment under ERMP	<ul style="list-style-type: none"> Data available upon request by any interested parties Reports made available on GPC website 	<ul style="list-style-type: none"> GPC ERMP GPC ERMP reports
E38	ERMP	Ecology – turtles (light)	<ul style="list-style-type: none"> Monitor the sea-finding ability of hatching Flatback turtles at nesting beaches on Curtis Island Collection and analysis of quantitative data to advise decision making on rookeries and management of artificial light sources associated with the WBDDP and LNG facilities on Curtis Island 	GPC and the ERMPAP	GPC ERMP	2013 to 2014	Once-off	Impact of artificial light on the orientation of hatchlings in selected nesting beaches within the ERMP region	<ul style="list-style-type: none"> Curtis Island South End Beach Facing Island Settlement Beach, Ocean Beach 1, Ocean Beach 2 	Figure 4: Marine turtle nesting and hatching monitoring	Annual report	Commitment under ERMP	<ul style="list-style-type: none"> Data available upon request by any interested parties Reports made available on GPC website 	<ul style="list-style-type: none"> GPC ERMP reports
E39	ERMP	Ecology – turtles (nesting)	Monitor marine turtle nesting populations on index beaches in the Port Curtis and Port Alma region and surrounds.	GPC and the ERMPAP	GPC ERMP	2013 to 2017	Annually	Quantification of demographic parameters for the nesting female, including nesting success, clutches laid per female per nesting season, number of eggs per clutch, adult breeding frequency, and adult recruitment	Curtis Island and Peak Island	Figure 4: Marine turtle nesting and hatching monitoring and Figure 3a and Figure 3b: ERMP and BOS study area	Annual report	Commitment under ERMP	<ul style="list-style-type: none"> Data available upon request by any interested parties Reports made available on GPC website 	<ul style="list-style-type: none"> GPC ERMP reports
N1	GPC noise monitoring	Noise	Monitor noise at GPC facilities based on noise complaints. Comply with <i>Environmental Protection (Noise) Policy 2008</i> .	GPC	GPC	Dates not specified	As required - complaint driven	Not specified	Gladstone community	Spatial data not available	Internal GPC data	Compliance with EA conditions	Internal GPC data	NA

Table B1 - Priority Port of Gladstone master planning - environmental values monitoring and reporting programs from approximately 2013 (as at January 2017)

ID	Program name	Monitoring type	Objective	Responsible entity	Funding source	Timeframe and/or end date	Frequency	Monitoring parameters	Spatial scope	Figure reference	Program outputs	Requirement	Data availability	Additional information (refer attached information links table)
N2	ERMP	Noise (underwater)	Investigate the effects of noise and pressure associated with Project related activities (such as dredge vessel movement, pile driving, dredging and material placement) on the biology and ecology of marine megafauna.	GPC and the ERMPAP	GPC ERMP	2013 to 2014	Annually	<ul style="list-style-type: none"> Ambient aquatic noise during dredging works Ambient aquatic noise during no dredging 	<ul style="list-style-type: none"> Port Curtis and Port Alma 	<ul style="list-style-type: none"> Figure 11: Underwater noise monitoring Figure 3a and Figure 3b: ERMP Program and BOS study area 	Annual report	Commitment under ERMP	<ul style="list-style-type: none"> Data available upon request by any interested parties Reports made available on GPC website 	<ul style="list-style-type: none"> GPC ERMP reports GPC ERMP reports
N3	GPC Channel Duplication EIS baseline surveys	Noise (underwater)	Collect baseline underwater noise monitoring data in the vicinity of the potential Project impact area against which future monitoring data can be compared to support identification and management of Project impacts.	GPC	GPC	2014 to 2015	Once-off	<ul style="list-style-type: none"> Ambient noise monitoring including: <ul style="list-style-type: none"> Temporal and spatial variations in overall underwater noise levels Spectral variations in underwater noise levels Major noise contributors of various origins Correlations with other natural environment parameters such as weather, sea states and tides 	<ul style="list-style-type: none"> Port Central Channel/West Banks Outer Harbour Western Basin 	Figure 11: Underwater noise monitoring	Report	Baseline data for CD EIS	EIS not publicly available yet	NA
S1	Port Curtis Integrated Monitoring Program (PCIMP)	Sediment quality	<ul style="list-style-type: none"> Monitor the far field condition of the benthic marine environment in Port Curtis by: <ul style="list-style-type: none"> Examining the concentration and spatial distribution of nutrients, metals and metalloids and fluoride at all sites Analysing particle size at all sites Align with the PCIMP water quality monitoring program objectives 	Refer V1	Refer V1	2001 to present Ongoing, no end date specified	Biannually (currently)	<ul style="list-style-type: none"> Total metals: aluminium, arsenic, cadmium, chromium, cobalt, copper, gallium, iron, lead, manganese, mercury, molybdenum, nickel, selenium, silver, tin, uranium, vanadium, zinc Nutrients Particle size distribution 	<ul style="list-style-type: none"> Sample sites located in 13 zones in marine and estuarine environments (including reference sites) 	Figure 1: Port Curtis Integrated Monitoring Program water quality and sediment quality monitoring	PCIMP internal report	Voluntary	<ul style="list-style-type: none"> Individual sediment quality reports are not available to the public PCIMP data is now provided to the GHHP to contribute to the GHHP report card (refer V3) Data is available on the web but requires authorised member access 	PCIMP website
S2	Maintenance dredging: Long term monitoring and management plan for sea disposal of maintenance dredged material	Sediment quality	<ul style="list-style-type: none"> Ascertain the contaminant status of material to be disposed of at sea through maintenance dredging Ascertain the contaminant status of material that has been placed within the East Banks DMPA 	GPC	GPC	2013 to 2018	Every 5 years	Contaminants in sediment (TBD)	<ul style="list-style-type: none"> Areas to be dredged, including shipping channels, berths, and DMPA 	Spatial data not available	<ul style="list-style-type: none"> Report prepared to support GPC Sea Dumping Permit Assessment in accordance with National Guidelines for Dredging (NAGD) 2009 Sampling and Analysis Plan (SAP) 	Compliance with GPC Sea Dumping Permit	<ul style="list-style-type: none"> Reports prepared for compliance purposes and for internal use by GPC 	<ul style="list-style-type: none"> GPC long term monitoring and management plan for sea disposal of maintenance dredged material 2013 to 2018 GPC dredging monitoring

Table B1 Priority Port of Gladstone master planning - environmental values monitoring and reporting programs from approximately 2013 (as at January 2017)

ID	Program name	Monitoring type	Objective	Responsible entity	Funding source	Timeframe and/or end date	Frequency	Monitoring parameters	Spatial scope	Figure reference	Program outputs	Requirement	Data availability	Additional information (refer attached information links table)
S3	Maintenance dredging. Long term monitoring and management plan for sea disposal of maintenance dredged material	Sediment quality	<ul style="list-style-type: none"> Monitor accumulation of material at East Banks DMPA and remaining capacity Monitor siltation rates within areas to be dredged for maintenance dredging 	<ul style="list-style-type: none"> GPC Maritime Services Queensland (MSQ) 	<ul style="list-style-type: none"> GPC MSQ 	2013 to 2018	Annually -completed after each major maintenance dredging campaign	<ul style="list-style-type: none"> Accumulation of material at DMPA and remaining capacity Siltation rates 	<ul style="list-style-type: none"> DMPA Shipping channel (siltation) 	Spatial data not available	Report prepared to support GPC Sea Dumping Permit	Compliance with GPC Sea Dumping Permit	<ul style="list-style-type: none"> Reports prepared for compliance purposes and for internal use by GPC 	<ul style="list-style-type: none"> GPC long term monitoring and management plan for sea disposal of maintenance dredged material 2013 to 2018 GPC dredging monitoring
WQ1	Queensland government water quality monitoring	Water quality	<ul style="list-style-type: none"> Collect a long term dataset of water quality monitoring in estuaries and inshore waters in the Central Queensland area from 1993 to assess the quality of these waters with respect to both condition and long-term trend. Data collected also serves as: Input to EISs Input to licensing decisions Use by natural resource management (NRM) bodies Use as base data for deriving water quality guidelines 	<ul style="list-style-type: none"> DSITI EHP (former) Environmental Protection Agency (EPA) 	Government	1993 to present	Monthly (approximately)	<ul style="list-style-type: none"> Conductivity Temperature pH Dissolved oxygen (DO) Turbidity Secchi depth Nutrients 	<ul style="list-style-type: none"> Regular sites at the mouth of rivers that flow into Gladstone Harbour (ie. Boyne, Calliope and Fitzroy) Sites within the Port of Gladstone for previous targeted monitoring programs 	Figure 2: Marine and estuarine water quality monitoring	<ul style="list-style-type: none"> Internal Queensland government data published over time as required (eg Comparison of current and historical water quality 2011, analysis of water quality in relation to fish health in Gladstone Harbour 2012, Post flood event monitoring reports 2013) 	Government program	<ul style="list-style-type: none"> Continuous monitoring data not available (data may be provided upon request) Some reports are available on the Queensland government website (reports may also be provided upon request) Some historical raw data available on Queensland Government open data portal 	<ul style="list-style-type: none"> EHP Gladstone region water quality reports Queensland Government datasets
WQ2	GPC wharf water quality monitoring	Water quality	To record ambient readings of water quality physicochemical parameters at key GPC port infrastructure sites to provide a continuous and long term dataset.	GPC	GPC	2015 to present	Continuous	<ul style="list-style-type: none"> Temperature Conductivity pH Turbidity DO 	<ul style="list-style-type: none"> Fisherman's Landing Clinton Wharf Boyrne Wharf 	Spatial data not available	GPC internal monitoring data	Voluntary	GPC internal monitoring data	NA
WQ3	GPC stormwater quality monitoring	Water quality	Monitor releases of stormwater to the Port of Gladstone at GPC operational licenced discharge points.	GPC	GPC	Start date unknown	<ul style="list-style-type: none"> Once per stormwater discharge event (physical parameters) Twice yearly and when pH <6.5 (metals and sulfate) 	<ul style="list-style-type: none"> DO pH Suspended solids Total petroleum hydrocarbons (TPH) Dissolved metals (Hg, Zn, Cu, Ag, Ni, Pb, Cr, Cd, and sulfate) 	<ul style="list-style-type: none"> Barney Point Coal Terminal - Six locations RG Tanna Coal Terminal - Five locations 	Spatial data not available	GPC internal monitoring data	Compliance with Environmental Authority (EA) conditions	GPC internal monitoring data	NA
						Upon discharge (up to 4 times/year)		<ul style="list-style-type: none"> DO Suspended solids pH Oil and grease 	Port Central, and extraction sites (Tloor and Byelee)					

Table B1 Priority Port of Gladstone master planning - environmental values monitoring and reporting programs from approximately 2013 (as at January 2017)

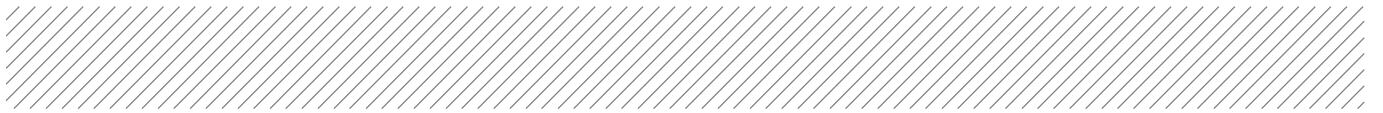
ID	Program name	Monitoring type	Objective	Responsible entity	Funding source	Timeframe and/or end date	Frequency	Monitoring parameters	Spatial scope	Figure reference	Program outputs	Requirement	Data availability	Additional information (refer attached information links table)
WQ4	Maintenance dredging. Long term monitoring and management plan for sea disposal of maintenance dredged material	Water quality	<ul style="list-style-type: none"> Measure the behaviour of sediments and water quality within the dredge plume and adjacent areas to validate hydrodynamic modelling predictions Measure bioaccumulation and bioavailability of contaminants through deployment of oysters 	GPC	GPC	2013 to 2018	<ul style="list-style-type: none"> Before, during and after maintenance dredging Oyster deployment TBD 	<ul style="list-style-type: none"> Trace metals Nutrients Turbidity Bioaccumulation and bioavailability of contaminants (oysters) 	<ul style="list-style-type: none"> Water: Areas to be dredged, East Banks DIMPA and adjacent areas Oysters: East Banks DIMPA 	Spatial data not available	Report prepared to support GPC Sea Dumping Permit	Compliance with GPC Sea Dumping Permit	<ul style="list-style-type: none"> Reports prepared for compliance purposes and for internal use by GPC PCIMP data may be used for background assessments 	<ul style="list-style-type: none"> GPC long term monitoring and management plan for sea disposal of maintenance dredged material 2013 to 2018 GPC dredging monitoring
WQ5	GPC Channel Duplication EIS baseline surveys	Water quality	Conduct baseline water quality monitoring in the vicinity of the potential Project impact area against which future monitoring data can be compared to support identification and management of Project impacts and to compare results to predictive modelling.	GPC	GPC	2014 to 2015	<ul style="list-style-type: none"> Continuous Monthly Quarterly 	<ul style="list-style-type: none"> Turbidity Temperature pH Conductivity DO Sedimentation BPAR Total suspended solids (TSS) Chlorophyll a Nutrients Total and dissolved metals TPH (C6-C40) Polycyclic aromatic hydrocarbon (PAH) Organochlorine Pesticides (OCP)/ Organophosphate Pesticides (OPP) Herbicides 	<ul style="list-style-type: none"> Eight sites located from The Narrows, Port of Gladstone, Outer Harbour and open coastal waters east of Facing Island 	Figure 2: Marine and estuarine water quality monitoring	Report	Baseline data for CD EIS	EIS not publicly available yet	NA

Table B1 Priority Port of Gladstone master planning - environmental values monitoring and reporting programs from approximately 2013 (as at January 2017)

ID	Program name	Monitoring type	Objective	Responsible entity	Funding source	Timeframe and/or end date	Frequency	Monitoring parameters	Spatial scope	Figure reference	Program outputs	Requirement	Data availability	Additional information (refer attached information links table)
WQ6	Port Curtis Integrated Monitoring Program (PCIMP)	Water quality	<ul style="list-style-type: none"> Monitor the far field health of estuarine and marine water quality in Port Curtis Ensure a broad spatial sampling coverage of water bodies in Port Curtis and maintain a longitudinal study of water quality Include adequate sampling frequency to detect and understand annual temporal changes Collect data on key water quality parameters including: <ul style="list-style-type: none"> Document the physiochemical water quality parameters at all sites Examine the concentration and spatial distribution of nutrients and chlorophyll a at all sites At all sites assess the concentration and spatial distribution of dissolved and total metals and metalloids, metals and metalloids accumulated by oysters (in soft tissues) and fluoride accumulated by oysters (in shell growth) <ul style="list-style-type: none"> Compare results to trigger values reported in the Australian Water Quality Guidelines (AWQG) (ANZECC/ARMCANZ 2000) and Queensland Water Quality Guidelines (QWQG) (EHP 2009) Provide a baseline for analysing any future water quality changes in Port Curtis Allow identification of cumulative impacts of a variety of activities in Port Curtis Compare monitoring data temporally between zones within Port Curtis 	Refer V1	Refer V1	2001 to present Ongoing, no end date specified	Quarterly (currently)	<ul style="list-style-type: none"> Total metals: aluminium, arsenic, cadmium, chromium, cobalt, copper, manganese, mercury, molybdenum, nickel, selenium, silver, tin, uranium, vanadium, zinc Total suspended solids Chlorophyll a Cyanide species Fluoride Nutrients Orthophosphate-P Dissolved organic carbon Total organic carbon Bioaccumulation of metals through the deployment of oysters (biannually) 	Sample sites located in 13 zones in marine and estuarine environments (including reference sites)	Figure 1: Port Curtis Integrated Monitoring Program water quality and sediment quality monitoring	PCIMP internal report	Voluntary	<ul style="list-style-type: none"> Individual water quality reports are not available to the public PCIMP data is now provided to the GHHP to contribute to the GHHP report card (refer V3) Data is available on the web but requires authorised member access 	PCIMP website
WQ7	Gas Industry Social and Environmental Research Alliance (GISERA): An integrated study of the Gladstone marine system	Water quality	<ul style="list-style-type: none"> Assess the optical properties of waters in the study area to support the development and improvement of biogeochemical models for both the pelagic and benthic environments within the Port of Gladstone. 	GISERA	GISERA (CSIRO, Australia Pacific LNG, QGC)	2012 to 2013	Annually	<ul style="list-style-type: none"> Biological properties of Gladstone Harbour waters: <ul style="list-style-type: none"> Secchi depth Total suspended matter Pigment analysis Particulate and detrital absorption Coloured Dissolved Organic Matter 	<ul style="list-style-type: none"> 34 sampling sites from The Narrows to Outer Harbour (2012) 43 sampling sites from The Narrows to coastal waters east of Facing Island (2013) 	Spatial data not available	<ul style="list-style-type: none"> Results reported in Chapters 1 and 3 of CSIRO published report: An integrated study of the Gladstone marine system Hydrodynamic/Biogeochemical model of Port Curtis, predicting water quality and seagrass growth 	Voluntary	<ul style="list-style-type: none"> Report is publicly available on the CSIRO research publications repository 	<ul style="list-style-type: none"> GISERA homepage An integrated study of the Gladstone marine system report An integrated study of the Gladstone marine system report overview
W1	GPC waste monitoring program	Waste	Monitoring of waste streams for compliance with environmental management system	GPC	GPC	Dates not specified	Not specified	Waste tracking certificates	Gladstone	Spatial data not available	Internal GPC data	Compliance with waste management plan	Monitoring by GPC has ceased	NA

Abbreviations

Abbreviation	Meaning
AIMS	Australian Institute of Marine Science
ANZECC	Australian and New Zealand Environment Conservation Council
AWQG	Australian Water Quality Guidelines
APLNG	Australia Pacific Liquefied Natural Gas
BOS	Biodiversity Offset Strategy
BPAR	benthic photosynthetically active radiation
CD EIS	Port of Gladstone Gatcombe and Golding Cutting Channel Duplication Project Environmental Impact Statement
CQU	Central Queensland University
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAF	Department of Agriculture and Fisheries
DoEE	Department of Environment and Energy (Commonwealth)
DMPA	dredged material placement area
DPA	Dugong Protection Area
DSITI	Department of Science, Information Technology and Innovation
est.	established
EA	Environmental Authority
EHP	Department of Environment and Heritage Protection
EPA	Environmental Protection Agency
EPBC	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
ERMP	Ecosystem Research and Monitoring Program
ERMPAP	Ecosystem Research and Monitoring Program Advisory Panel
FBA	Fitzroy Basin Association
GBRMP	Great Barrier Reef Marine Park
GBRMPA	Great Barrier Reef Marine Park Authority
GISERA	Gas Industry Social and Environmental Research Alliance
GHHP	Gladstone Healthy Harbour Partnership
GIS	geographic information system
GLNG	Gladstone Liquefied Natural Gas Project
GPC	Gladstone Ports Corporation
GRC	Gladstone Regional Council
ISP	independent science panel
MSQ	Maritime Safety Queensland
NAGD	National Assessment Guidelines for Dredging
NRM	natural resource management
NRG	NRG Gladstone Power Station



Abbreviation	Meaning
OCP	organochlorine pesticides
OPP	organophosphate pesticides
PAH	polycyclic aromatic hydrocarbon
PCIMP	Port Curtis Integrated Monitoring Program
PSD	particle size distribution
QAL	Queensland Alumina Limited
QER	Queensland Energy Resources
QGC	QGC Pty Ltd
QWQG	Queensland Water Quality Guidelines
RIMRep	Reef 2050 Integrated Monitoring and Reporting Program Strategy
SAP	sampling and analysis plan
TBD	to be determined
TPH	total petroleum hydrocarbons
TOC	total organic carbon
TSS	total suspended solids
WBDDP	Western Basin Dredging and Disposal Project
WICET	Wiggins Island Coal Export Terminal Pty Ltd

Figures

Figure number	Figure title
Figure 1	Port Curtis Integrated Monitoring Program water quality and sediment quality monitoring
Figure 2	Marine and estuarine water quality monitoring
Figure 3a	Ecosystem Research and Monitoring Program and Biodiversity Offset Strategy study area
Figure 3b	Ecosystem Research and Monitoring Program and Biodiversity Offset Strategy Port Curtis study area
Figure 4	Marine turtle nesting and hatchling monitoring
Figure 5	Shorebird monitoring
Figure 6	Seagrass monitoring
Figure 7	Air quality monitoring
Figure 8	Reef monitoring
Figure 9	Fish monitoring
Figure 10	Benthic fauna monitoring
Figure 11	Underwater noise monitoring
Figure 12	Flora monitoring
Figure 13	Inshore dolphin monitoring

Environmental monitoring programs table identifiers

Prefix	Monitoring type
AQ	Air quality
E	Ecology
N	Noise
S	Sediment
W	Waste
WQ	Water quality
V	Various

Information Links

Program / webpage	URL
Arrow LNG Plant Supplementary EIS shorebird technical study	http://eisdocs.dsdip.qld.gov.au/Shell%20Australia%20LNG%20(aka%20Arrow%20LNG%20Plant)/SEIS/Appendices/appendix-18-final-shorebird-technical-study.pdf
Australian Government marine pests information	http://www.agriculture.gov.au/pests-diseases-weeds/marine-pests
BOS	BOS overview: http://www.gpcl.com.au/environment/bos BOS reports http://www.gpcl.com.au/envirodocs-desc?j={Biodiversity%20Offset%20Strategy}&y=1
EHP Gladstone region water quality	https://www.ehp.qld.gov.au/gladstone/water-quality.html#water_quality
EHP marine wildlife strandings annual reports	https://www.ehp.qld.gov.au/wildlife/caring-for-wildlife/strandnet-reports.html
GBRMPA website	http://www.gbrmpa.gov.au/
GBRMPA Reef 2050 Integrated Monitoring and Reporting Program	http://www.gbrmpa.gov.au/managing-the-reef/reef-2050/reef-integrated-monitoring-and-reporting-program

Program / webpage	URL
GHHP	<p>GHHP publications: http://ghhp.org.au/publications</p> <p>GHHP coral investigations: https://dims.ghhp.org.au/repo/data/public/26521b</p> <p>GHHP 2015 report card technical report: http://ghhp.org.au/assets/pdf/tech-report/2015%20Report%20Card%20Technical%20Report_FINAL-20160211202711.pdf</p> <p>GHHP ePortal: http://data.ghhp.org.au/</p>
GISERA	<p>GISERA homepage: www.gisera.org.au</p> <p>An integrated study of the Gladstone marine system report: https://publications.csiro.au/rpr/pub?pid=csiro:EP152793</p> <p>An integrated study of the Gladstone marine system report overview: https://gisera.org.au/wp-content/uploads/2017/01/An-integrated-study-of-the-Gladstone-marine-system.pdf</p>
GladFish	<p>Gladfish overview: http://infofishaustralia.com.au/gladfish-case-study/</p> <p>Gladfish 2013 report: http://infofishaustralia.com.au/wp-content/uploads/2016/08/Gladfish-2013-report-final.pdf</p>
GPC air quality monitoring overview	http://www.gpcl.com.au/environment/compliance-and-monitoring/air-quality-monitoring-program
GPC coral studies	http://www.gpcl.com.au/envirodocs-desc?j={Coral}&y=1
GPC dredging monitoring	http://www.gpcl.com.au/operations/dredging
GPC environmental reports	http://www.gpcl.com.au/envirodocs-desc?j=*&y=1
GPC ERMP overview	http://www.gpcl.com.au/environment/ermp
GPC ERMP reports	http://www.gpcl.com.au/envirodocs-desc?j={Ecosystem%20Research%20and%20Monitoring%20Program}&y=1
GPC Long term monitoring and management plan for sea disposal of maintenance dredge material 2013-2018	http://gpcl.com.au/SiteAssets/Dredging%20Plans/Long_Term_Monitoring_and_Management_Plan_for_Sea_Disposal_of_Maintenance_Dredge_Material_2013_2018.pdf
Infofish website	http://infofishaustralia.com.au/
PCIMP	http://www.pcimp.com.au

Program / webpage	URL
Qfish website	http://qfish.fisheries.qld.gov.au/
Queensland Government air quality monitoring	Gladstone air quality monitoring network: https://www.qld.gov.au/environment/pollution/monitoring/air-monitoring/gladstone/ EHP Gladstone region air quality reports page: https://www.ehp.qld.gov.au/gladstone/air-quality.html EHP hourly air quality data: https://www.ehp.qld.gov.au/air/data/search.php
Queensland Government dataset search	https://data.qld.gov.au/
Queensland Government library catalogue	https://www.qld.gov.au/environment/library
Seagrass-Watch publications	http://www.seagrasswatch.org/publications.html

References

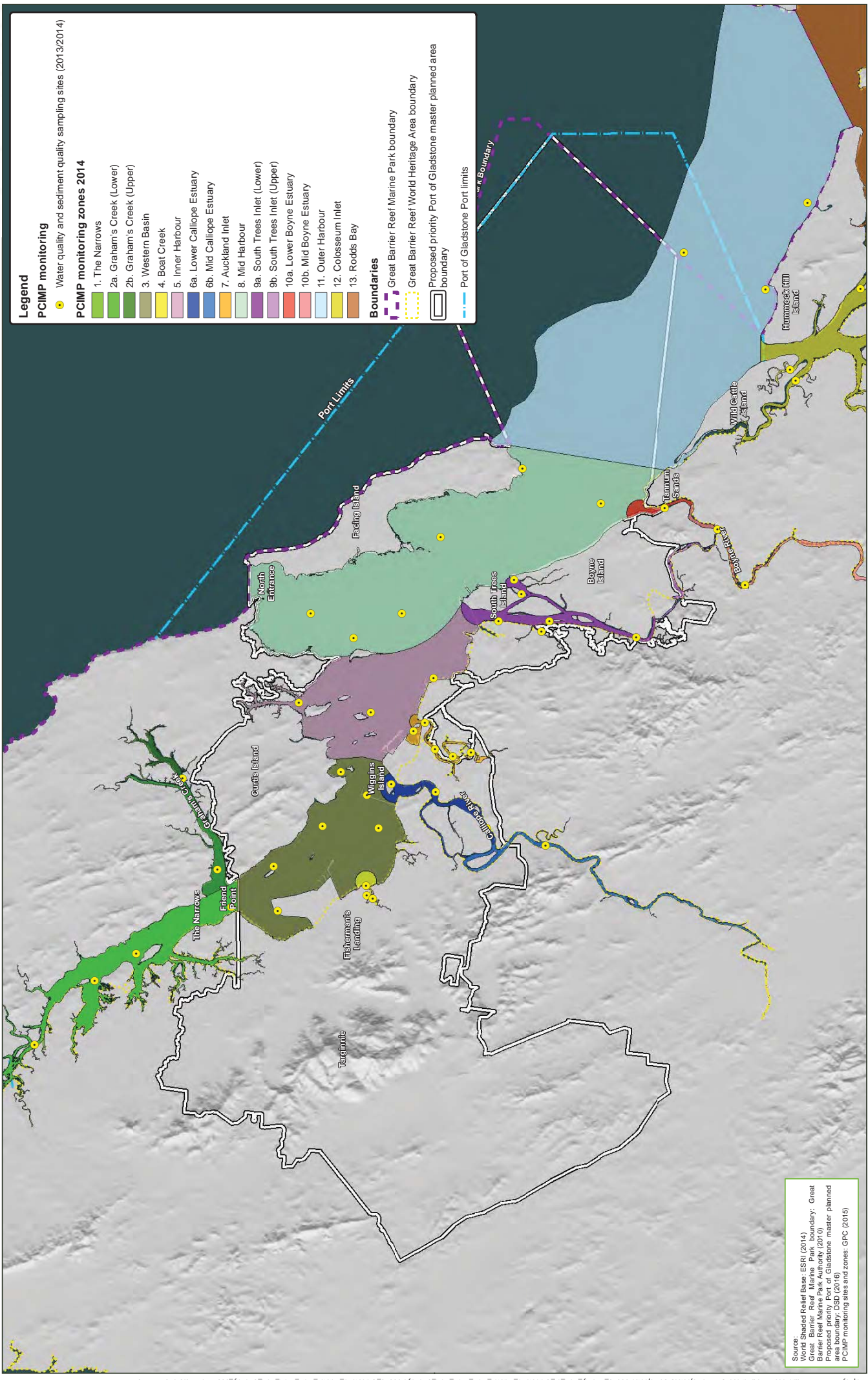
Australian and New Zealand Environment Conservation Council/Agriculture and Resources Management Council of Australia and New Zealand 2000, *National Water Quality Management Strategy, Paper No. 4*, Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Volume 1, The Guidelines (Chapters 1-7) pp. 3.1: 1-3, 4.4: 10-11.

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Department of Environment and Heritage Protection 2009, *Queensland Water Quality Guidelines*, Version 3, ISBN 978-0- 9806986-0-2.

Storey, AW, Andersen, LE, Lynas J, & Melville, F, 2007, *Port Curtis Ecosystem Health Report Card. Port Curtis Integrated Monitoring Program*, Centre for Environmental Management, Central Queensland University.

Vision Environment 2011, *Port Curtis Ecosystem Health Report Card 2008-2011*, PCIMP, Gladstone, Queensland.



Legend

PCIMP monitoring

- Water quality and sediment quality sampling sites (2013/2014)

PCIMP monitoring zones 2014

- The Narrows
- Graham's Creek (Lower)
- Graham's Creek (Upper)
- Western Basin
- Boat Creek
- Inner Harbour
- Lower Calloope Estuary
- Mid Calloope Estuary
- Auckland Inlet
- Mid Harbour
- South Trees Inlet (Lower)
- South Trees Inlet (Upper)
- Lower Boyne Estuary
- Mid Boyne Estuary
- Outer Harbour
- Collesseum Inlet
- Rodds Bay

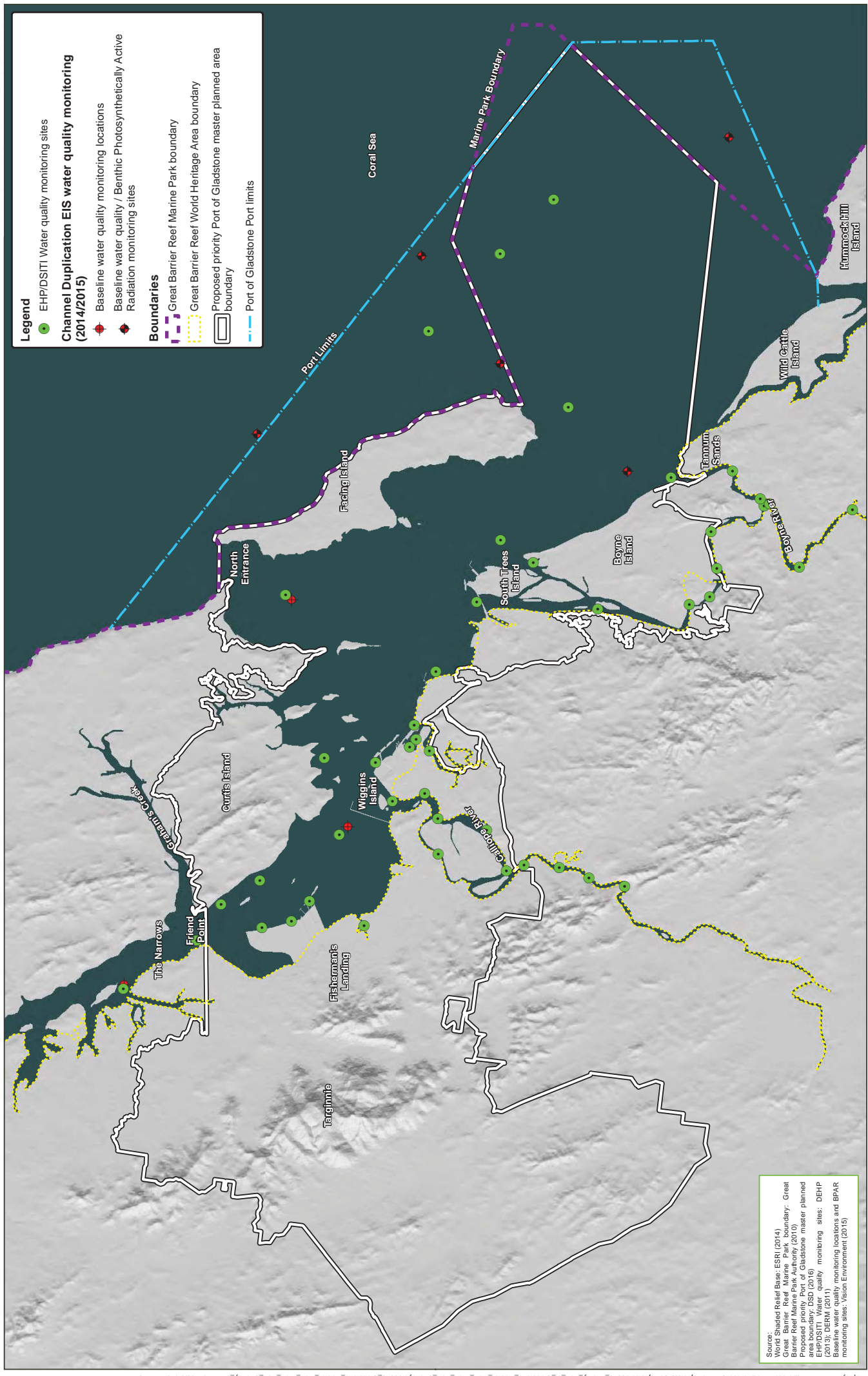
Boundaries

- Great Barrier Reef Marine Park boundary
- Great Barrier Reef World Heritage Area boundary
- Proposed priority Port of Gladstone master planned area boundary
- Port of Gladstone Port limits

Source:
 World Shaded Relief Base: ESRI (2014)
 Proposed priority Port of Gladstone master planned area boundary: GDA 1994 MGA Zone 56
 PCIMP monitoring sites and zones: GPC (2015)



Priority Port of Gladstone master planning environmental monitoring programs
Figure 1: Port Curtis Integrated Monitoring Program water quality and sediment quality monitoring



Legend

- EHPDSTI Water quality monitoring sites
- ♦ Baseline water quality monitoring locations
- ♦ Radiation monitoring sites

Channel Duplication EIS water quality monitoring (2014/2015)

- ♦ Baseline water quality monitoring locations
- ♦ Baseline water quality / Benthic Photosynthetically Active Radiation monitoring sites

Boundaries

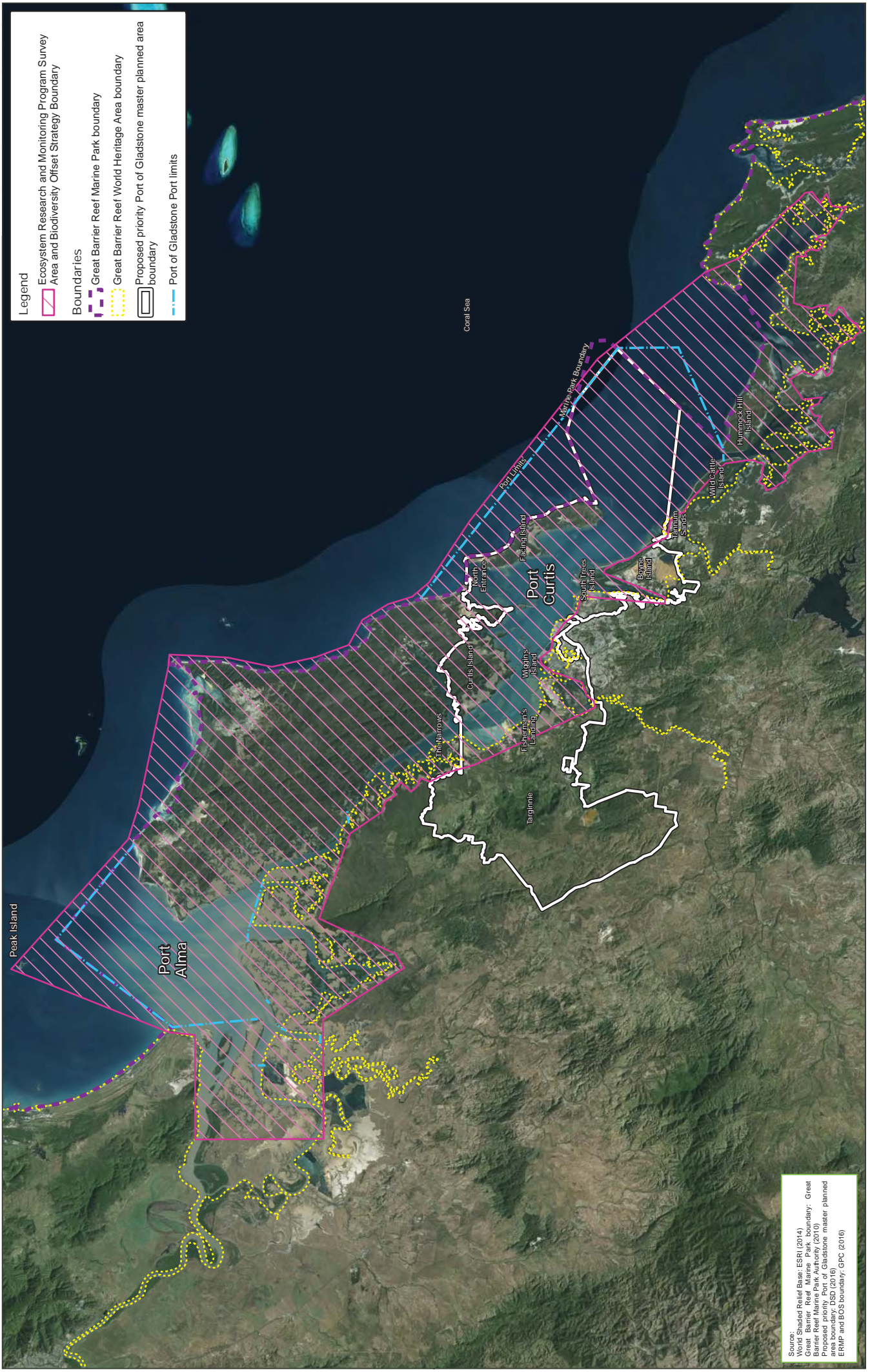
- Great Barrier Reef Marine Park boundary
- Great Barrier Reef World Heritage Area boundary
- Proposed priority Port of Gladstone master planned area boundary
- Port of Gladstone Port limits

Source:
 World Shaded Relief Base: ESRI (2014)
 Great Barrier Reef Marine Park boundary: Great Barrier Reef Marine Park Authority (2010)
 Proposed priority Port of Gladstone master planned area boundary: DPWS (2013)
 EHPDSTI Water quality monitoring sites: DEHP (2013); DERM (2011)
 Baseline water quality monitoring locations and BPAR monitoring sites: Vision Environment (2015)



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 Coordinate system: GDA 1994 MGA Zone 56

Priority Port of Gladstone master planning environmental monitoring programs
Figure 2: Marine and estuarine water quality monitoring



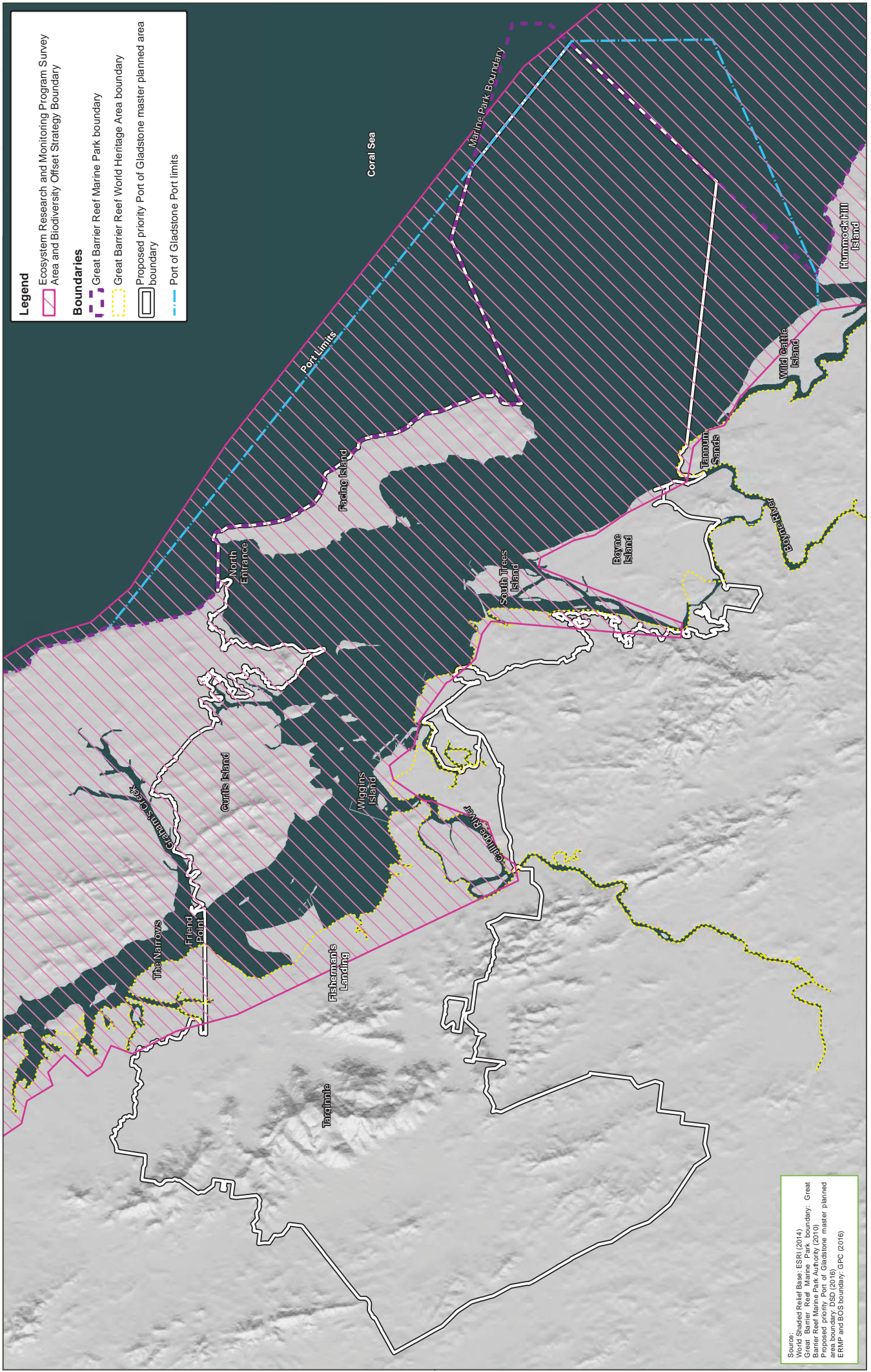
- Legend**
- Ecosystem Research and Monitoring Program Survey Area and Biodiversity Offset Strategy Boundary
 - Boundaries**
 - Great Barrier Reef Marine Park boundary
 - Great Barrier Reef World Heritage Area boundary
 - Proposed priority Port of Gladstone master planned area boundary
 - Port of Gladstone Port limits

Source: Shaded Relief Base: ESR (2014)
 Great Barrier Reef Marine Park boundary: Great Barrier Reef Marine Park Authority (2010)
 Proposed priority Port of Gladstone master planned area boundary: DSD (2016)
 ERMP and BOS boundary: GFC (2016)

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Priority Port of Gladstone master planning environmental monitoring programs
 Figure 3a: Ecosystem Research and Monitoring Program and Biodiversity Offset Strategy study area



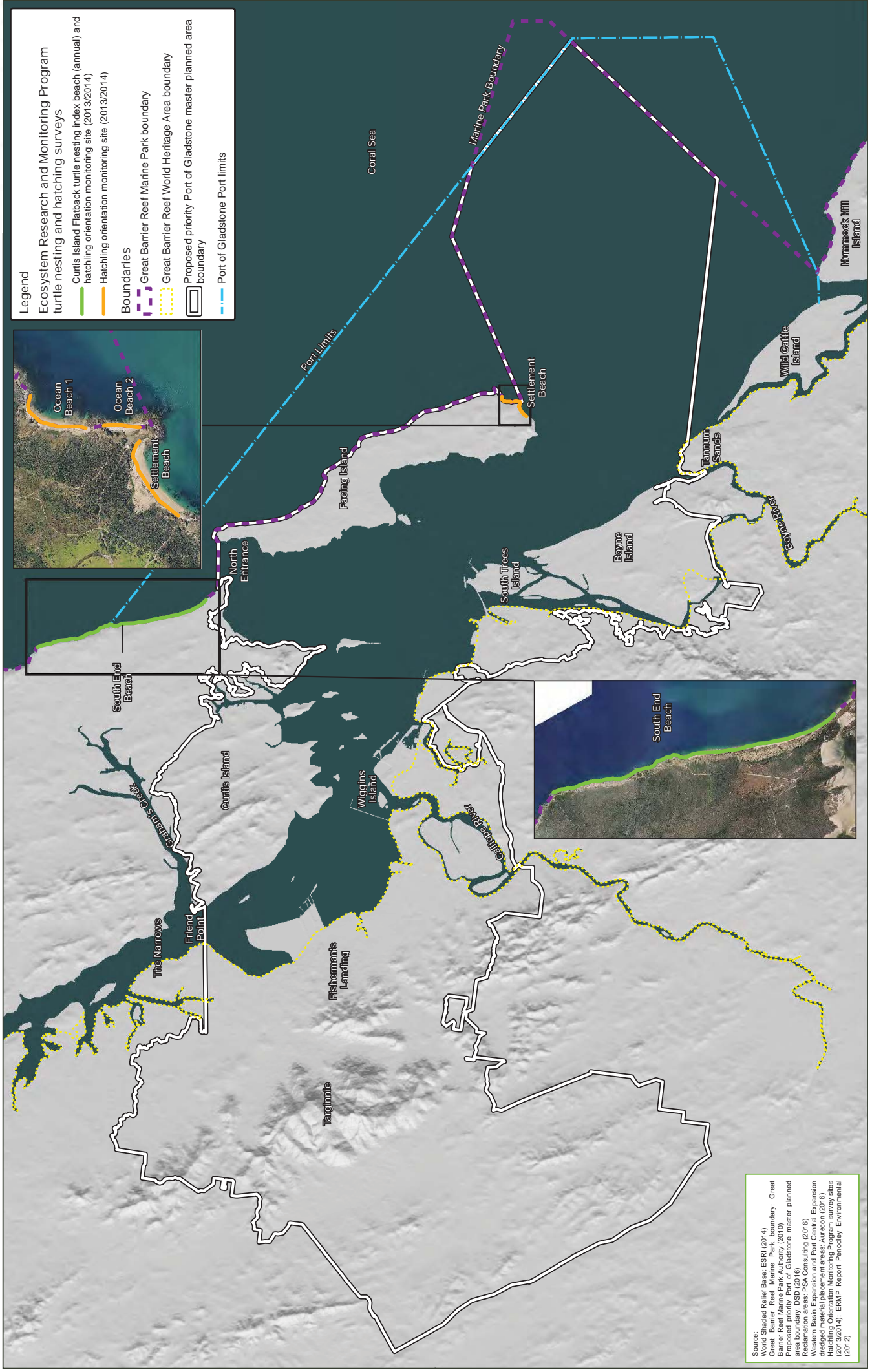
- Legend**
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 - Boundaries**
 - Great Barrier Reef Marine Park boundary
 - Great Barrier Reef World Heritage Area boundary
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 - Port of Gladstone Port limits

Sources:
 World Shaded Relief Base: ESRI (2014)
 Great Barrier Reef Marine Park boundary: Great Barrier Reef Marine Park Authority (2010)
 Proposed priority Port of Gladstone master planned area boundary: SDP (2016)
 ERM and BOS boundary: GPC (2016)

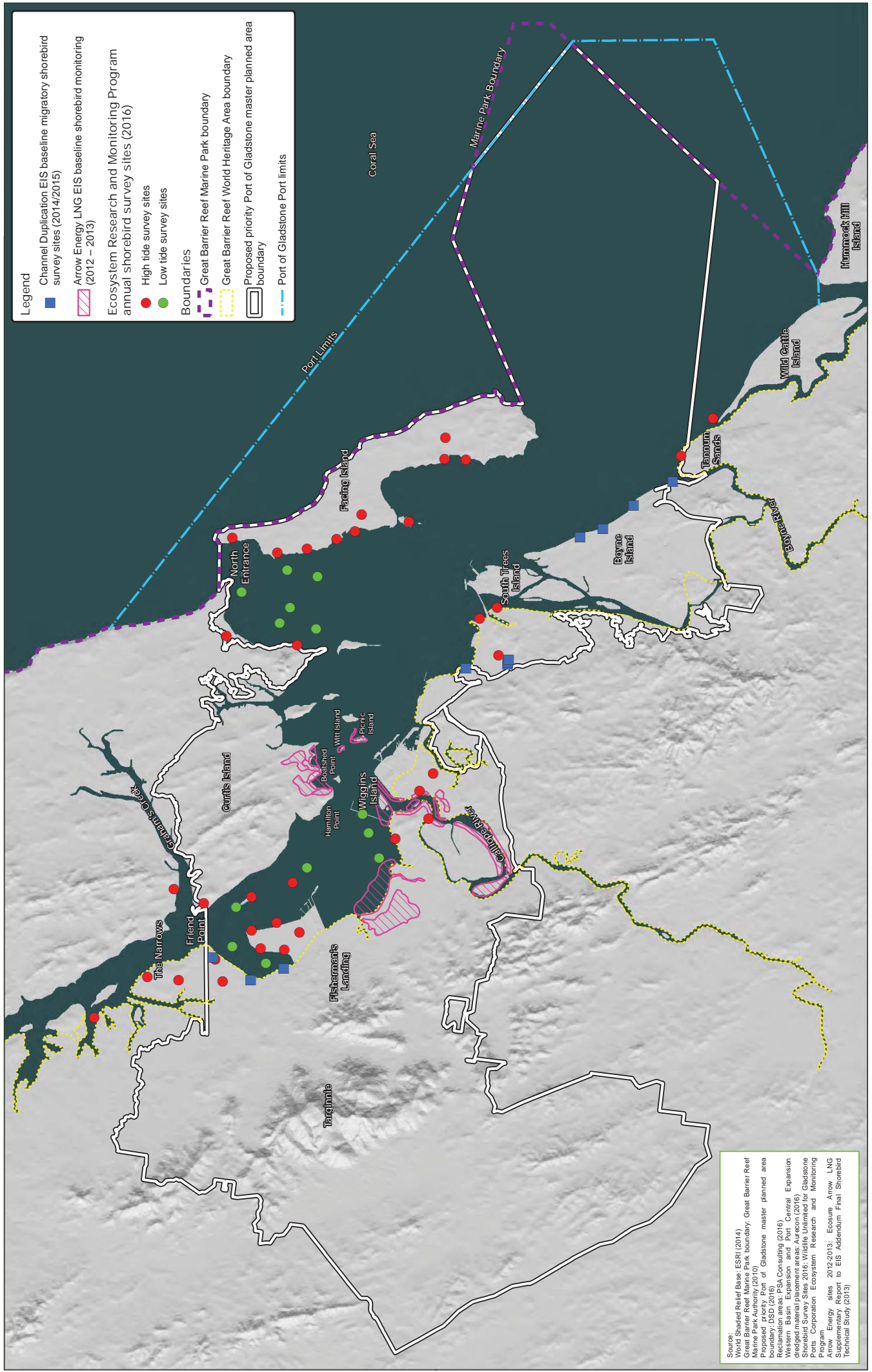


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 Coordinate system: GDA 1994 MGA Zone 56

Priority Port of Gladstone master planning environmental monitoring programs
 Figure 3b: Ecosystem Research and Monitoring Program and Biodiversity Offset Strategy Port Curtis study area



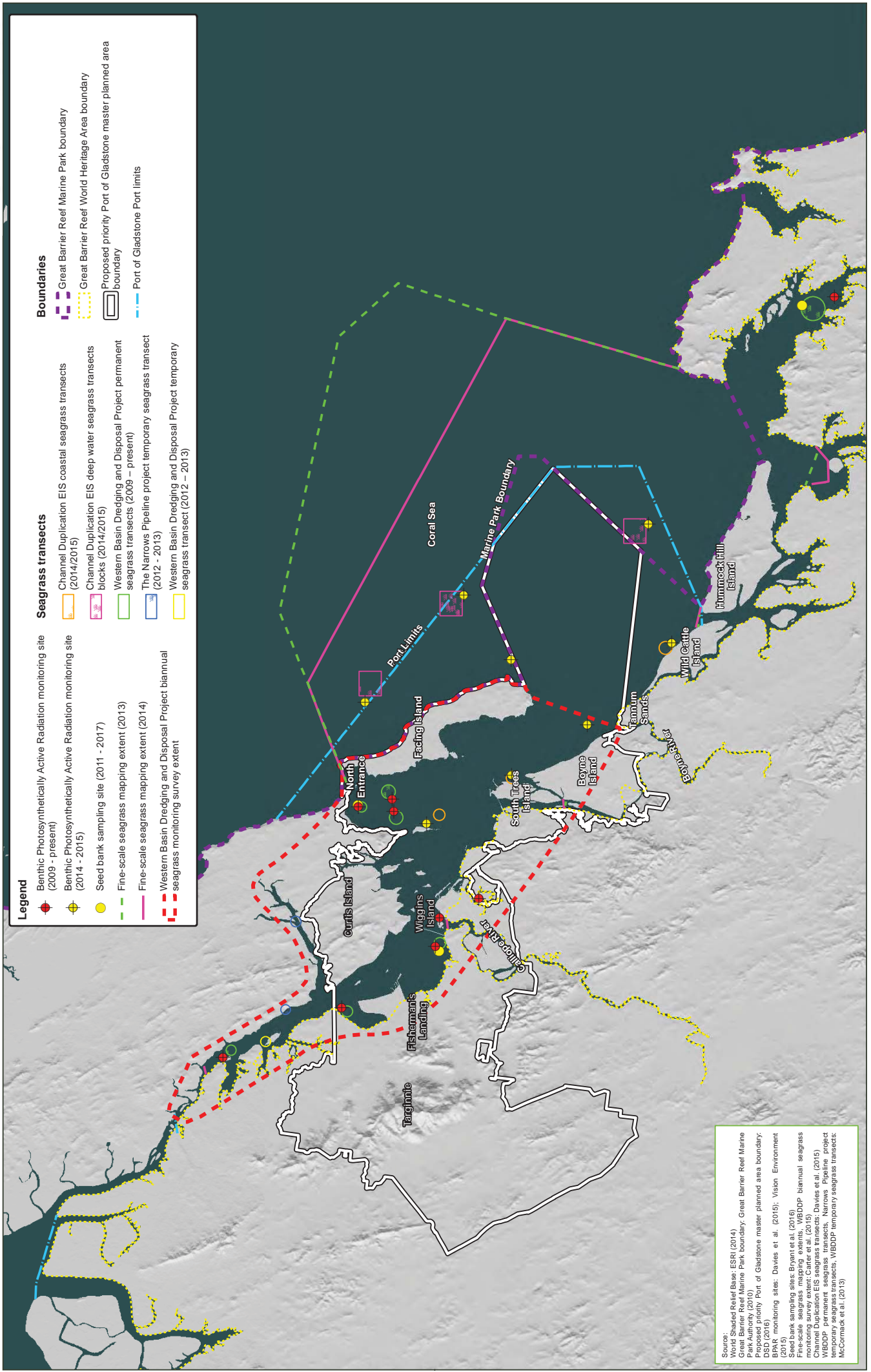
Priority Port of Gladstone master planning environmental monitoring programs
 Figure 4: Marine turtle nesting and hatchling monitoring



Priority Port of Gladstone master planning environmental monitoring programs

Figure 5: Shorebird monitoring





Legend

- Benthic Photosynthetically Active Radiation monitoring site (2009 - present)
- Benthic Photosynthetically Active Radiation monitoring site (2014 - 2015)
- Seed bank sampling site (2011 - 2017)
- Fine-scale seagrass mapping extent (2013)
- Fine-scale seagrass mapping extent (2014)
- Western Basin Dredging and Disposal Project biannual seagrass monitoring survey extent

Seagrass transects

- Channel Duplication EIS coastal seagrass transects (2014/2015)
- Channel Duplication EIS deep water seagrass transects blocks (2014/2015)
- Western Basin Dredging and Disposal Project permanent seagrass transects (2009 - present)
- The Narrows Pipeline project temporary seagrass transect (2012 - 2013)
- Western Basin Dredging and Disposal Project temporary seagrass transect (2012 - 2013)

Boundaries

- Great Barrier Reef Marine Park boundary
- Great Barrier Reef World Heritage Area boundary
- Proposed priority Port of Gladstone master planned area boundary
- Port of Gladstone Port limits

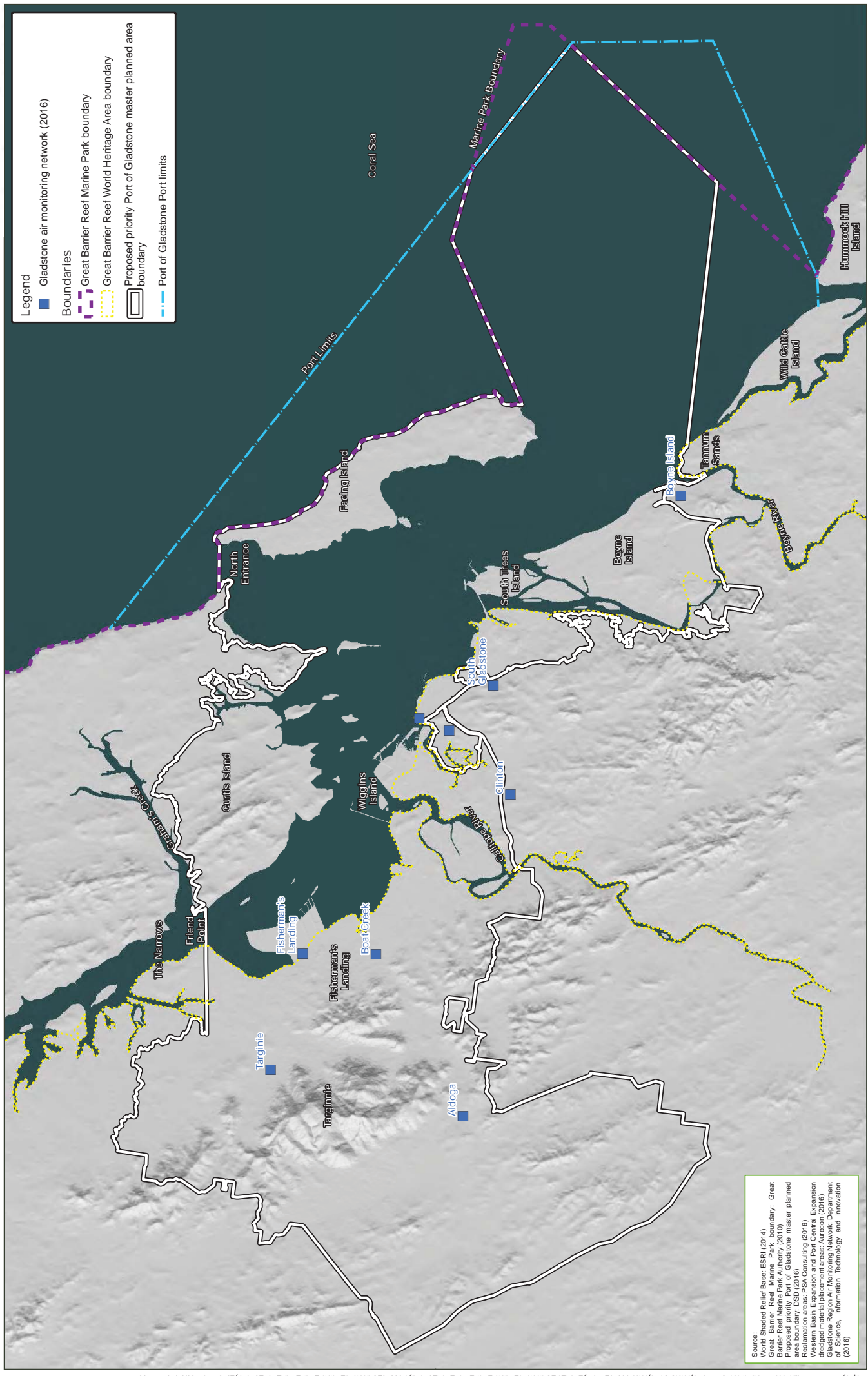
Source:
 World Shaded Relief Base: ESRI (2014)
 Great Barrier Reef Marine Park boundary: Great Barrier Reef Marine Park Authority
 Proposed priority Port of Gladstone master planned area boundary: DSD (2016)
 BPAR monitoring sites: Davies et al. (2015); Vision Environment (2015)
 Seed bank sampling sites: Bryant et al. (2016)
 Fine-scale seagrass mapping extent: Vision Environment (2015)
 Channel Duplication EIS seagrass transects: Davies et al. (2015)
 WBDDP permanent seagrass transects, Narrows Pipeline project temporary seagrass transects, WBDDP temporary seagrass transects: McCormack et al. (2015)



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Priority Port of Gladstone master planning environmental monitoring programs
 Figure 6: Seagrass monitoring



Legend

- Gladstone air monitoring network (2016)

Boundaries

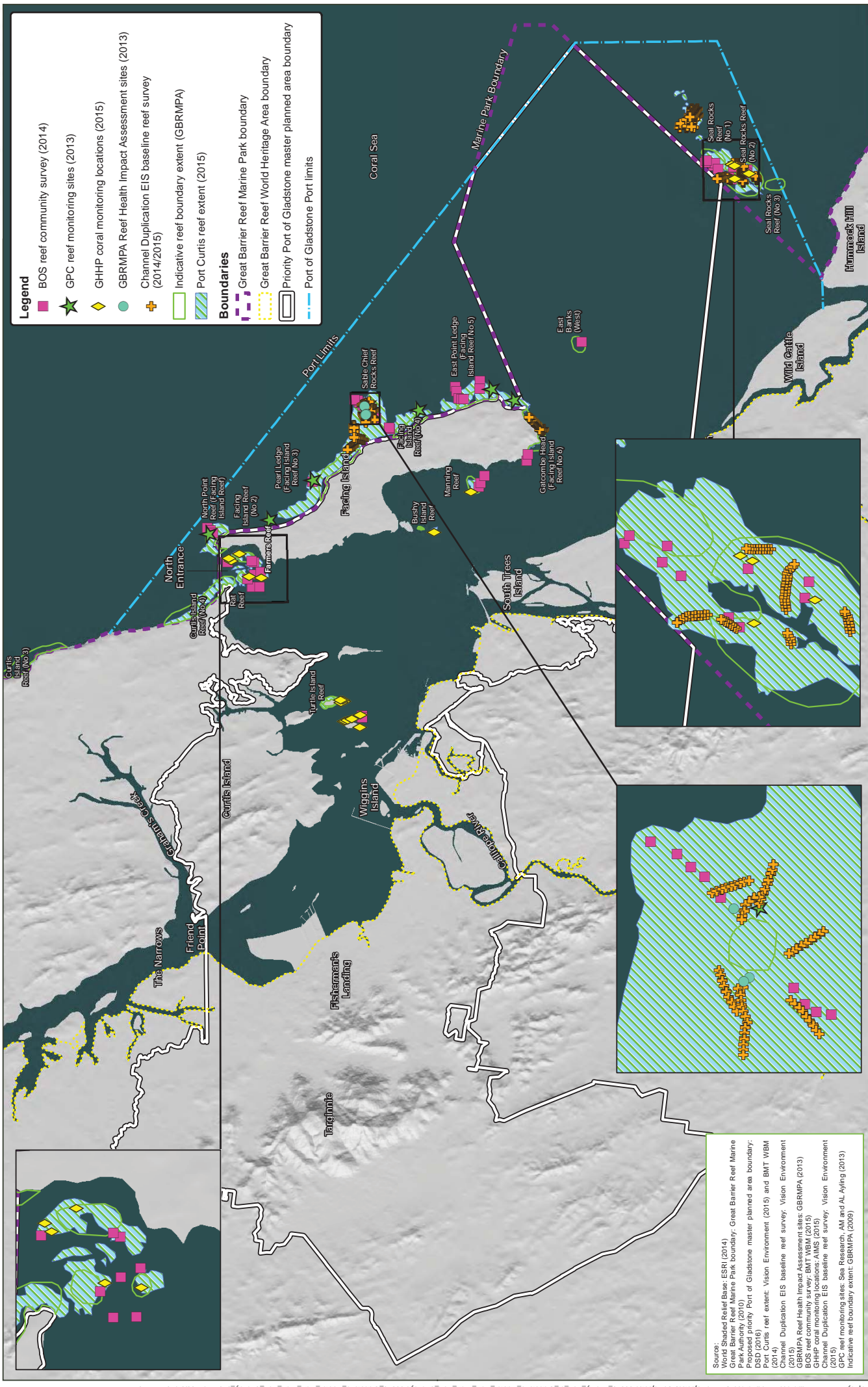
- Great Barrier Reef Marine Park boundary
- Great Barrier Reef World Heritage Area boundary
- Proposed priority Port of Gladstone master planned area boundary
- Port of Gladstone Port limits

Source:
 World Shaded Relief Base: ESRI (2014)
 Great Barrier Reef Marine Park boundary: Great Barrier Reef Marine Park Authority (2010)
 Proposed priority Port of Gladstone master planned area boundary: DSD (2016)
 Reclamation areas: PSA Consulting (2016)
 Western Basin Expansion and Port Central Expansion: Gladstone Region Air Monitoring Network; Department of Science, Information Technology and Innovation (2016)



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Priority Port of Gladstone master planning environmental monitoring programs
 Figure 7: Air quality monitoring

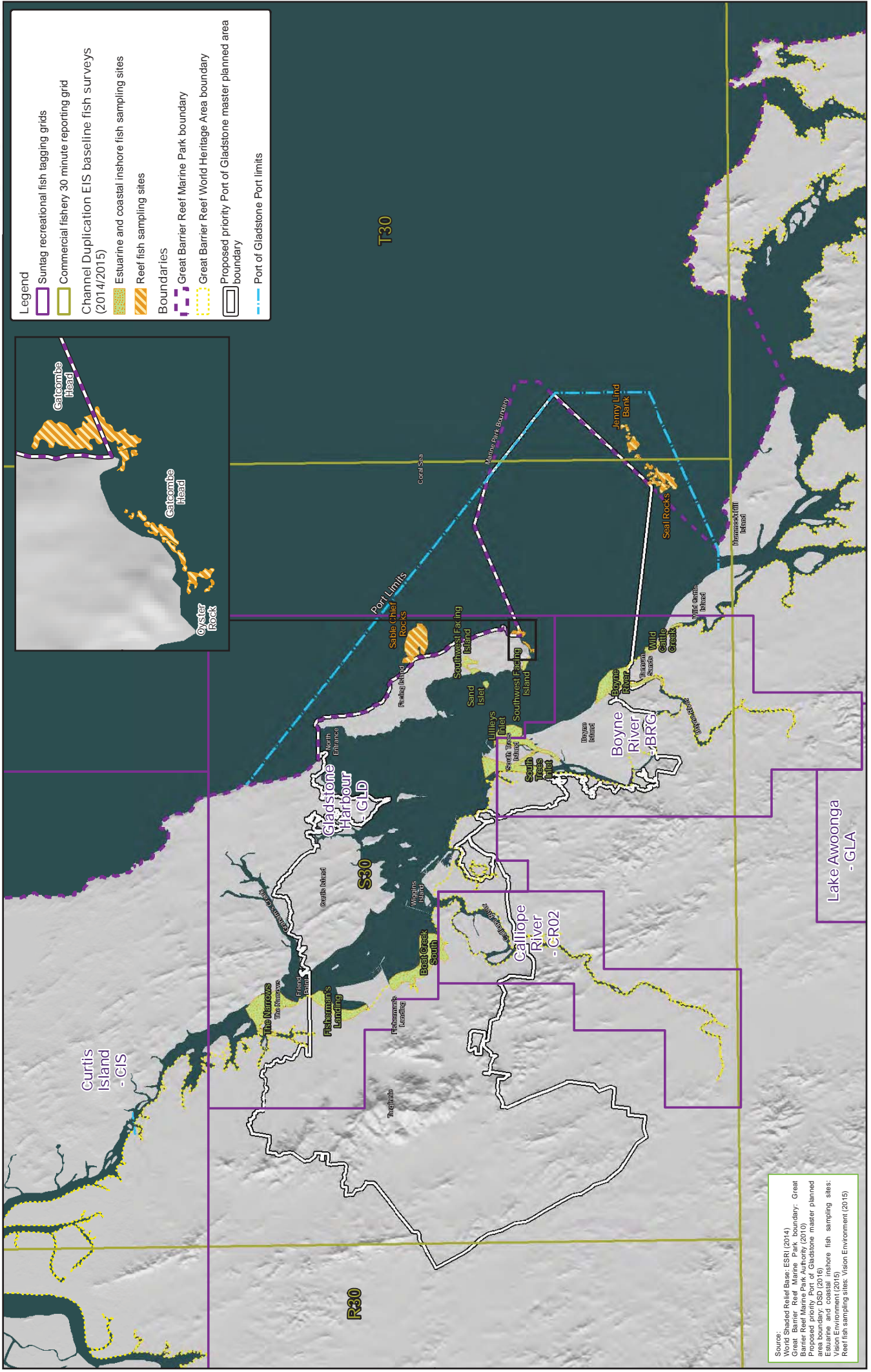


Sources:
 Inset map of Great Barrier Reef: ESRI (2014)
 Great Barrier Reef Marine Park boundary: Great Barrier Reef Marine Park Authority (2010)
 Proposed priority Port of Gladstone master planned area boundary: DSD (2016)
 Port Curtis reef extent: Vision Environment (2015) and BMT WBM (2015)
 Channel Duplication EIS baseline reef survey: Vision Environment (2015)
 GBRMPA Reef Health Impact Assessment sites: GBRMPA (2013)
 BOS reef community survey: BMT WBM (2015)
 Channel Duplication EIS baseline reef survey: Vision Environment (2015)
 GPC reef monitoring sites: Sea Research, AM and AL Ayling (2013)
 Indicative reef boundary extent: GBRMPA (2009)



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Priority Port of Gladstone master planning environmental monitoring programs
 Figure 8: Reef monitoring



Legend

- Suntag recreational fish tagging grids
- Commercial fishery 30 minute reporting grid
- Channel Duplication EIS baseline fish surveys (2014/2015)
- Estuarine and coastal inshore fish sampling sites
- Reef fish sampling sites

Boundaries

- Great Barrier Reef Marine Park boundary
- Great Barrier Reef World Heritage Area boundary
- Proposed priority Port of Gladstone master planned area boundary
- Port of Gladstone Port limits

Source:
 World Shaded Relief Base: ESRI (2014)
 Great Barrier Reef Marine Park boundary: Great Barrier Reef Marine Park Authority (2010)
 Gladstone master planned area boundary: DSD (2016)
 Estuarine and coastal inshore fish sampling sites: Vision Environment (2015)
 Reef fish sampling sites: Vision Environment (2015)

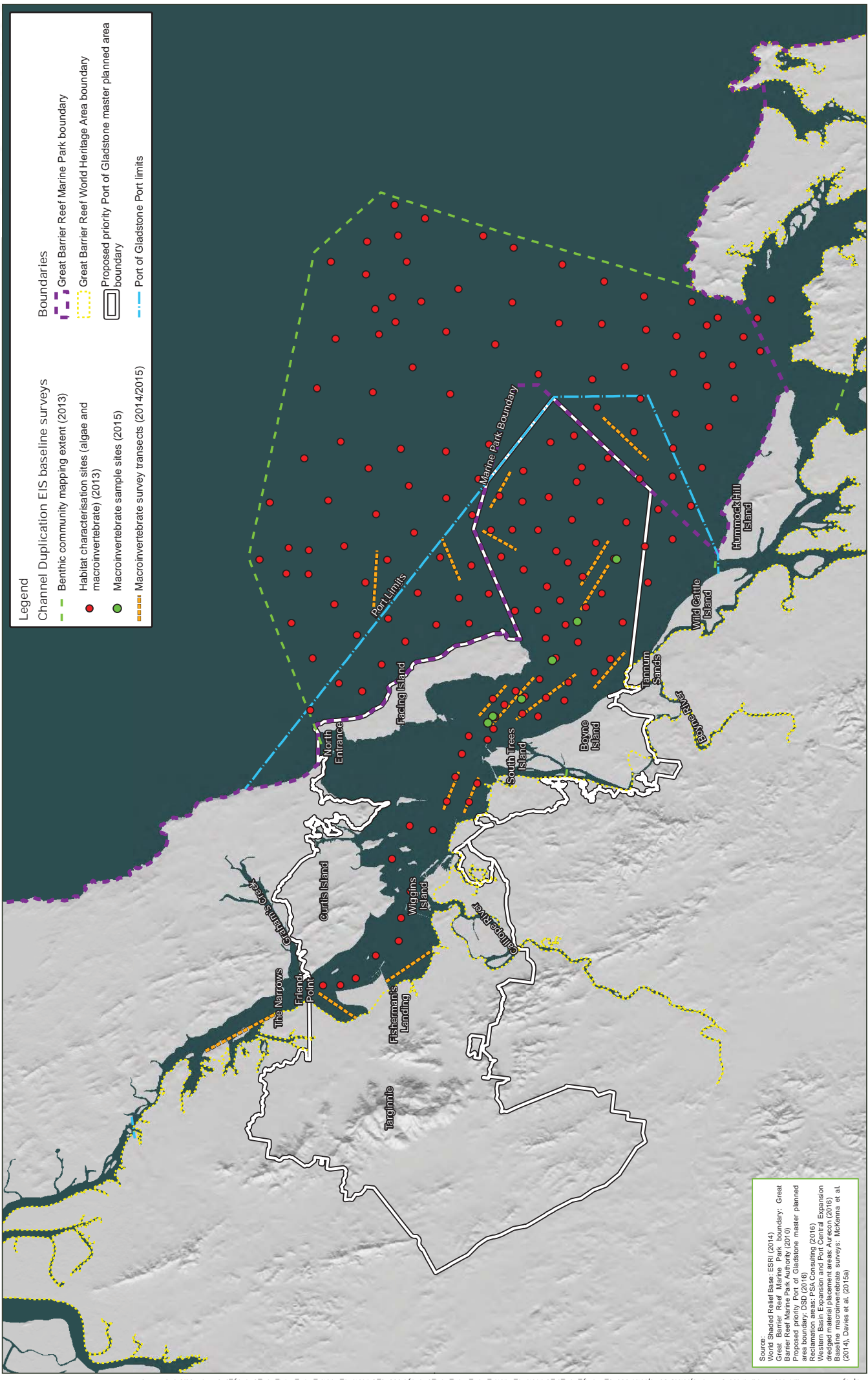


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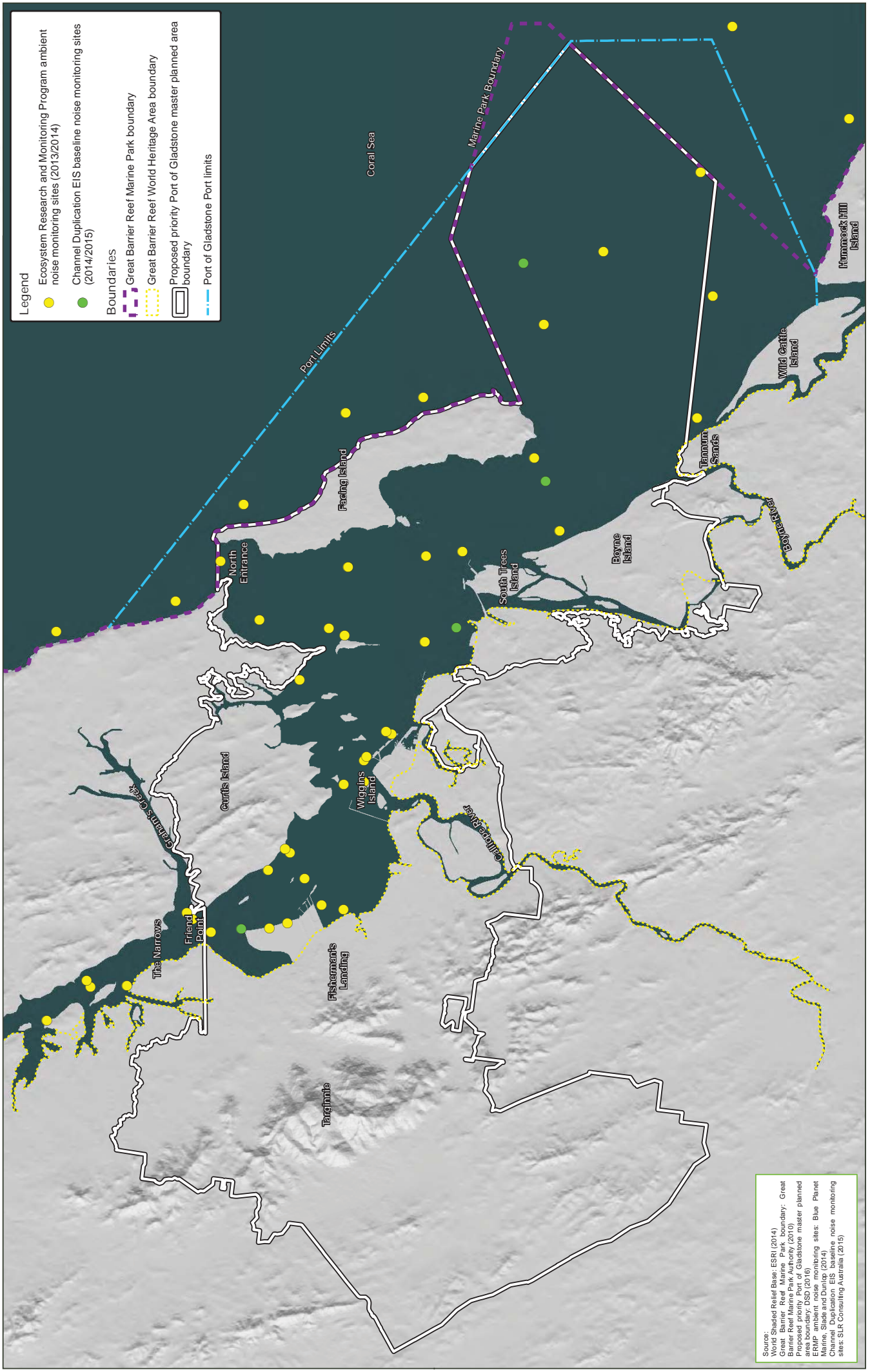
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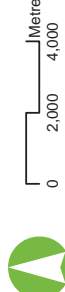
Figure 9: Fish monitoring



Map by: RB
 Priority Port of Gladstone master planning environmental monitoring programs
 Figure 10: Benthic fauna monitoring



Sources:
 World Shaded Relief Base: ESRI (2014)
 Great Barrier Reef Marine Park boundary: Great Barrier Reef Marine Park Authority (2010)
 Priority Port of Gladstone master planned area boundary: DSD (2016)
 ERM ambient noise monitoring sites: Blue Planet Marine, Slade and Dunlop (2014)
 Channel Duplication EIS baseline noise monitoring sites: SLR Consulting Australia (2015)



Priority Port of Gladstone master planning environmental monitoring programs

Figure 11: Underwater noise monitoring

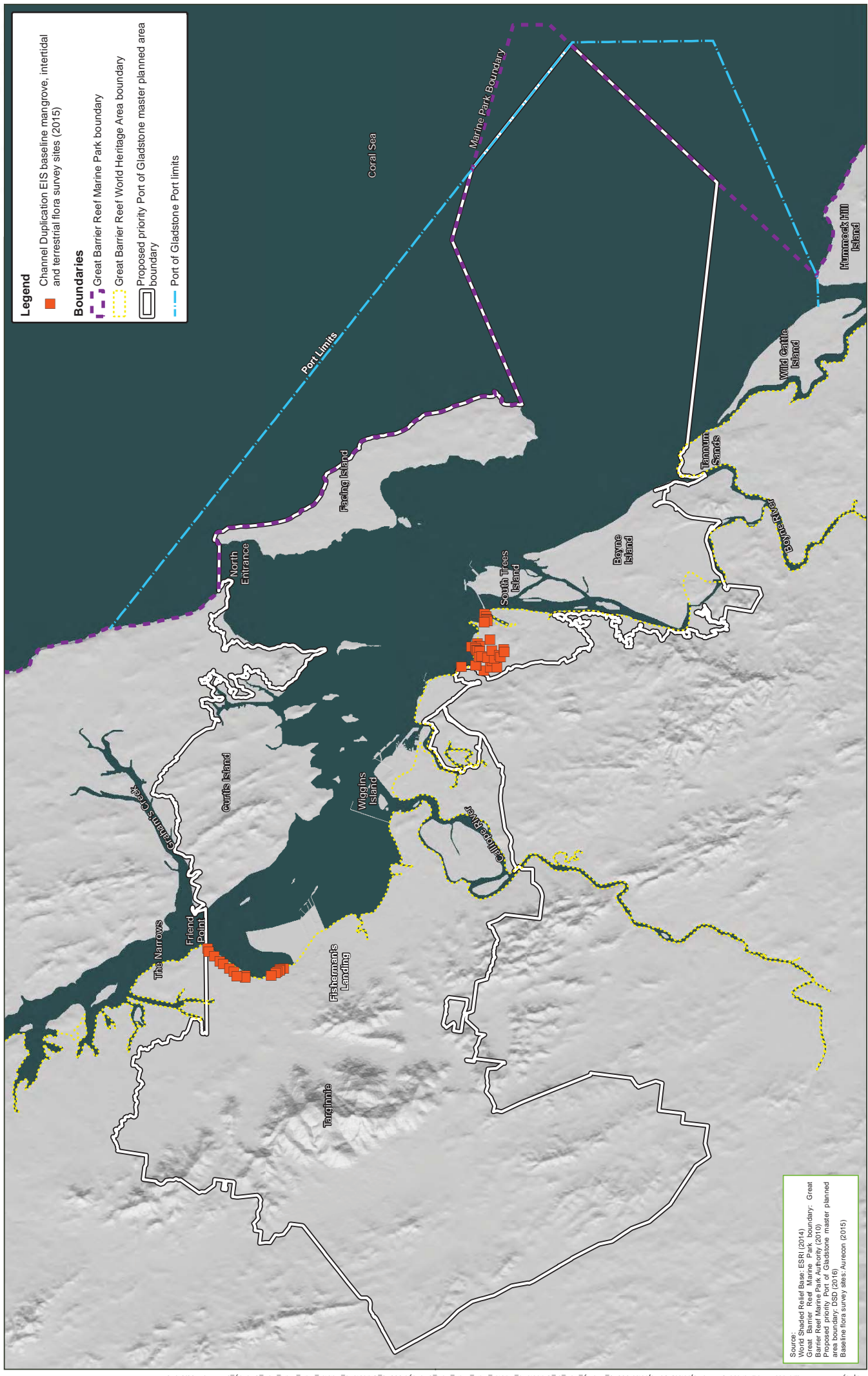


Figure 12: Flora monitoring

Legend

Ecosystem Research and Monitoring Program Inshore Dolphin Surveys (2014-2016)

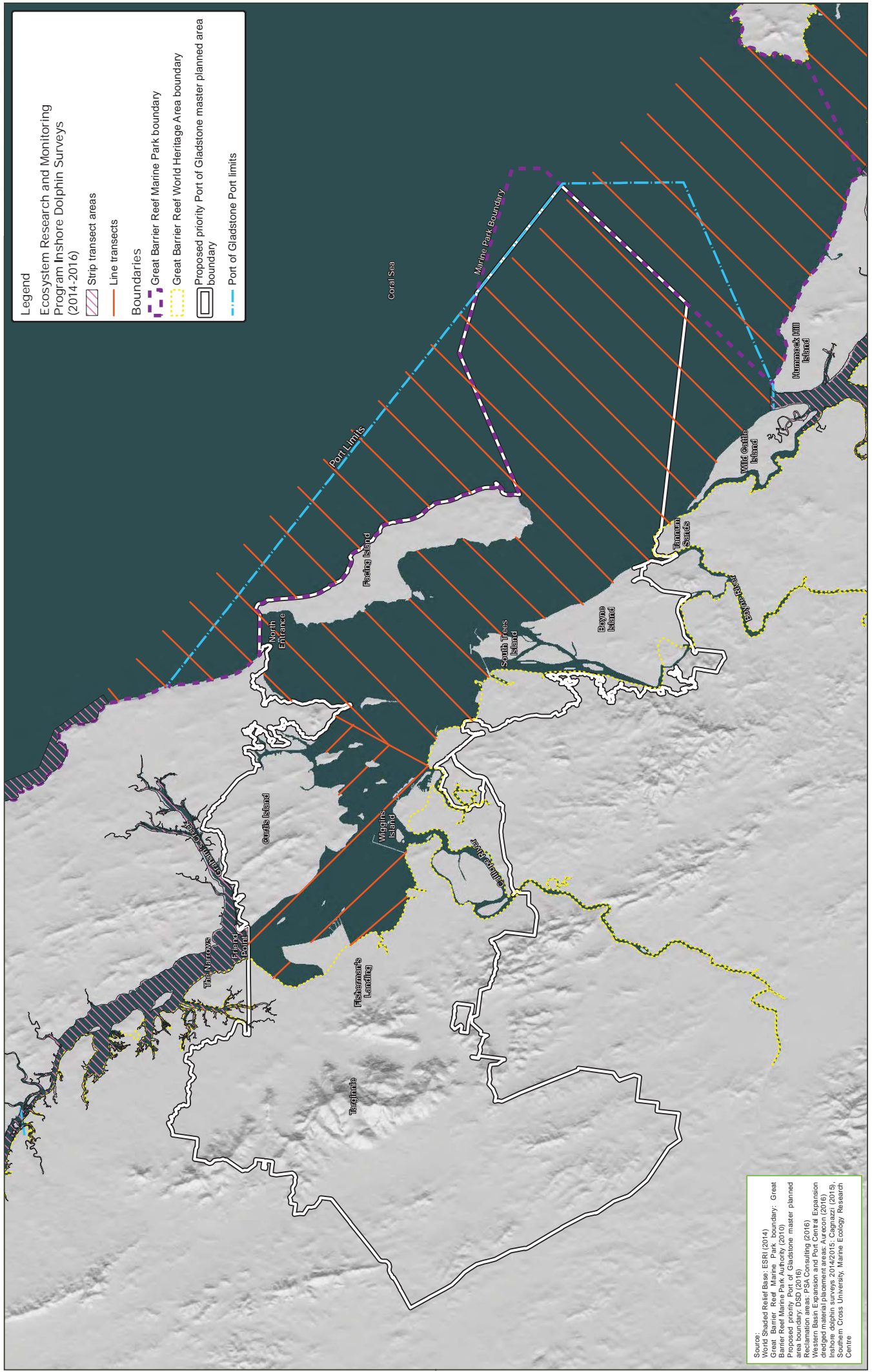
- Strip transect areas
- Line transects

Boundaries

- Great Barrier Reef Marine Park boundary
- Great Barrier Reef World Heritage Area boundary

Proposed priority Port of Gladstone master planned area boundary

Port of Gladstone Port limits



Map by: RB

Source: World Shaded Relief Base: ESRI (2014)
 Great Barrier Reef Marine Park boundary: Great Barrier Reef Marine Park Authority (2014)
 Proposed priority Port of Gladstone master planned area boundary: DSD (2016)
 Reclamation areas: PSA Consulting (2016)
 Western Basin Expansion and Port Central Expansion: Integrated Regional Planning and Research Centre (2015), Southern Cross University, Marine Ecology Research Centre



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Priority Port of Gladstone master planning environmental monitoring programs
 Figure 13: Inshore dolphin monitoring

Part C

Addendum to the infrastructure and supply chain requirements assessment report





**Priority Port of Gladstone master
planning**

Addendum to the Infrastructure and Supply
Chain Requirements Assessment

Department of State Development

24 January 2017
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*Bringing ideas
to life*

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1 Introduction

1.1 Background

The Queensland Government is currently advancing master planning for the priority ports of Gladstone, Abbot Point, Townsville, and Hay Point and Mackay in accordance with the *Sustainable Ports Development Act 2015* (Qld) (Ports Act).

Master planning for priority ports is one of the port-related actions of the Reef 2050 Long-Term Sustainability Plan (Reef 2050), and is mandated under the Ports Act.

Through port master planning, the Queensland Government seeks to effectively manage the land and marine areas needed for the efficient development and operation of each of the priority ports, while ensuring that the Outstanding Universal Value (OUV) of the Great Barrier Reef World Heritage Area (GBRWHA) is an intrinsic consideration in port development, management and governance.

Master planning for each of Queensland's priority ports is required to:

- Define a long term strategic vision, objectives and desired outcomes for each port master planned area
- Identify the state interests in relation to the priority ports and articulate how those interests are to be considered in all planning decisions made within each port master planned area
- Present an environmental management framework (EMF) that states priority management measures (PMMs) for managing potential impacts on environmental values in the master planned area and surrounding areas in accordance with principles of ecologically sustainable development (ESD)

The Ports Act requires that a master plan be prepared for each of the priority ports of Gladstone, Abbot Point, Townsville, and Hay Point and Mackay.

To support each master plan, the Ports Act also requires that a port overlay be made for each priority port as the relevant legislative instrument for the master plan over each master planned area.

1.2 Purpose

To support master planning for the priority Port of Gladstone, the Department of State Development (DSD) has prepared an evidence base which collates information on the economic, environmental, community and cultural aspects of the priority Port of Gladstone. The evidence base consists of the following reporting:

- Evidence Base Report for the Proposed Gladstone Port Master Planned Area (AECOM 2016) (herein referred to as the 'evidence base report')
- Capacity for Growth Scenarios – Master Planning for the Priority Port of Gladstone Master Plan (DSD 2016)
- Priority Port of Gladstone Master Planning – Risk Assessment (Aurecon 2016)
- Infrastructure and Supply Chain Requirements Assessment (ISCRA) Report (PSA Consulting 2016) (herein referred to as the ISCRA)

This report is an addendum to the ISCRA prepared by PSA Consulting, and provides additional information on the infrastructure and supply chain requirements to inform preparation of the priority Port of Gladstone draft master plan and preliminary draft port overlay.



This report contains sections on:

- **Port trade growth (Section 2)** – an outline of the growth scenario 3, with development of potential port throughput by specific cargo and description of corresponding infrastructure and shipping requirements. This section provides more detailed breakdown of throughput predictions by cargo, supplementing Section 4.1 of the ISCRA.
- **Potential marine infrastructure expansion (Section 3)** – presents the potential port throughput by specific cargo and a description of corresponding marine infrastructure and shipping requirements. This section also summarises possible vessel size changes, berth numbers and locations, and possible requirements for dredging, dredged material placement and emergency anchorages within the master planned area. Finally, this section provides a more detailed breakdown of throughput predictions by cargo, and highlights linkages between the predicted throughput and the potential expansion of port infrastructure, supplementing Section 4.1 and Section 4.2 of the ISCRA.
- **Supply chain linkage – infrastructure corridors (Section 4)** – a summary of the additional port supply chain linkages and infrastructure requirements required to support the master plan growth scenario 3. This section provides additional description to Section 4.3 of the ISCRA.
- **Optimisation of port infrastructure (Section 5)** – provides an overview of the principles and processes involved in the optimisation of port infrastructure.
- **Key considerations for the draft master plan (Section 6)** – summarises the key issues discussed in this addendum which should be considered in the preparation of the priority Port of Gladstone draft master plan and preliminary draft port overlay.

2 Port trade growth

DSD, in consultation with key stakeholders has determined the capacity for growth scenarios for the priority Port of Gladstone master planning process to a 2050 timeframe. Three scenarios were developed and documented by DSD in the Capacity for Growth Scenarios (DSD 2016).

The ISCRA discusses several growth scenarios and details the infrastructure and supply chain requirements for growth scenario 3. Growth scenario 3 has been considered further within this addendum report. The Capacity for Growth Scenarios prepared by DSD assumes that the master plan growth scenario 3 constitutes the industries within the master planned area as summarised in Table 2.1.

Table 2.1 Growth scenario 3 industries at the Port of Gladstone

Industry	Trade throughput	Growth
Coal	164 Mtpa	Coal exports
LNG export	50 Mtpa	LNG export
Bauxite import and alumina/aluminium export	40 Mtpa	Alumina and aluminium industry
Other commodities	40 Mtpa	Other existing commodities/general cargo, and formation of new industries including petroleum refinery, shale oil export, steel plant, nickel refinery and container import hub
Total	294 Mtpa	

Table notes:

LNG – liquefied natural gas

Mtpa - Million tonnes per annum

The master plan growth scenario 3 is consistent with the Gladstone Ports Corporation's (GPC) 50 Year Strategic Plan 2012 (the GPC 50 Year Strategic Plan). The 50 Year Strategic Plan states that the port may ultimately develop into a strategic port centre handling 250-300 Million tonnes (of cargo) per annum (Mtpa). The GPC 50 Year Strategic Plan showing existing and potential port centres and developments is shown in Figure 2.1.

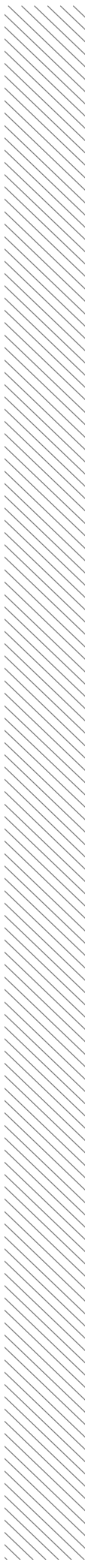


Figure 2.1 GPC 50 Year Strategic Plan – port centres and planned development

Source: GPC 2012

3 Potential marine infrastructure expansion

3.1 Overview

This section provides a description of the potential future marine infrastructure required to support the master plan growth scenario 3. This includes consideration of:

- Throughput for each cargo type
- Berth locations and requirements
- Channel expansion and capital dredging
- Maintenance dredging
- Material placement areas
- Emergency anchorages

3.2 Throughput growth by cargo type

The ISCRA describes general potential industry growth, but does not appear to nominate specific commodities, tonnages and number of berths required to reach the throughput capacity identified for the master plan growth scenario 3. The ISCRA and growth scenario reporting specifies throughput for coal, LNG and aluminium, and generally described throughput for 'other' industries.

Further consideration of specific throughput per cargo, corresponding number of berths, potential berth locations and corresponding shipping requirements has been made in this addendum report, to correlate the growth scenario to the infrastructure requirements needed in the master plan. In particular, more detail around a potential scenario for the growth of 'other existing commodities and new industries' to 40 Mtpa (DSD 2016) is required to identify possible future infrastructure requirements.

It should be noted that there is an inherent level of uncertainty in the size, form and timing of the development of new or the expansion of existing trades and industries within the Port of Gladstone. New industries can occur as a result of technology developments, or can become feasible on the back of other developments and industries expanding at the port. However, consideration of one of the potential trade growth scenarios to reach the master plan growth scenario 3 has been undertaken, to identify potential infrastructure and supply chain requirements.

A breakdown of the throughput growth and potential marine infrastructure requirements to achieve the throughput in the master plan growth scenario 3 is provided in Table 3.1.

Table 3.1 Marine and shipping requirements for growth scenario 3

Cargo type	Existing situation – berths and throughput	Master plan growth scenario 3 – maximum berths and throughput
Cargo export		
Coal	Wiggins Island -1 berth - 16 Mtpa	Wiggins Island - 4 berths - 84 Mtpa
	RG Tanna - 4 berths - 64 Mtpa	RG Tanna - 5 berths - 80 Mtpa
LNG	Curtis Island - 3 berths - 20.6 Mtpa	Curtis Island - 6 berths - 50 Mtpa
Alumina and Aluminium	Fisherman's Landing - 1 berths - 3 Mtpa	Fisherman's Landing - 2 berths - 6 Mtpa
	South Trees and Boyne - 2 berths - 3.3 Mtpa	South Trees and Boyne Island - 2 berths - 4 Mtpa

Cargo type	Existing situation – berths and throughput	Master plan growth scenario 3 – maximum berths and throughput
Cement, clinker, fly ash	Fisherman's landing - 1 berth - 2.1 Mtpa	Fisherman's Landing - 1 berth - 2.2 Mtpa
Grain	Auckland Point - 1 berth - 0.7 Mtpa	Auckland Point - 1 berth - 1.1 Mtpa
General and miscellaneous cargo	Various general cargo berths - 1.6 Mtpa	Various general cargo berths - 2.1 Mtpa
Petroleum and shale oil	N/A	Tide Island - 1 berth - 4 Mtpa
Nickel	N/A	Fisherman's Landing general cargo berth - 0.1 Mtpa
Steel	N/A	Fisherman's Landing - 1 berth - 4 Mtpa
Cargo import		
Bauxite	Fisherman's Landing - 1 berths - 9 Mtpa	Fisherman's Landing - 2 berths – 20 Mtpa
	South Trees - 1 berth - 10 Mtpa	South Trees - 1 berth – 10 Mtpa
Caustic soda and ammonia	Various general and multi cargo berths- 2.5 Mtpa	Various general and multi cargo berths - 3.2 Mtpa
Petroleum	Auckland Point - 1 berth - 1.6 Mtpa	Auckland Point - 1 berth - 1.6 Mtpa
	N/A	Fisherman's Landing - 1 berth - 2 Mtpa
General and miscellaneous cargo	Various general cargo berths - 0.5 Mtpa	Various general cargo berths - 2.1 Mtpa
Nickel ore and sulphur	N/A	Wiggins Island - 1 berth - 4 Mtpa
Limestone (steel industry)	N/A	Fisherman's Landing - 1 berth- 1.0 Mtpa
Iron ore (steel industry)	N/A	Fisherman's Landing - 1 berth- 5.6 Mtpa
Other		
Container hub	N/A	Hamilton Point - 3 berths - 1,000,000 TEU (approximately 7 Mtpa)
Cruise industry	N/A	Auckland Point - 1 berth
Total	20 berths - 135 Mtpa	42 berths - 294 Mtpa

Table notes:


* Current throughput based on 2016 published data, further to 2014/2015 data documented in Infrastructure and Supply Chain Requirements Assessment

NA – Not applicable

Mtpa – Million tonnes per annum

TEU – Twenty-foot equivalent unit

It should be noted that different berths have different throughput capacities for a number of reasons. The different cargo types being shipped have different masses, use different cargo handling equipment with different capacities and have a different level of vessel queuing and berth utilisations which all impact throughput capacity. The maximum berth utilisation (time a vessel is at a berth) is also typically not more than around 70% due to the need to limit vessel queuing, and allow for vessel transiting, delays and other reasons. Container berths for example have a low density of the cargo and



the container cranes handle containers one at a time, meaning a lower throughput per berth compared to a high throughput conveying and shiploading system installed on a coal export berth.

The container import hub identified in the evidence base report is a possible new industry to develop in the port over the life of the master plan. Currently a small volume of containers for the local region are imported at Auckland Point. However in the future should the Australian Rail Track Corporation's (ARTC) Inland Rail project be constructed, operated and extended to Gladstone, the Port of Gladstone will have access to an integrated east coast rail network. The Port of Gladstone has a natural advantage of a number of natural deep water berths in the inner harbour. If deep draft berths and rail access is developed, Gladstone could conceivably become a container import/export hub for the east coast of Australia, and part of an overall integrated east coast freight solution. The container import/export hub could accommodate post-Panamax container vessels. The port could accommodate vessels larger than existing design vessels at the current east coast container ports.

The east coast of Australia has a current throughput of approximately 5.5 million twenty-foot equivalent unit (TEU) (Ports Australia 2014), and over the life of the master plan this is expected to incrementally grow to over 10 million TEU. It has been assumed that Gladstone could capture 10% of this trade, and therefore have a possible throughput of 1,000,000 TEU per year (approximately 7 Mtpa), with 3 post-Panamax berths.

The evidence base report and the ISCRA describe the possible industry growth and drivers for the other industries included in the 40 Mtpa of 'other' throughput.

3.3 Vessel size

Consideration of shipping including future vessel size is a key factor for potential capital dredging and infrastructure expansion, and has been discussed at a high level in Section 4.2 of the ISCRA.

Over a number of decades, the maximum vessel sizes and average vessel sizes of the global vessel fleet have been increasing, making product transport more efficient. Low value cargoes in particular are often shipped in larger vessels to minimise the shipping costs per tonne of cargo. This trend is expected to continue into the future, and the master plan should allow for larger vessels using the channel and berths.

Recent developments and expansions of the key trade routes of the Panama Canal and Suez Canal have also opened up these routes for larger vessels and increased traffic. The increase in size of the Panama Canal will likely increase the number of New Panamax or post-Panamax vessels built, with a corresponding decrease in Panamax and smaller vessels. The trend of increasing vessel size is predicted to continue into the future, as older smaller vessels are scrapped and newer larger vessels continue to be built, and channel and berth infrastructure is incrementally expanded to cater for larger vessels.

The Panama Canal expansion can now cater for New Panamax vessels, including container vessels up to 14,000 TEU (increased from 5,000 TEU), bulk vessels up to 180,000 deadweight tonnage (dwt) and LNG vessels up to 177,000 m³ (Panama Canal Authority 2016). The Suez Canal can already cater for vessels larger than this, up to 15,000 TEU and 185,000 dwt bulk carriers.

Typical vessel dimensions, characteristics and naming conventions are shown in Figure 3.1.

Classification	Displacement (t)	Capacity	Length overall L_{oa} (m)	Beam B (m)	Draught T_{FL} (m)
Tankers					
Panamax	90 000	70 000 DWT	245.0	32.2	12.0
Aframax	140 000	125 000 DWT	274.0	43.8	16.2
New Panamax	220 000	170 000 DWT	366.0	49.0	15.2
Suezmax	238 700	185 000 DWT	330.0	53.0	18.6
Bulk Carriers					
St Lawrence Seaway	35 000	25 000 DWT	226.0	24.0	8.0
Panamax	86 000	70 000 DWT	236.0	32.2	12.0
Capesize	192 000	150 000 DWT	294.0	45.9	17.5
New Panamax	220 000	180 000 DWT	366.0	49.0	15.2
Chinamax	450 000	400 000 DWT	365.0	65.0	22.0
LNG Carriers					
Spherical	107 000	145 000 m ³	283.0	42.7	12.0
QFlex	141 000	218 000 m ³	315.0	50.0	12.0
QMax	175 000	267 000 m ³	345.0	55.0	12.0
Container ships					
Panamax	83 000	5 000 TEU	290.0	32.2	13.2
New Panamax	180 000	13 000 TEU	366.0	49.0	15.2
Suezmax	210 000	15 000 TEU	382.0	56.4	15.5
VLCS	260 000	18 000 TEU	400.0	59.0	18.0

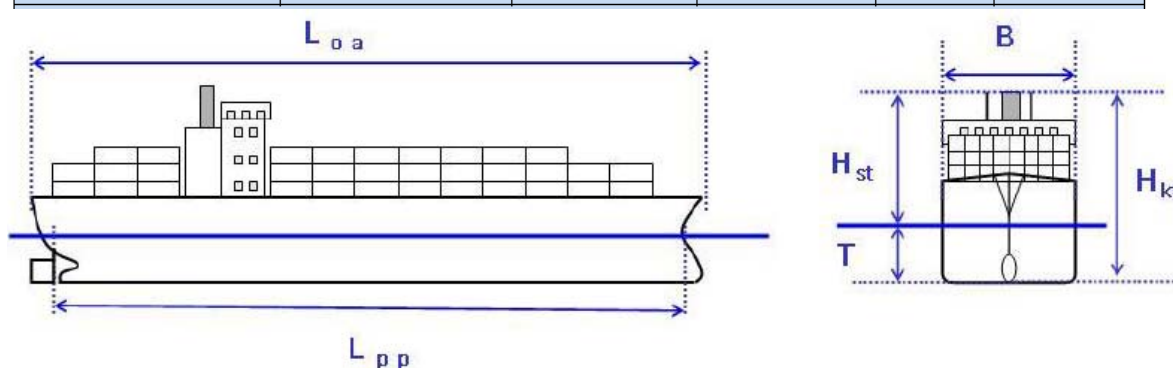


Figure 3.1 Typical vessel classifications and dimensions

Source: PIANC 2014

Large cape class bulk carriers can be up to 220,000 dwt, larger than shown in the reference above. The current design vessels at the Port of Gladstone are summarised in Table 3.2.

Table 3.2 Existing maximum design vessels

Berth	Maximum vessel size (fully loaded)
Boyne	60,000 dwt
South Trees East and West	80,000 dwt
Barney Point	90,000 dwt
Auckland Point 1-4	55,000 – 70,000 dwt
RG Tanna 1-4	220,000 dwt
Wiggins Island	220,000 dwt
Fisherman's Landing 2-5	25,000 – 80,000 dwt
Curtis Island 1-3	145,000 dwt (220,000 m ³)

Table note:

dwt – deadweight tonnage

Currently the design vessel for the Port of Gladstone is a 220,000 dwt coal bulk carrier. It is expected that if larger tankers, LNG carriers, or container ships are considered for new trades, they will choose a design vessel that requires similar navigational dredged areas to the current design vessel, in order to minimise additional dredging. This design vessel accommodates the majority of the global world fleet, and it is unlikely that additional dredging would be viable to capture a small fraction of the global fleet.

Although the maximum design vessel for the Port of Gladstone may not increase substantially, the percentage of larger vessels visiting the port is expected to increase over the timeframe of the master plan.

The increasing size of vessels will have some impacts on marine infrastructure requirements, with berths requiring slightly longer areas to accommodate the vessels and slightly deeper berth pockets. The main impact will be on shipping and channel requirements. The size and number of vessels using the port is intrinsically linked with any assessment of channel capacity, channel duplication or channel deepening. This is discussed further in Section 3.5.

Some of the potential trends in vessel size which should be considered in the master planning process are described in Table 3.3.

Table 3.3 Vessel size

Vessel	Historical trend	Possible future trend	Future Port of Gladstone impacts
Bulk carriers	Steady increase in size and proportion of cape class vessels used	Continued increase in fleet proportion of cape class vessels and post-Panamax vessels, putting additional demand on berth infrastructure and channel requirements	Increasing use of cape class vessels
LNG carriers	Have not significantly increased in size, but a larger proportion of the fleet is increasing in size to Q-Flex and Q-Max	A larger proportion of the global fleet likely to increase in size to Q-Max As LNG trade diversifies away from Qatar, deeper draft vessels could be procured specifically for new ports	Use of slightly larger Q-Max vessels likely (are similar draft to Q-Flex vessel though). A possible deeper draft vessel class could develop in the future and use the Port of Gladstone, but this is not currently planned

Vessel	Historical trend	Possible future trend	Future Port of Gladstone impacts
Container vessels	Fleet has rapidly increased in size over the last few decades, with both the size of the largest vessel and fleet proportion of post-Panamax vessels increasing significantly	Continued increase in maximum vessel size and proportion of post-Panamax vessels in fleet	New container facility to accommodate vessels up to New Panamax and Suezmax, equivalent to Cape Class vessels. Unlikely to accommodate VLCS
Bulk liquid tankers	Since ~1990, the average tanker size has not increased significantly. VLCCs and ULCCs have been used since then, but not in increasing number. Vessel size beneath that are limited by Suez Canal (Suezmax)	Likely continued use of VLCC and ULCC in some parts of world, but unlikely to be used in Australia due to port limitations	New bulk liquid industries to accommodate vessels up to New Panamax and possibly Suezmax, if located near deep channel areas Unlikely to accommodate VLCC and ULCC

Table notes:

LNG – Liquefied natural gas

VLCS – Very large container ship

VLCC – Very large crude carrier

ULCC – Ultra large crude carrier

3.4 Berths and shipping growth summary

The possible marine berth infrastructure and shipping growth for the master plan growth scenario 3 has been summarised in Table 3.4 based on comparing the existing infrastructure to the possible future requirements. The marine and shipping requirements have been split by cargo type, throughput and berth location, to allow specific berth locations and shipping requirements to be established. This is a key input to inform the master plan.

It should be noted that the vessel size shown in dwt (dead weight tonne - average vessel cargo mass) is the average, and a range of vessel sizes and classes larger and smaller than this will use the facility.

The assessment suggests a total of 42 berths may be required under a possible master plan growth scenario 3. However it is important for the master plan to provide flexibility for future development. In some cases there is more than one location where this expansion could feasibly occur, and a pre-feasibility or feasibility study would be required to determine the preferred location for the new berth precinct. Therefore, in some cases, two different location options are identified for a particular potential development. For example, a deep draft container import/export hub could be located at Hamilton Point or on the potential West Banks Island material placement area. There are advantages and disadvantages associated with each option that would need to be explored in detail, should this new trade be realised.

This flexibility is important so future developments are not constrained to a particular location, and also given that the growth profile and throughput identified is only one possible future growth scenario.

Table 3.4 Marine and shipping requirements for the master plan growth scenario 3

Cargo type	Existing situation		Master plan growth scenario 3			
	Existing berths and throughput	Average vessel size and type	Maximum berths and throughput	Average vessel size and type	Berths and shipping growth	Number vessels per year
Coal	Wiggins Island 1 berth - 16 Mtpa	95,000 dwt Up to Cape Class	Wiggins Island 4 berths - 84 Mtpa	120,000 dwt 75% Cape Class and 25% Panamax	3 additional berths, and an increase in Cape class vessel use	700 total 525 Cape Class
	RG Tanna 4 berths - 64 Mtpa	95,000 dwt Up to Cape Class	RG Tanna 5 berths - 80 Mtpa	120,000 dwt 75% Cape Class and 25% Panamax	1 additional berth, and an increase in Cape Class vessel use	667 total 500 Cape Class
LNG	Curtis Island 3 berths - 20.6 Mtpa	65,000 dwt 50% Q-Flex and 50% spherical and below	Curtis Island 6 berths - 50 Mtpa	100,000 dwt 25% Q-Max and 75% Q-Flex and spherical	3 additional berths, and increase in Q-Flex and new use of Q-Max	500 total No Cape Class
Alumina and Aluminium	Fisherman's Landing 1 berths - 3 Mtpa	35,000 dwt Panamax and Handy	Fisherman's Landing 2 berths - 6 Mtpa	35,000 dwt Panamax and Handy	1 additional berth, no major vessel use changes	171 total No Cape Class
	South Trees and Boyne 2 berths - 3.3 Mtpa	35,000 dwt Panamax and Handy	South Trees and Boyne 2 berths - 4 Mtpa	35,000 dwt Panamax and Handy	N/A	114 total No Cape Class
Cement, clinker, fly ash	Fisherman's Landing 1 berth - 2.1 Mtpa	20,000 dwt Handy	Fisherman's Landing 1 berth - 2.2 Mtpa	20,000 dwt Handy	N/A	110 total No Cape Class
	Auckland Point 1 berth - 0.7 Mtpa	16,000 dwt Handy	Auckland Point 1 berth- 1.1 Mtpa	20,000 dwt Handy	N/A	55 total No Cape Class
Grain	Various general cargo berths 1.6 Mtpa	20,000 dwt Handy	Various general cargo berths 2.1 Mtpa	25,000 dwt Handy	1 additional berth, no major vessel use changes	84 total No Cape Class
	N/A	N/A	Tide Island- 2 berths - 4 Mtpa	70,000 dwt Panamax	2 additional berth	57 total No Cape Class

Cargo type	Existing situation		Master plan growth scenario 3			
	Existing berths and throughput	Average vessel size and type	Maximum berths and throughput	Average vessel size and type	Berths and shipping growth	Number vessels per year
Nickel	N/A	N/A	Fisherman's Landing - general cargo berth - 0.1 Mtpa	25,000 dwt Handy	N/A	4 total No Cape Class
Steel	N/A	N/A	Fisherman's Landing - 1 berth - 4 Mtpa	70,000 dwt Panamax and below	1 additional berth	57 total No Cape Class
Cargo import						
Bauxite	Fisherman's Landing - 1 berths - 9 Mtpa	70,000 dwt Panamax and below	Fisherman's Landing - 2 berths - 20 Mtpa	70,000 dwt Panamax and below	1 additional berth, no major vessel use changes	286 total No Cape Class
	South Trees - 1 berth - 10 Mtpa	70,000 dwt Panamax and below	South Trees - 1 berth - 10Mtpa	70,000 dwt Panamax and below	N/A	143 total No Cape Class
Caustic soda and ammonia	Various general and multi cargo berths - 2.5 Mtpa	40,000 dwt Panamax and handy	Various general and multi cargo berths - 3.2 Mtpa	40,000 dwt Panamax and Handy	1 additional berth, no major vessel use changes	80 total No Cape Class
Petroleum	Auckland Point - 1 berth - 1.6 Mtpa	20,000 dwt Handy	Auckland Point - 1 berth - 1.6Mtpa	25,000 dwt Handy	N/A	64 total No Cape Class
	N/A	N/A	Fisherman's Landing - 1 berth - 2 Mtpa	50,000 dwt Panamax & below	1 additional berth	40 total No Cape Class
General and miscellaneous cargo	Various general cargo berths - 0.5 Mtpa	20,000 dwt Handy	Various general cargo berths - 2.1 Mtpa	25,000 dwt Handy	1 additional berth, no major vessel use changes	84 total No Cape Class
Nickel ore and sulphur	N/A	N/A	Wiggins Island - 1 berth - 4 Mtpa	100,000 dwt 50% Cape Class and 50% Panamax	1 additional berth	40 total 20 Cape Class
Limestone (steel industry)	N/A	N/A	Fisherman's Landing - 1 berth - 1.0 Mtpa	40,000 dwt Panamax and Handy	1 additional berth	25 total No Cape Class

Cargo type	Existing situation		Master plan growth scenario 3			
	Existing berths and throughput	Average vessel size and type	Maximum berths and throughput	Average vessel size and type	Berths and shipping growth	Number vessels per year
Iron ore (steel industry)	N/A	N/A	Fisherman's Landing - 1 berth - 5.6 Mtpa	70,000 dwt Panamax and below	1 additional berth	80 total No Cape Class
Other						
Container hub	N/A	N/A	Hamilton Point - 3 berths - 1,000,000 TEU (approximately 7 Mtpa)	8,000 TEU average 75% New Panamax and 25% Panamax	3 additional berth	125 total 94 Cape Class equivalent
Cruise industry	N/A	N/A	Auckland Point – 1 berth	300m length	N/A- existing berths used	20 total No Cape Class
Total	20 berths - 135 Mtpa	Varies	42 berths - 294 Mtpa	Varies	22 berths	3,476 vessels 1,139 Cape Class

Table notes:

* Current throughput based on 2016

Of the 1,139 Cape Class vessels projected to use the port each year, indicatively 110 of these may be Cape Class Equivalent vessels importing cargo.

Figure 3.2 identifies the existing and potential berths to consider in the master plan as per the IS CRA report together with additional potential berths associated with the potential material placement areas identified through this addendum.

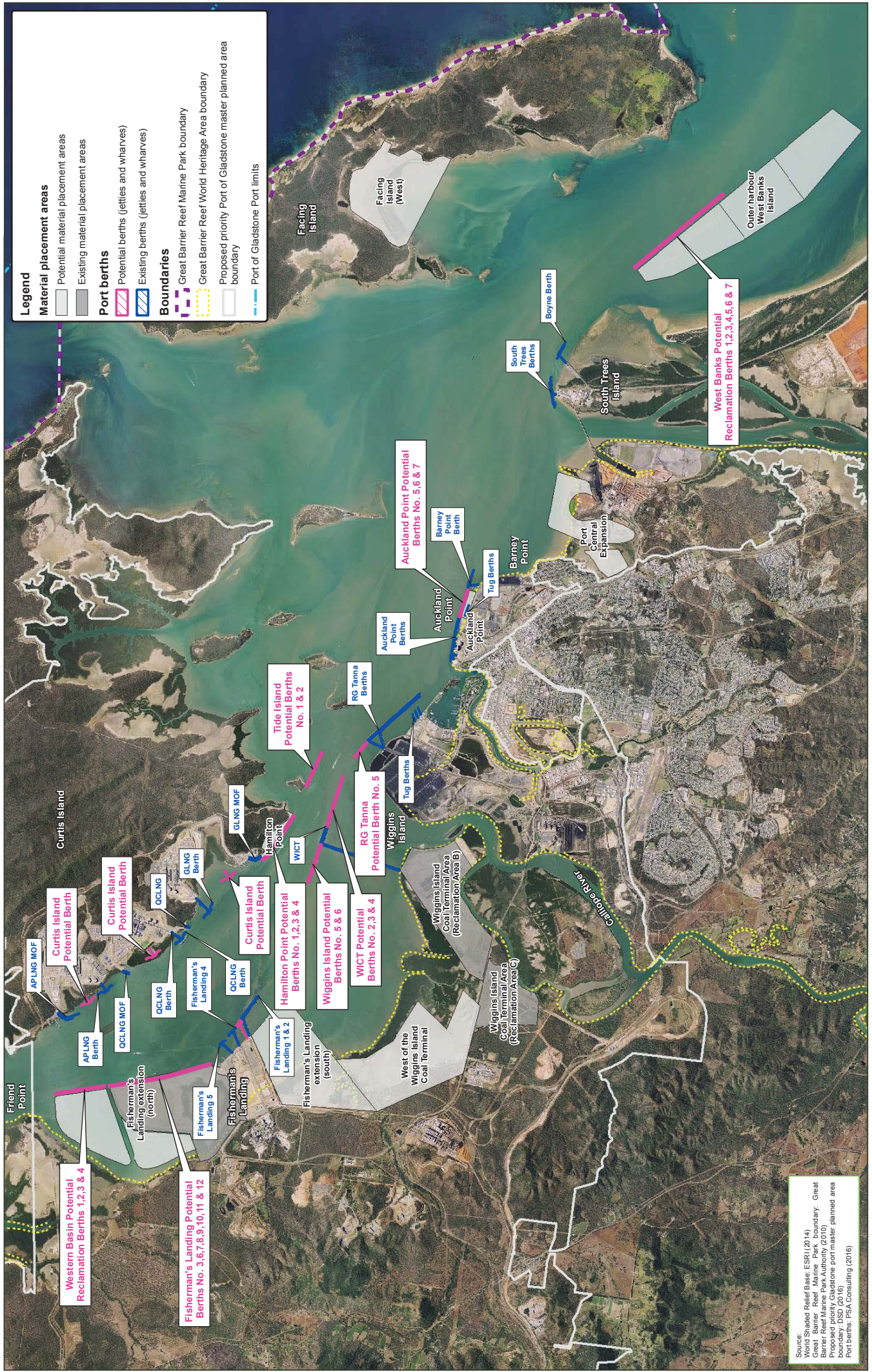


Figure 3.2: Existing and potential berths and material placement areas





3.5 Channel expansion and capital dredging

Section 4.2.1 of the ISCRA describes the potential extent of deepening and duplication of the shipping channel and the resultant volume of dredged material requiring placement.

This section considers the vessel profile (number of vessels and vessel type) generated for the master plan growth scenario 3 (as detailed in Table 3.4), and demonstrates the requirement for a duplicated channel.

3.5.1 Tidally constrained export vessels

Tidally constrained export Cape Class vessels have a limited window to depart on the flood tide (incoming/rising tide). On average, approximately two Cape departures are possible on each flood tide with a 1 hour following headway between vessels. The following headway provides an allowance for aborting the manoeuvre in the event of a channel blockage by the preceding vessel. The existing single channel is therefore limited to approximately 750 departing Cape vessels per year.

The master plan growth scenario 3 includes 1,050 export Cape vessels per year, exceeding the capacity of a single channel. The following headway can be reduced to 30 minutes for Cape vessels for a fully duplicated channel. In this case, the following vessel has the option to change channels in the event that the preceding vessel becomes grounded. The reduction in following headway increases the number of tidally constrained vessels that are able to depart on a given tide, allowing for the number of Cape vessels forecast in the master plan growth scenario 3.

GPC has considered the option of deepening the existing channel, and compared it to the duplication of the existing channel. Deepening the channel does not allow for a potential need to accommodate Cape class import vessels in the future or the overall vessel movements required for the master plan growth scenario 3.

3.5.2 Passing of tidally constrained vessels


The master plan growth scenario 3 includes 123 Cape import vessels. If a Cape class import trade is developed at the Port of Gladstone, there is limited opportunity for deep draft Cape vessels to both enter (import) and exit (export) in the same tidal window, for a single channel configuration. A duplicate channel would allow deep draft Cape vessels to enter and exit the port simultaneously.

3.5.3 Overall channel utilisation

The growth trade profile detailed in Table 2.2 and Table 3.4 comprises approximately 3,700 vessels annually. Corresponding channel utilisation for a single outer harbour channel is 75-95% depending on the average number of inbound and outbound vessels that can be scheduled in convoy. This level of channel utilisation is not achievable in practice when port scheduling constraints and the limitations of other port resources, including berths, towage and pilotage, are taken into account.

Channel utilisation for a duplicated outer harbour channel is reduced to approximately 24% and is expected to be appropriate to enable the master plan growth scenario 3 trade profile. Duplication of the Auckland Channel may also be required to achieve acceptable port scheduling outcomes, providing full channel duplication from port entry through to the inner harbour.

Channel duplication also provides significant risk mitigation for the port. In the event of a vessel grounding over an extended period of time in a single channel section, closure of the port will be required for the duration of the grounding. With a duplicated channel however, in the event of a vessel grounding the port would be able to continue to operate albeit at a lesser capacity.



Deepening of some areas of the inner harbour channel may be required in the future to accommodate deeper draft vessels in the inner harbour areas, depending on the ultimate trade profile and industry developments. Extensions of the inner harbour channel and dredging of new berth pockets will also be required to accommodate new berths.

3.6 Maintenance dredging

Maintenance dredging of the channels, berth pockets and swing basins is necessary to maintain an operational port because siltation of these areas occurs over time, reducing the water depth. The ISCRA identified that the current annual maintenance dredging volume is 190,000 m³ per annum, with 60% in the outer harbour and 40% in the inner harbour.

Future maintenance dredging would be undertaken under the Commonwealth and State approval processes and will comply with the Maintenance Dredging Strategy for GBRWHA Ports (DTMR 2016). GPC currently holds approval for the placement of maintenance dredged material at the existing East Banks dredged material placement area (DMPA), which is located within port limits. The East Banks DMPA has sufficient remaining capacity for the master plan timeframe (ie 2050), and no additional infrastructure is required for maintenance dredging.

Maintenance dredged material could also be placed in existing material placement areas within the master planned area.

The Maintenance Dredging Strategy for GBRWHA Ports provides an assessment on future maintenance dredging, and indicates that future maintenance dredging volumes with a duplicated and/or deepened outer channel will not be significantly higher than current volumes. Maintenance dredging of berth pockets will increase proportionally with increasing berth numbers.

3.7 Dredged material placement

3.7.1 Identification of potential material placement areas

GPC has undertaken a dredged material placement options investigation (DMPOI) as part of the Port of Gladstone Gatcombe and Golding Cutting Channel Duplication Environmental Impact Statement (EIS). Whilst the primary objective of the DMPOI was to identify potential dredged material placement site options for the 12.6 Mm³ of dredged material from the Channel Duplication Project, the following secondary objectives have also been sought:

- Support a strategic approach to planning for the long term dredging needs of the Port of Gladstone through consideration of the suitability of potential sites for other future Port dredging requirements (capital and/or maintenance dredging); and
- Development of a transparent, robust and repeatable process for how dredged material placement alternatives are considered and preferred options identified for future capital and/or maintenance dredging within the Port of Gladstone.

In seeking to achieve both these primary and secondary objectives, the DMPOI process was underpinned by a strong emphasis on early and ongoing stakeholder and regulatory agency engagement throughout the options assessment and decision making process.

The DMPOI process identified fifteen specific site locations which have the potential to receive dredged material. Figure 3.3 illustrates the location of these dredged material placement options.

As part of the DMPOI process and this addendum report, eight of the DMPOI site locations have been removed from further consideration as part of the master planning process, due to a combination of unacceptable factors, including:

- Potential Indigenous cultural heritage impacts
- Potential significant ecological impacts, including impacts on the OUV of the GBRWHA
- Insufficient dredged material storage capacity for capital dredging projects
- Not compatible and/or conflicts with the current and future industry operations
- High reclamation area construction costs and/or dredging costs

3.7.2 Potential dredging volumes

The potential dredging volumes, material placement areas (existing and potential) and capacity are described in Section 4.2 of the ISCRA. The report states that ultimate dredging requirements, including the channel duplication, channel deepening, Western Basin dredging and Targinie Channel deepening for Panamax vessels, is in the order of 68 Mm³ of dredged material. This dredging volume requires a combined material placement area volume of 82 Mm³, including a material bulking factor of 1.2.

The ISCRA identifies a number of potential material placement areas (Section 4.2.3 and Map 13), and a number of other potential material placement areas have been identified in this addendum. Figure 3.2 shows the potential material placement areas identified through this addendum, however it should be noted that dredged material placement is not assumed to occur over areas where dredged material placement has already occurred and where infrastructure has been constructed (eg within the Wiggins Island Coal Terminal (WICT) Reclamation Area B).

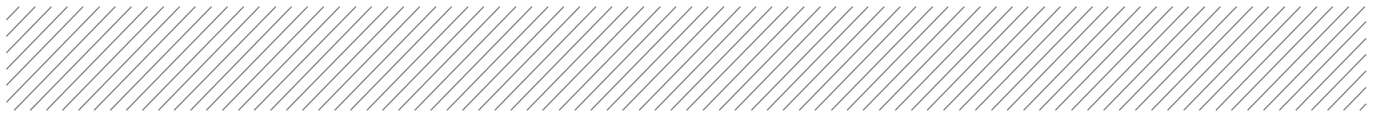
A capacity comparison between the required volumes and identified potential material placement area volumes was not specifically undertaken in the ISCRA. The material placement areas identified and approximate capacity are detailed in Table 3.5.

Table 3.5 Material placement areas and capacities – existing and potential areas with remaining capacity

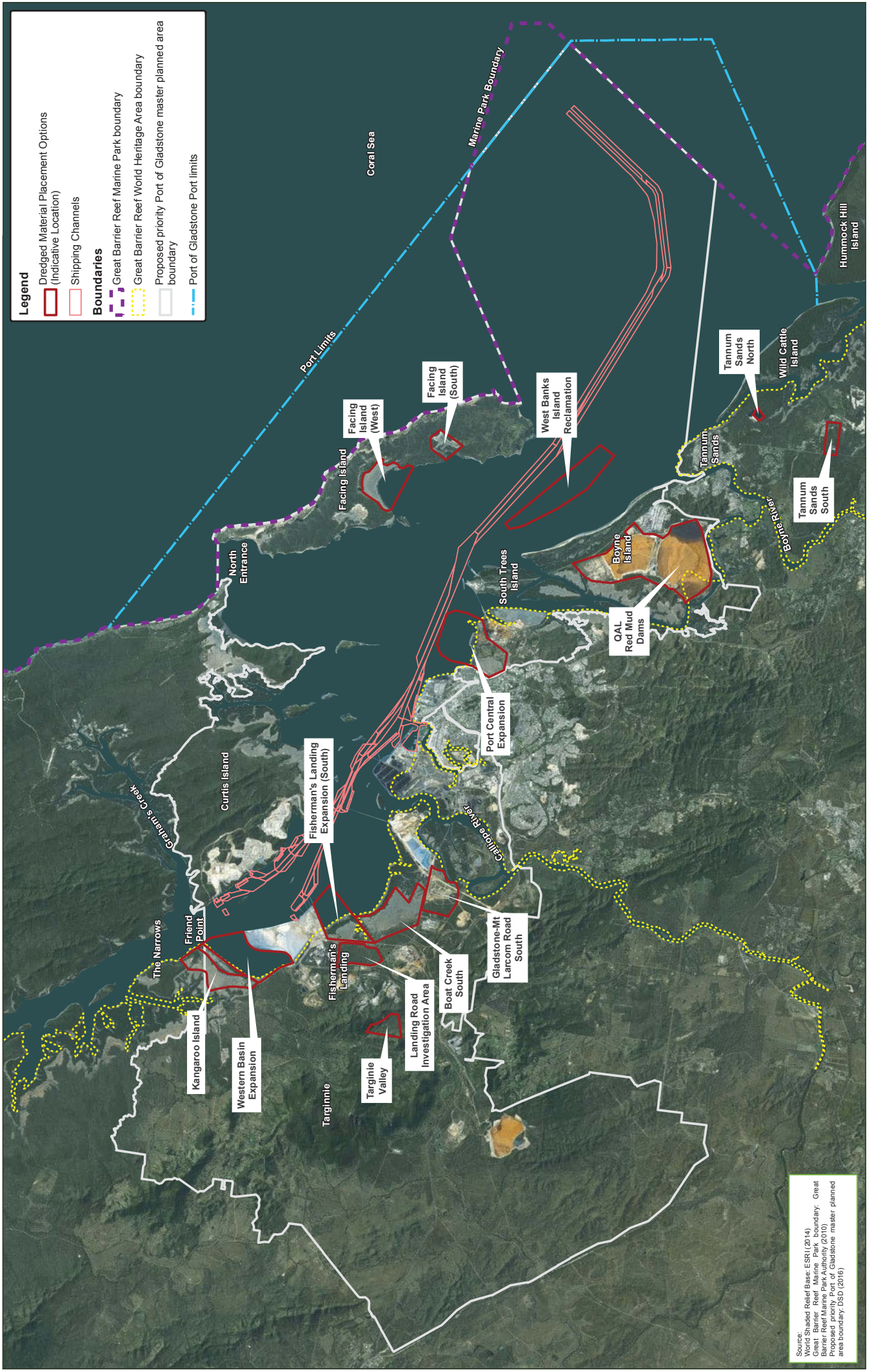
Area	Location	Approximate capacity
Area 1	Fisherman's Landing extension (north and south)	50 Mm ³
Area 2	Hamilton Point	Not applicable (NA)
Area 3	West of the Wiggins Island Coal Terminal	24 Mm ³
Area 4	Wiggins Island Coal Terminal Areas (Reclamation Areas B and C)	10 Mm ³
Area 5	Auckland Point	NA
Area 6	Port Central Expansion	18 Mm ³
Area 7	Outer harbour West Banks Island	46 Mm ³
Area 8	Facing Island (West)	8 Mm ³
Total		156 Mm³

Areas 2 and 5 are likely to require minimum quantities, or may use earth fill rather than dredged material.

The material placement areas identified have potential capacities to store approximately 156 Mm³ of material, compared to the ultimate 82 Mm³ (approximately) required for the capital dredging.



While the areas identified are in excess of potential capital dredged material volume requirements, it is important that master planning presents options that ensure flexibility for future development. Flexibility in both the location and size of the material placement areas is required, to allow future developments to investigate alternative locations and determine the preferred site, taking into account all relevant factors at the time.



Priority Port of Gladstone master planning - Addendum evidence base report
 Figure 3.3: Indicative dredged material placement options

Source:
 World Shaded Relief Base: ESRI (2014)
 Great Barrier Reef Marine Park boundary: Great Barrier Reef Marine Park Authority (2010)
 Proposed priority Port of Gladstone master planned area boundary: USD (2016)



Date: 24/01/2017 Version: 1 Job No: 253916
 Coordinate system: GDA 1994 MGA Zone 56



3.8 Emergency and permanent anchorages

A number of emergency anchorages are situated in the inner harbour, adjacent to the Gatcombe and Auckland Channels. There are currently three major Cape class anchorages at South Trees, and three smaller anchorages for small vessels at the Quoin and South Trees anchorage. The existing anchorages are shown in Figure 3.4. These anchorages are not a permanent anchorage and are a safety feature for vessels to anchor at in an emergency situation, such as a vessel with engine failure, to prevent closure of the port or potential environmental issues with vessel groundings.

These key areas should remain in the master plan for use as emergency anchorages, and may be expanded as the port expands.

The majority of permanent anchorages are located outside of the master planned area, as shown in Figure 3.4, with only one permanent anchorage located within the master planned area, and one permanent anchorage approximately on the boundary.

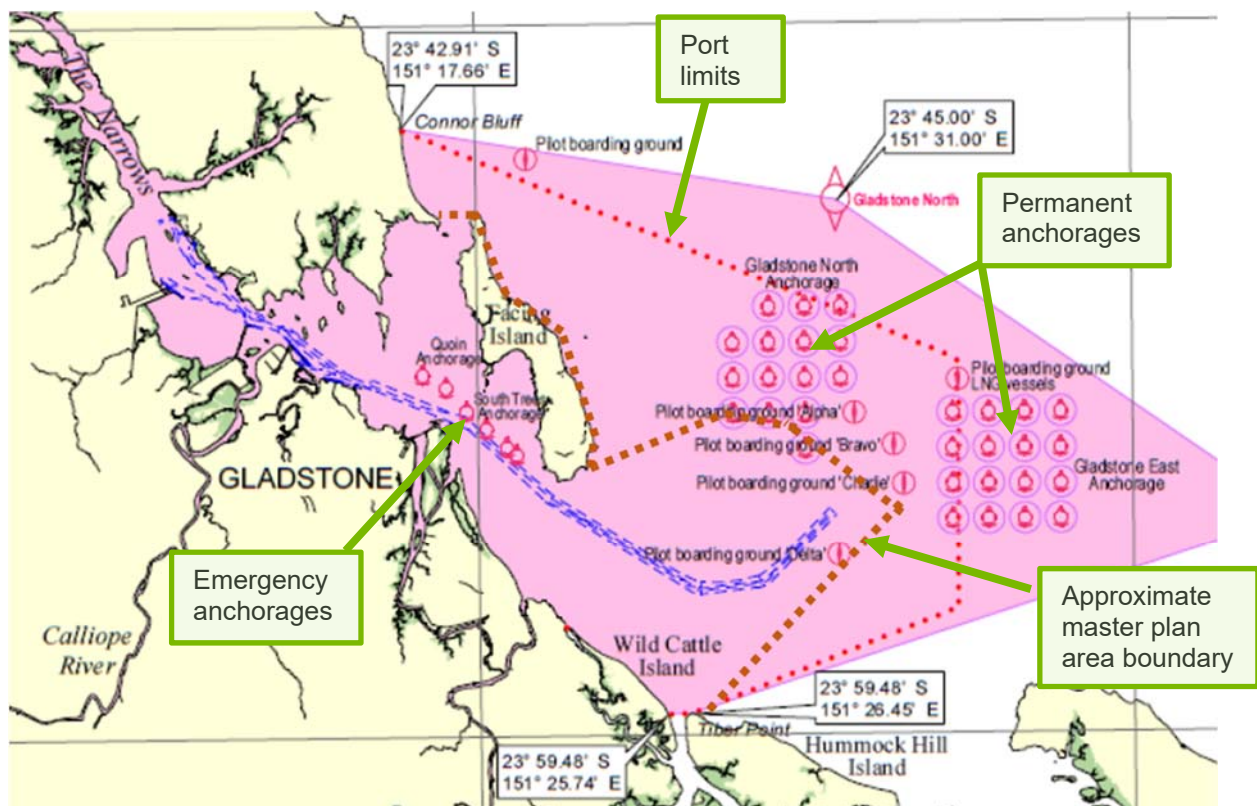


Figure 3.4 Existing emergency and permanent anchorages

Source: DTMR 2016

4 Supply chain linkage – infrastructure corridors

This section discusses potential infrastructure requirements across both land and marine areas, and recommends infrastructure corridors that should be preserved through the master planning process. A summary of the additional port supply chain linkages and infrastructure corridors required to support the potential port growth is provided. This section provides additional description to Section 4.3 of the IS CRA.

4.1 Requirements to protect supply chain infrastructure corridors

The efficiency and effectiveness of the Port of Gladstone is related to the extent that:

- Import cargoes can be efficiently transported to consumers in the broader region, including the Gladstone, Calliope, and the Hinterland, including Rockhampton, the Central Highlands and Dawson Valley
- Import and export cargoes can be efficiently handled through to the Gladstone State Development Area (Gladstone SDA) to encourage development of industrial facilities in the Gladstone SDA
- Export cargoes can be effectively transported from hinterland areas to the Port of Gladstone

This movement of goods from origin or destination to the port requires suitable road, rail, pipeline, services and conveyor corridors in appropriate locations to facilitate the movement of cargoes to the required port centre. It is therefore important that corridors be identified to preserve land allocation to linear infrastructure requirements and allow management of adjoining land uses for the future development of the master planned area.

4.2 Supply chain infrastructure corridor requirements

4.2.1 Potential industry triggers

The growth or development of potential industries is likely to trigger the need for supply chain corridors to accommodate industry enabling infrastructure, including road, rail, bulk materials transport and services. Based on master plan growth scenario 3, it is envisaged that the infrastructure corridors provided in Table 4.1 will be triggered by will be triggered by the potential industries listed in Table 4.1.

Table 4.1 Potential industry triggers for infrastructure corridors

Infrastructure corridor	Potential industry that will trigger the need for the infrastructure
Port Access Road extension (Stages 2 and 3)	Incremental development of the trades through Port Central (eg container, general cargo, minerals, cruise ship industry)
Gladstone SDA Link Road (Gladstone – Mt Larcom Road link to Bruce Highway)	Development of the Gladstone SDA enabling a more efficient road transport route to and from the Port of Gladstone
Mainland to Curtis Island road and rail link	Development of a major container terminal at Hamilton Point
West Bank Island material placement area road and rail link	Development of a major container terminal at the West Bank Island material placement area
Pipeline corridor from Tide Island to oil and petroleum industry	Development of oil refinery industries located west of Fisherman's Landing
Pipeline corridors through the master planned area to LNG plants	Development of additional LNG plants at Fisherman's Landing and/or Curtis Island
Services corridor from Aldoga industrial area to Fisherman's Landing	Development of Aldoga industrial area, including a potential steel plant

In the same way that Hamilton Point and West Banks Island are alternative locations for a potential container import/export hub, the mainland to Curtis Island road and rail link, and the West Banks Island material placement area road and rail link are alternative corridors to service these potential berth locations.

4.2.2 Road and rail infrastructure

To support the master plan growth scenario 3, four future public road and rail infrastructure corridors have been identified as shown on the ISCRA, Appendix 4, Map 9 (road) and Map 10 (rail).

Table 4.2 summarises where these identified potential road and rail infrastructure corridors have been included within existing planning instruments.


Table 4.2 Road and rail infrastructure corridor identification within existing planning instruments

Infrastructure corridor	Planning instruments		
	GPC Port Land Use Plan (2012)	Gladstone SDA Development Scheme (2015)	GRC Planning Scheme (2013)
Port Access Road extension (Stages 2 and 3)	Corridor not identified as outside of plan boundary	Corridor not identified as outside of scheme boundary	Corridor <u>identified</u>
Gladstone SDA Link Road (Gladstone-Mt Larcom road link to Bruce Highway)	Corridor not identified as outside of plan boundary	Corridor <u>identified</u>	Corridor not identified as outside of scheme boundary
Mainland to Curtis Island road and rail link	Corridor not identified as outside of plan boundary	Corridor not identified as marine areas outside of scheme boundary	Corridor not identified as outside of scheme boundary
West Banks Island material placement area road and rail link	Corridor not identified as outside of plan boundary	Corridor not identified as outside of scheme boundary	Corridor not identified as marine areas outside of scheme boundary

The purpose of the identified future road infrastructure corridors is to provide a supply chain link for road transport of the increased volume of materials to and from the Port of Gladstone. The future road corridors will link the port areas to existing major road networks, allowing efficient transport of materials, creating new development fronts, alleviating impact of heavy vehicles on the existing Gladstone road infrastructure and improving safety outcomes for the community. The new road infrastructure will also create potential industrial development fronts through the master planned area.

There is currently no access to the Port of Gladstone for road trains, and all road train freight is transferred into B-doubles at Gracemere and Banana and then trucked to the port. If Sheepstation Bridge between Biloela and Calliope was upgraded to road train capacity then agriculture products could possibly arrive from the Central West via Biloela, Calliope and the Dawson Highway, and then on to the Port Access Road (Stage 2) directly into Port Central.

The purpose of the identified future rail infrastructure corridors is to provide a supply chain link for a potential container import/export hub. The future rail corridors will link the port areas to existing major rail networks, allowing efficient transport of materials to and from the port areas, creating new development fronts, alleviating impact of heavy haul and freight rail on communities. If the inland rail project proceeds, the rail corridors will facilitate connecting the Port of Gladstone into an integrated east coast freight supply chain.



It is feasible that the master plan growth scenario 3 may trigger the use of short ‘sprinter’ trains to transport bulk materials locally within the master planned area, particularly between the port areas and the Gladstone SDA. Use of short trains could potentially be an alternative to off-road truck haulage or overland conveyor systems, and corridors for such have been identified in the road and services corridors sections of this addendum.

Aurizon has an established development plan (Aurizon Network Develop Plan 2015) detailing proposed upgrades to the Blackwater and Moura systems to support a rail system throughput of 230 Mtpa. These planned upgrades include the Aldoga Bank, North Coast Line bypass, Aldoga Rail Yards, Moura Link, future WICT Project rail expansions, East End Mine Branch duplication, and Callemondah Rail Yard.

A description of the identified road and rail infrastructure corridors required to support the potential future industry needs is provided below. It is noted that the identified rail infrastructure corridors are in addition to the rail upgrades planned by Aurizon.

Port Access Road extension (Stages 2 and 3)

The Port Access Road extension (Stages 2 and 3) would link the Port Central area to the existing Blain Drive and Red Rover Road via extension of the existing Port Access Road. The road infrastructure design will need to consider topographic constraints including the west Gladstone community and industry, tidal waterways, and multiple rail lines heading north from the Callemondah rail yard.

The Port Access Road extension has been identified within the strategic framework of the GRC Planning Scheme (2013) (Part 3.5 Connecting our places).

Gladstone SDA Link Road

The Gladstone SDA Link Road would connect the Bruce Highway to Gladstone-Mt Larcom Road through the master planned area, alleviating heavy haul movements along the existing Calliope River Road and through the township of Yarwun. The road corridor would be largely along the existing Aldoga Road alignment, and topographic constraints to consider would include terrestrial vegetation and creeks, and crossing of gas pipelines.

The Gladstone SDA Link Road has been identified within the Gladstone SDA Development Scheme (2015).

Mainland to Curtis Island road and rail link

The mainland to Curtis Island road and rail link would provide a corridor for road and rail infrastructure to connect from the mainland to Curtis Island via a bridge structure(s) across The Narrows.

On the mainland a road corridor would extend north from the existing Landing Road past Fisherman’s Landing to The Narrows. A separate rail corridor would link from the existing North Coast railway line, extending north-east from near the Mount Larcom township to run around the north of Aldoga and Mount Larcom landform, then east to The Narrows. There is also an option to extend the existing Fisherman’s Landing Branch Line north to connect to Curtis Island via the same bridge structure across the Narrows.

A substantial road and rail bridge structure(s) will be required at The Narrows to support road, rail, bulk materials transport and services infrastructure connecting between the mainland and Curtis Island. The bridge structure(s) could be located adjacent to the existing gas pipelines that cross beneath the seafloor at The Narrows.

On Curtis Island a road and rail infrastructure corridor would run east from The Narrows and then south-east behind the LNG plants to arrive at Hamilton Point. This corridor on Curtis Island has been identified in the Gladstone SDA Development Scheme.

Road and rail infrastructure design will need to consider topographic constraints, including crossing of gas pipelines, crossing of Queensland Energy Resources (QER) tenements, terrestrial vegetation, rugged terrain and hard ground associated with the foothills of Mount Larcom, tidal flats and mangroves along the shoreline, The Narrows crossing, and terrestrial vegetation and undulating ground on Curtis Island.

West Banks Island material placement area road and rail link

The West Banks Island material placement area road and rail link would connect the potential West Banks Island material placement area to the mainland. A common road and rail infrastructure corridor would be utilised.

A substantial bridge structure(s) would be required to span from the West Banks Island material placement area to the mainland, to support road, rail, bulk materials transport and services infrastructure.

On the mainland the corridor would need to connect the rail infrastructure to the nearby existing North Coast railway line, and to connect the road infrastructure to the nearby existing Gladstone-Benaraby Road or Boyne Island Road.

Road and rail infrastructure design would need to consider topographic constraints, including the crossing of the harbour from West Banks Island, shoreline tidal waterways, tidal flats and mangroves, 'red mud' dams, and crossing of Gladstone-Benaraby Road.

4.2.3 Bulk materials transport and services infrastructure

Potential industry located in the master planned area requires bulk materials transport corridors to provide access to berth areas. These corridors could be used for pipelines (to convey bulk liquid products), or for conveyors or private haul roads (to convey bulk solid products). Additionally corridors for services infrastructure such as power, water, sewerage, telecommunications and data to support the development of industry also need to be identified.

To support the master plan growth scenario 3, a future petroleum industry pipeline infrastructure corridor has been identified as shown on the ISCRA, Appendix 4, Map 5. Future LNG industry pipeline infrastructure corridors have been identified as shown on the ISCRA, Appendix 4, Map 4. Future services/haul road corridor has also been identified on the ISCRA, Appendix 4, Map 12.

Table 4.3 summarises where these identified potential bulk materials transport and services infrastructure corridors have been included within existing planning instruments.

Table 4.3 Bulk materials transport and services infrastructure corridor identification within existing planning instruments

Services infrastructure corridor	Planning instruments		
	GPC Port Land Use Plan (2012)	Gladstone SDA Development Scheme (2015)	GRC Planning Scheme (2013)
Pipeline corridor from Tide Island to oil and petroleum industry	Corridor not identified as outside of plan boundary	Corridor not identified as outside of scheme boundary	Corridor not identified as outside of scheme boundary
Pipeline corridors through the master planned area to LNG plants	Corridor not identified as outside of plan boundary	Land corridors identified Marine corridor not identified as outside of scheme boundary	Corridor not identified as outside of scheme boundary

Services infrastructure corridor	Planning instruments		
	GPC Port Land Use Plan (2012)	Gladstone SDA Development Scheme (2015)	GRC Planning Scheme (2013)
Services corridor from Aldoga industrial area to Fisherman's Landing	Corridor not identified as outside of plan boundary	Corridor <u>identified</u>	Corridor not identified as outside of scheme boundary

None of the identified pipeline infrastructure corridor have been included within existing planning instruments.

The purpose of the identified future services infrastructure corridors is to provide a supply chain link for transport of bulk materials (such as iron ore, steel, gas, oil and petroleum) to and from future berths.

A description of the identified bulk materials and service infrastructure corridor is detailed in the below sections.

Pipeline corridor through the master planned area to LNG plants

Pipeline corridors through the master planned area would deliver natural gas to potential LNG plants at Fisherman's Landing and Curtis Island. From the central and south-west Queensland gas fields the pipeline corridor would cross the western boundary of the master planned area, and then run east roughly parallel to the existing alignments of Aldoga Road and Mt Larcom-Yarwun Road, then passing between the Comalco rail balloon loop and Yarwun Refinery before branching to run along the Landing Road alignment to Fisherman's Landing. From Fisherman's landing the pipeline corridor could take a direct route beneath the harbour seafloor to Curtis Island, or alternatively the pipeline could run north to access Curtis Island via a road and rail bridge across The Narrows (as described above).


Pipeline corridor infrastructure design would need to consider the topographic constraints, including terrestrial vegetation and creeks, crossing of existing gas pipelines, road and rail crossings, tidal flats and mangroves along the shoreline, the seafloor crossing and marine infrastructure.

The pipeline corridor through the master planned area to LNG plants has been identified within the Gladstone SDA Development Scheme (2015) for the land infrastructure corridors, however the marine corridor components are not identified as they area outside of the boundaries of the noted planning instruments.

Pipeline corridor from Tide Island to oil and petroleum industries

A pipeline corridor would link from Tide Island to potential oil and petroleum industries located in the master planned area west of Fisherman's Landing. The pipeline corridor could take various routes, including along the road and rail corridors discussed above to cross from the mainland to Curtis Island across bridge structure at The Narrows. This corridor has been identified in the road and rail corridors described above.

Alternatively a more direct pipeline and services corridor to Tide Island could be established that includes infrastructure installed under the harbour seafloor and connecting to mainland corridors. The alignment and location of a possible pipeline route and corridor is not known, but may traverse between the GSDA and Tide Island area. Existing identified corridors within the Gladstone SDA Development Scheme (2015) could be used for any land infrastructure pipeline corridor, however the marine corridor components are not identified as they area outside of the boundaries of the noted planning instruments.



Pipeline corridor infrastructure design would need to consider the topographic constraints, including QER tenements, crossing of gas pipelines, road and rail crossings, tidal flats and mangroves along the shoreline, the harbour seafloor crossing and marine infrastructure.

Services corridor from Aldoga industrial area to Fisherman's Landing

A services corridor linking Fisherman's Landing to an industrial area located at Aldoga (including a potential Steel Plant). The services corridor from port to plant could be utilised for both import of iron ore and export of steel associated with the Steel Plant, and infrastructure running along the corridor could include a private haul road for trucking, overland conveyor, power, water and communications. From Fisherman's Landing the services corridor would run south parallel to the Fisherman's Landing Branch railway line before crossing the railway line and heading south-west roughly parallel to Gladstone-Mt Larcom Road and then head north-west to the Steel Plant at Aldoga on the west side of Mt Larcom.

Services corridor infrastructure design will need to consider the topographic constraints, including tidal flats and mangroves near Fisherman's Landing, terrestrial vegetation, undulating terrain and hard ground adjacent the Yarwun Quarry and the Mount Larcom foothills, as well as crossings of Landing Road, Targinnie Road and Fisherman's Landing Branch rail line. There is potential that WICT berths 5 and 6 could be used to service a steel industry rather than Fisherman's Landing, in which case the services corridor would need to extend further along a route roughly parallel to Gladstone-Mt Larcom Road/Port Curtis Way to connect to the WICT site.

The services corridor from an Aldoga industrial area to Fisherman's Landing has been identified within the Gladstone SDA Development Scheme (2015).

4.2.4 Summary of corridors required that are not within existing planning instruments

In summary, there are several supply chain infrastructure corridors which are likely to be required in master plan growth scenario 3, but which are not currently identified (or wholly identified) within existing planning instruments.

A number of other infrastructure corridors are identified within existing planning instruments.

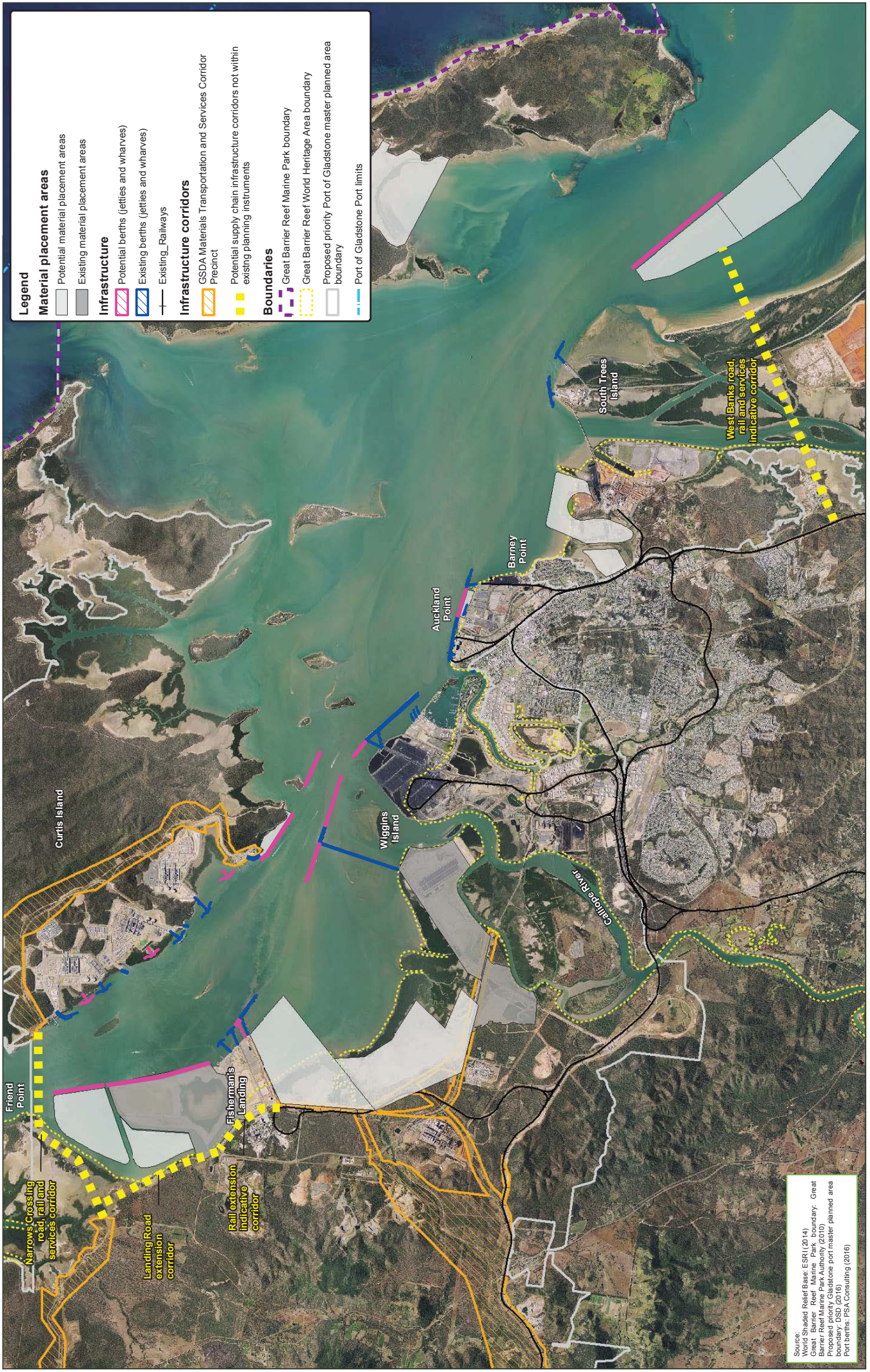
It should also be noted that a number of marine corridor crossings of the Port of Gladstone waters are likely to be required, however the marine corridor components are not identified in any planning instruments as they are outside of the boundaries of the land based planning instruments.

The additional infrastructure corridors identified which are not within existing planning instruments are:

- Mainland to Curtis Island road and rail link
- West Banks Island material placement area road and rail link

The supply chain infrastructure corridors not within existing planning instruments are shown in Figure 4.1. It should be noted that the corridors shown in the figure are indicative only and a number of corridor locations and alignments exist, and engineering and environmental studies would be required to identify the preferred corridors in more detail.

A pipeline corridor from Tide Island to oil and petroleum industry may also be required and is not specifically within existing planning instruments, although a number of other infrastructure corridor options exist to reach Tide Island, including the Curtis Island road and rail link. However while the marine corridor components are not identified, they area outside of the boundaries of the existing planning instruments, and existing land corridors within the Gladstone SDA Development Scheme (2015) could be used for any land infrastructure pipeline corridor. The pipeline corridor has not been shown on Figure 4.1 for these reasons.



- Legend**
- Material placement areas**
 - Potential material placement areas
 - Existing material placement areas
 - Infrastructure**
 - Potential berths (jetties and wharves)
 - Existing berths (jetties and wharves)
 - Existing_Railways
 - Infrastructure corridors**
 - GSDA Materials Transportation and Services Corridor Precinct
 - Potential supply chain infrastructure corridors not within existing planning instruments
 - Boundaries**
 - Great Barrier Reef Marine Park boundary
 - Great Barrier Reef World Heritage Area boundary
 - Proposed priority Port of Gladstone master planned area boundary
 - Port of Gladstone Port limits

Source:
 World Shaded Relief Base: ESRI (2014)
 Great Barrier Reef Marine Park boundary: Great Barrier Reef Marine Park Authority (2010)
 Proposed priority Port of Gladstone master planned area boundary: DSD (2016)
 Port berths: PSA Consulting (2016)





4.3 Infrastructure connecting to the master planned area boundary

The key existing infrastructure elements that cross the master planned area boundary and facilitate transport of materials and services to and from the Port of Gladstone need to be considered in the master planning process. These include:

Road

- Bruce Highway
- Dawson Highway
- Gladstone-Mt Larcom Road
- Gladstone-Benaraby Road
- Calliope River Road
- Red Rover Road
- Port Access Road

Rail

- North Coast Line
- Moura Short Line
- East End Mine Branch Line

Services

- High voltage electricity supply mains (Powerlink and Ergon)
- Raw water supply pipelines (GAWB)
- Gas supply pipelines (Jemena)
- LNG pipelines (namely APLNG, QCLNG and GLNG)

The key existing marine infrastructure elements that interface with the master planned area boundary and facilitate transport of materials to and from the Port of Gladstone include:

- Movement of vessels through designated navigation shipping routes
- Permanent anchorages for vessels waiting for a berth spot to become available

5 Optimisation of port infrastructure

5.1 Background from the Independent Review of the Port of Gladstone 2013 and Reef 2050

In 2012, the Commonwealth Government commissioned the Independent Review of the Port of Gladstone in response to a request from the World Heritage Committee. This request, and a later additional request, placed a strong emphasis upon reviewing and recommending management arrangements for the Port of Gladstone that would improve optimisation of port development and operation of the port and on Curtis Island, as well as for other existing port developments.

The independent review committee produced an initial report in July 2013 followed by a supplementary report in October 2013 which identified key principles to guide future planning and port operations within the GBRWHA. In particular, the supplementary report recognised the need to improve port optimisation practices in order to ensure that ongoing growth of port capacity along the coast adjacent to the GBRWHA is managed to ensure it does not compromise the OUV of the GBRWHA by:

- Concentrating development within existing port footprints through better use of long-established port nodes; together with
- Continually improving environmental management within priority ports through leading and best practice in port planning, environmental assessment and decision making, monitoring and reporting, and compliance (Commonwealth Government 2013b)

The Independent Review identified a set of best practice principles, which in relation to port optimisation included:

- Principle 5 - Port planning and operations should be reviewed and improved regularly, informed by advances in technology and knowledge
- Principle 6 - Existing developed footprints within port areas should be optimised to the greatest extent possible prior to expansion into greenfield sites, including through consolidation and sharing of infrastructure (Commonwealth Government 2013a)

Following on from the findings and recommendations of the Independent Review of the Port of Gladstone, the Reef 2050 was prepared and included a specific action requiring the Queensland Government to address 'port infrastructure optimisation' through master planning for each of the priority ports. This requirement is now being addressed through the master planning process mandated by the Ports Act.

5.2 Definition of optimisation

Historically, port infrastructure has been optimised through sound port development planning decisions by the relevant port authority to make efficient use of strategic port land, minimise capital intensive marine based infrastructure, and minimise capital dredging. However, the underlying guiding principles of these port planning decisions have not previously been formally described.

Optimisation can be defined as an act, process, or methodology of making something (as a design, system or decision) as fully perfect, functional or effective as possible.

Parameters that may typically impact on the optimisation of a port include:

- The extent of capital dredging (ie shipping channels, swing basins and/or berth pockets)
- The number of berths
- The distance between land based facilities and berths

- The extent of land-based storage and facilities
- Corridors
- The environmental outcomes
- Capital expenditure for a single proponent's project
- The operational efficiency of the supply chain
- The operational efficiency of the port in isolation.

Where one parameter only is selected for optimisation, the outcome of that optimisation will be different depending upon which parameter is optimised. Optimisation of one parameter can sometimes result in a sub-optimal outcome in a different parameter.

In terms of port infrastructure, optimisation usually centres around the resources that are the scarcest. However, different developments may require different aspects of the infrastructure development to be optimised, depending on the economic, environmental and social context of the project.

The optimisation of a port, and in particular a proponent's project, requires a balance across a number of these parameters.

5.3 Principles of optimisation of port infrastructure

Some of the primary principles of optimisation of port infrastructure are detailed below, along with case studies from the Port of Gladstone, where these principles have been adopted in the past.

5.3.1 Optimise the requirement for capital dredging, while still providing navigable access to the berths

The avoidance of capital dredging can have significant impact on the environmental aspects of a port.

Optimisation can be achieved through:

- Navigation modelling to ensure the minimum safe swing basin geometry is provided (this is the current practice for any Port of Gladstone development)
- Having a tidally restricted port, that requires laden vessels to transit during a limited tidal window, to reduce the required depth of the shipping channel (refer case study 1)
- Co-locate trades where a smaller class of vessels is typically required, to reduce the depth of dredging required (eg restricting the vessel size that berths at Fisherman's Landing results in a shallower Targinie Channel)
- Maximisation of the transit windows through changing of operational practices. This is achieved through berthing and sailing on all states of the tide.



Case study 1 – Cape class vessels are tidally restricted at the Port of Gladstone. This means that the fully laden deep draft vessels can only sail out of the Port on the high tide.

This is because the depth of the shipping channel was optimised, resulting in sacrificing operational flexibility. The resultant optimised channel depth is RL -16.1 m compared with a RL -20.0 m deep channel that would be required for vessels with an 18 m draft to have non-tidally-restricted access.

- Encouraging larger vessels in precincts where berths are designed for cape class vessels, in order to reduce the number of vessel movements, for a given trade volume, to maximise channel capacity. This approach can be somewhat constrained factors outside the ports control, such as destination port draft restrictions, and the way traders enter into shipping contracts.

All of these considerations have been adopted at the Port of Gladstone.

5.3.2 Optimise the requirements for additional berths

Where capability exists to avoid the development of a new berth there is a potential flow on for the requirement to dredge for the berth pocket and access to the channel.

Optimisation can be achieved through:

- Maximising throughput via a given berth by providing high throughput rate cargo handling equipment on the berth, to allow for an efficient vessel turnaround time, which in turn maximises throughput capacity for a given berth
- Where several entities wish to import or export the same type of cargo, provide multi-user facilities that allow for aggregation of the cargoes at a single terminal (implemented at both the RG Tanna Coal Terminal (RGTCT) and WICT)
- Where one trade does not have enough throughput to fully utilise a berth, provide multiple types of cargo handling equipment to allow sharing of a berth by several different cargoes. The time taken to clean up the berth and cargo handling system when changing products to ensure quality assurance/quality of exported/imported cargo (which results in a reduced berth capacity) also needs to be taken in to account (refer case study 2).

However, in some cases an additional berth is provided in order to allow the efficient operation of a tidally-restricted channel. For example, at RGTCT four berths are provided, even though there are only three shiploaders, so only three vessels can be loaded at any one time. This additional berth is provided to allow vessels, once loaded, to wait for the tidal window within which they can depart, and also to maximise the available time that the shiploaders can operate by reducing the time they are waiting for vessels to berth and de-berth.




Case study 2 – Magnesia, Calcite, and Break Bulk is handled across Auckland Point Berth No.1. Cruise ships also berth there from time to time.

Using a single berth for multiple products and uses is effective when the contamination issues between the products are not significant, and the cargo handling equipment is compatible or does not interfere with each other, and the trade volumes do not require the full utilisation of the berth.



Case study 3 – Four berths being serviced by three shiploaders at the RGTCT.

This allows for ships to wait for the tide to depart while the shiploader moves onto a different ship. This enables the operation of a tidally restricted shipping channel, while still keeping shiploaders and conveyors fully utilised.



This is an example where the number of berths is not optimised, in order to optimise the shipping channel depth and reduce the extent of capital dredging and hence reduce dredging costs, and in order to optimise the utilisation of the outloading conveyors and shiploader which in turn reduces the capital and operating cost of the terminal (refer case study 3).

5.3.3 Optimisation of land backed berths

Some cargo handling methods (wet bulk) can operate on island berths, or (wet bulk, dry bulk) berths with access jetties remote from land based facilities, whereas others (container, general cargo and break bulk, roll on-roll off (RoRo), and material offloading facilities (MOF)) require suitable deck areas for cargo handling operations.

At the Port of Gladstone, berths which are land backed, or have access to natural deep water close to available strategic port land, are generally prioritised for the container, general cargo, breakbulk, and RoRo facilities, in order to optimise the use of available land backed berths.

Although wet bulk and dry bulk facilities do not need to be land backed, the distance between the berth and the storage facilities (tanks/stockyards) still needs to be minimised in order to transfer the cargo efficiently from the berth to the storage. Consideration needs to be given to optimal pumping distances for wet bulk products based on viscosity and temperature (cryogenic) of the products handled. Consideration needs to be given to conveyor length and optimal loading /unloading rates and hence conveyor drive capacity for dry bulk products.

5.3.4 Optimisation of jetty length (distance from port lands to berth)

For cargoes which can be conveyed or piped over a jetty back to land (eg coal, LNG, bulk liquids, cement, bauxite, alumina) the length of jetty can be optimised either by increasing the extent of dredging, or by undertaking reclamation or causeway development out to the deeper water. The extent to which a jetty length should be optimised depends upon the relative environmental and economic impact of reclamation, jetty length and dredging.

The dredging of an approach channel to bring the berth closer to the shoreline may introduce potential environmental impacts associated with dredging works. Similarly, the introduction of a causeway or reclamation may introduce potential environmental impacts through changes to the hydrodynamics of the harbour waters.

Long jetty infrastructure has the potential to impact on the economic viability of a project.

5.3.5 Optimisation of wharf decking type and layout

Once it is determined that a berth will be used for a certain cargo, the design of the berth structure can be optimised for that cargo. For example, a container berth requires a very large deck structural capacity and good access for transfer of the containers back to shore via mobile equipment and/or trucks. Manoeuvring room for the equipment requires a wide deck area to allow for efficiency and safety in the operation of the equipment.

A dry bulk berth needs large capacity rail girders to support the shiploader or ship-unloader, but then only needs a limited deck area and capacity to suit vehicles and cranes for operations and maintenance activities.

By allocating precincts or berths to a certain industry or cargo, the berth structure can be optimised for that cargo (refer case study 4).



Case study 4 – Fisherman’s Landing Berth No. 5 (top berth in picture) is an island berth with a very limited decked area, optimised for wet bulk cargoes

Fisherman’s Landing Berth No. 4, 2, and 1 are dry bulk berths which have limited deck capacity, that have been specifically designed for dry bulk cargoes. Berth No 3 is a temporary aggregate loadout facility, and therefore does not require any decking.

5.3.6 Optimisation of cargo storage facilities

Stockyard facilities provide a buffer between the land transport (rail or road or pipeline) and shipping in the supply chains. They enable cargo to be aggregated and enable different transport mode schedules to be accommodated.

A stockyard allows for operational features such as blending of products, and the ability for multiple users to store product in different areas.

The extent of storage required depends on the extent to which the rail/road and shipping schedules are optimised. For example, regular railing or trucking results in the least number of rolling stock/truck fleet, but also results in the largest stockyard requirement at the port.

Campaign railing or trucking, where cargoes are delivered just in time to meet the shipping schedule, results in the largest rolling stock/truck fleet requirement (and larger stockyards elsewhere), but a lower volume stockyard at the port.

The stockyard and storage facilities need to provide as a minimum, the ability to assemble the full cargo requirements for a shipment. In the event that a full shipment is not available, there is a potential for a high social impact from increased demands in the supply chain, particularly through the use of trucks.

The extent to which the stockyard is optimised usually depends upon the ability of the upstream supply chain to deliver or receive a product, the availability of storage at the port, the noise and congestion issues associated with campaign trucking or railing operations, the number of products to be stored, and any special storage requirements.

In optimising the relationship between the point of supply, storage areas, and berth location, the transfer between the storage and vessel should be at the highest practical rate, whilst transfer of product between the supply point and the storage can be at a lower regular delivery rate. The latter reduces the demand on the supply chain and social interaction while the former optimises the berth.

5.3.7 Optimisation of land transport corridors

In order to facilitate both trade and industry, both Industrial land and strategic port land needs to have access to berths, through land allocated to transport and service corridors. By allocating common corridors for all proponents to co-locate their linear infrastructure (eg road, rail, conveyor, pipeline, power, water, sewerage), land used to access the port can be maximised, in turn facilitating a maximised extent of land that can also be used for industry.

This is a clear example where the optimal solution for a specific proponent is different from the optimal solution from a whole of port and state development area perspective. A proponent would typically want to select a route that is the shortest distance from the industrial/stockyard site to the berth, whereas, the port would want the routing to be inside designated corridors, to ensure future development is not denied access.

5.3.8 Repurposing of redundant facilities

When a cargo or industry no longer needs port facilities, consideration should be given as to how these facilities can best be repurposed. Consideration needs to be given to the age and condition of the facilities, and whether it is more practical and safe to extend their life, or to demolish them and reuse the berth to a new purpose (refer case study 5).

5.3.9 Shared infrastructure

Optimisation can occur by sharing infrastructure across industries or cargoes. For example the water and power distribution networks for the port can be sized for the total demand for industries expected within the precinct, rather than just being sized for a single proponent's needs. The challenge of this approach is in determining an equitable way of investing capital when a particular proponent (the first mover) may only need a portion of the installed capacity.

Road and rail links to the port are another example of where infrastructure is shared. The Port Access Road to Port Central and Fisherman's Landing corridors (and in the future the road link to West Banks Island, and the road link to Curtis Island) are used by multiple users requiring truck haulage to the port.

Where there is a requirement for continuous haulage, possibly using off-road trucks with unregistered vehicles, a private haul road a private road is required to ensure separation between public use of roads, and a continuous haulage operation. This is an example where the road infrastructure may not be able to be shared, but the private haul road could be sited in a shared services corridor.



Case study 5 – The Barney Point Coal Terminal has been decommissioned and is no longer exporting coal, due to proximity of coal stockpiles to urban areas, and the development of WICT, enabling this trade to be moved to the WICT.

The facility is now being considered to be repurposed for other uses (eg bulk export with covered storage) that can potentially make use of the existing berth, shiploading conveying and hardstand infrastructure.



5.3.10 Environmental outcomes

In some cases, it is decided to adopt a solution that requires more infrastructure in order to achieve an environmental or community outcome. For example a road or rail corridor might not take the shortest route from origin to destination, in order to avoid wetlands, or be a certain distance away from residential areas to limit noise impacts.

5.4 Constraints to optimisation in port planning

There are other principles of competition policy, ecologically sustainable development (ESD), and cargo handling methodology which constrain the goal of infrastructure optimisation in port planning. These include:

- **Competition policy** – if two different port operators are providing a competitive service, then they might not be in a position to share infrastructure, without either creating a situation of collusion, or a situation in which one proponent loses its competitive advantage
- **ESD** – if a significant environmental impact is identified for a project, additional infrastructure might be built in order to reduce the environmental impact
- **Cargo handling methodology** – as different cargoes are handled in different ways, it is sometimes difficult or impossible to collocate cargoes on the same berth, or even in the same precinct

5.5 Approach to optimisation of port infrastructure

Section 5.2 discussed examples where optimisation of various elements of the port results in a sub-optimal outcome in another area of the port. In these instances, either a prioritised approach or a balanced outcome approach needs to be considered as follows:

- **Prioritised approach** - where one aspect is given priority over other aspects, and the higher priority aspect is optimised.
- **Balanced outcome approach** - where a number of aspects are important, so the system is optimised to give a balanced outcome. Depending on the nature of the project, an example of a desired balanced outcome could be a combination of:
 - The ability for port to be operated safely
 - Ecologically sustainable development
 - Lowest port capex
 - Lowest port opex
 - Lowest port whole of life costing
 - Lowest risk to disruption of operation (reliability)

5.6 Process for achieving optimisation of port infrastructure

In order to achieve optimisation of port infrastructure, the principles of optimisation need to be cascaded through master planning, statutory planning, proponent planning, feasibility studies and finally through to detailed design and implementation. Different entities have different responsibilities at different stages through the planning and project lifecycle. There is also a distinction between projects that are developed by a private proponent and multi-user or common-user infrastructure that might be either funded or developed by GPC or the state. Table 5.1 shows an example of a model for the instance where a project is developed by a private proponent.

Table 5.1 Example model for enabling cascading of principles of optimisation for a private project

Status of port planning/ development	Responsible entity	Action required	Other entities involved	Responsibility of other entities
Port master plan	DSD	Ensure port infrastructure optimisation is included in the master plan objectives and desired outcomes To specify the port infrastructure optimisation considerations in the preliminary draft port overlay development assessment requirements	GPC, GRC and other key stakeholders	To provide input and review
Port overlay	DSD	Preliminary draft port overlay to respond to the objectives of the port master plan	GPC, GRC and other key stakeholders	To provide input and review
Port strategic plan	GPC	Provide a plan for the development of existing and potential strategic port land Optimisation of the relationship between port lands, berths and channels	DSD, DTMR and GRC	To provide input and review
Project plan	Proponent	Provide a plan for how a proponent proposes to develop their facilities To ensure early consultation occurs with GPC	GPC, DSD, DTMR and other key stakeholders	To appropriately locate proposed development and allocate land and berth slots according to port infrastructure optimisation principles
Project feasibility and identification of approvals pathway	Proponent	Demonstrate feasibility and confirm port and other infrastructure and services requirements (construction and operation) Confirm planning and environmental approvals pathway and supporting studies needed	GPC, DSD, DTMR and other key stakeholders	To ensure the proponent continues to develop the detail of the project in accordance with port optimisation principles
Preparation of development applications and supporting information (including an environmental impact assessment (EIA) if required)	Proponent	Prepare concept design and obtain approval in principle from port and other infrastructure and services entities on proposed strategy Prepare and submit project EIA and development applications	GPC, DSD, DTMR and other key stakeholders	To ensure the proponent continues to develop the detail of the project in accordance with port optimisation principles



6 Key considerations for the draft master plan

This addendum has provided additional information on the infrastructure and supply chain requirements to inform development of the priority Port of Gladstone draft master plan and preliminary draft port overlay. The ISCRA summarises key considerations for the master planning process (ISCRA Section 5).

The key outcomes of the overall infrastructure and supply chain assessment are summarised below.

Marine berths and channels

Expansion in the number of industries, port throughput, number of berths, number of vessels using the port and the extent of channels will be required to accommodate the master plan growth scenario 3. The assessment suggests a total of 42 berths may be required. It is important for the master planning process to provide flexibility for future development, and in some cases, two or more different location options may be identified for a particular proposed development. This flexibility is important so that future developments are not constrained to a particular location, and also given the growth scenario and throughput identified is only one possible future growth profile.

A number of emergency anchorages are also situated in the inner harbour, and these key areas should remain in the draft master plan for use as emergency anchorages, and may be reviewed as port throughput increases.

The existing and potential berths to consider in the draft master plan are shown in Figure 3.2. Master planning should address the need to protect existing and potential marine berth areas, anchorages and shipping channels.

Dredging and material placement areas

Capital dredging will be required to accommodate the master plan growth scenarios. Deepening and duplication of the shipping channel is required to accommodate the increase in number of vessels, the increasing use of deeper draft Cape Class vessels and the development of import industries requiring Cape Class vessels. Capital dredging of new channels and berth pockets are also required to service new berths. This capital dredging is a key requirement for the growth of the port.


Capital dredged material requires placement, and a number of potential material placement areas have been identified. The potential dredged material placement areas are typically in locations which will create beneficial port land and provide economic benefit, or in locations to provide environmental benefit.

Maintenance dredging of the channels, berth pockets and swing basins is necessary to maintain an operational port, and will be an ongoing requirement. No additional infrastructure is required for maintenance dredging, with the existing East Banks DMPA having sufficient remaining capacity for the master plan timeframe, although maintenance dredged material could also be placed in existing and potential material placement areas within the master planned area.

The existing and potential dredged material placement areas to be incorporated into the master planning process are shown in Figure 3.2. Master planning should address the need to protect dredged material placement areas, shipping channels and the East Banks DMPA.

Supply chain linkage – infrastructure corridors

The movement of goods to and from the port requires suitable road, rail, pipeline, services and conveyor corridors in appropriate locations. The master planning process should preserve appropriate infrastructure corridors to meet the future infrastructure requirements, and allow management of adjoining land uses for the future development of the master planned area.



A number of potential infrastructure corridors have been identified in the assessment. A number of these potential infrastructure corridors are already identified within existing planning instruments of the GPC Port Land Use Plan, Gladstone SDA Development Scheme and the GRC Planning Scheme.

Additional infrastructure corridors have been identified which are not within existing planning instruments, as shown in Figure 4.1. The additional corridors are:

- Mainland to Curtis Island road and rail link
- West Banks Island material placement area road and rail link

A number of marine corridors crossing the Port of Gladstone waters are also likely to be required, including a possible petroleum pipeline to Tide Island, and these marine corridor components are not identified in any planning instruments as the area is outside of the boundaries of the land based planning instruments. The master plan should consider these marine crossings.

Master planning should address the need to protect the infrastructure corridors required, including both the land based and marine based corridors.

Optimisation of port infrastructure

Reef 2050 includes a specific action requiring the Queensland Government to address 'port infrastructure optimisation' through master planning for each of the priority ports.

In order to achieve optimisation of port infrastructure, the principles of optimisation should be cascaded through master planning, statutory planning, proponent planning, feasibility studies and finally through to detailed design and implementation. The requirement for optimisation needs to be incorporated into the master planning process.



7 References

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United Arab Emirates, Vietnam.

Part D

Addendum to the risk assessment report





Part D

Addendum to the risk assessment report

D1 Master planning and risk assessment report background

The priority Port of Gladstone evidence base documents that have informed the key issues for incorporating into the master planning process include:

- Evidence Base Report for the Proposed Gladstone Port Master Planned Area (AECOM 2016)
- Priority Port of Gladstone growth scenarios (DSD 2016)
- Priority Port of Gladstone master planning – Infrastructure and Supply Chain Requirements Assessment (PSA Consulting 2016)
- Priority Port of Gladstone master planning – Risk Assessment (Aurecon 2016) (herein referred to as the ‘risk assessment’).

The purpose of the master planning risk assessment is to inform the content of the environmental management framework (EMF) for the draft master plan, which:

- Identified and mapped the environmental values within and surrounding the master planned area
- Involved a risk assessment of potential impacts associated with growth scenarios for the master planned area on the OUV of the GBRWHA and other environmental values. The risk assessment was based on potential activities and causes that could occur within master plan draft precincts.
- Outlined EMF objectives for managing potential impacts within the master plan draft precincts
- Identified proposed PMMs to achieve the EMF objectives for managing potential environmental impacts, addressing existing gaps and inconsistencies in statutory and operational environmental management measures, and reducing the risk levels (where practical) for activities within the master planned area.

The risk assessment was finalised on 24 August 2016 (revision 4), prior to the commencement of the preparation of the preliminary draft port overlay.

D2 Purpose of this addendum to the risk assessment

The purpose of this addendum is to identify and assess whether the findings of other parts of this addendum to the evidence base report result in the need to amend the risk assessment report. This addendum to the risk assessment also assesses the need to amend the risk assessment report based on master planning changes within the preliminary draft port overlay (revision 7).

It is important to note that the intent of this addendum is not to revise and re-issue the complete risk assessment report, however key content has been reviewed, revised and presented in this addendum. Key content of the risk assessment is defined as risk ratings, PMMs, draft precinct EMF objectives and potential impacts.

D3 Identification of amendments to the risk assessment report

Other parts of this addendum to the evidence base report provided below were reviewed to identify the need to amend the risk assessment report.

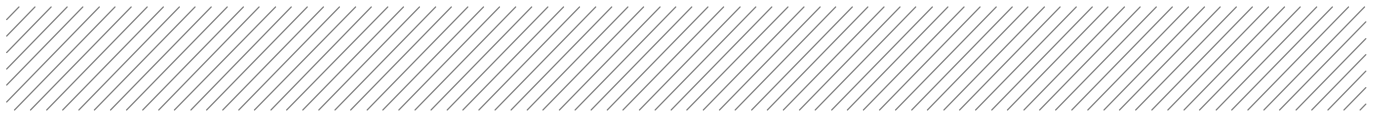
- The local expression of the OUV of the GBRWHA report (refer Part A)
- The environmental values monitoring and reporting programs summary table (refer Part B)
- The addendum to the infrastructure and supply chain requirements assessment report (refer Part C).

The master planning process and the preparation of the preliminary draft port overlay (revision 7) have also been reviewed to identify any changes that may require an amendment to the risk assessment report.

Table D1 provides a summary of the findings of the review and assessment of the above addendum to the evidence base deliverables and the preliminary draft port overlay.

Table D1 Summary of amendments required to risk assessment report

Source of potential amendment to the risk assessment report	Potential amendment description from existing risk assessment report	Addressed in this addendum to the risk assessment
Changes to master plan draft precinct names and spatial extent	Amendment to Figure 1.1 required	Refer Figures D1 and D2
	Amendment to precinct names in the EMF objectives required (Section 5.4 of the risk assessment report)	Refer Section D4
	Amendment to precinct names in the potential impacts (Section 5.5 of the risk assessment report)	Refer Section D5
New marine infrastructure precinct	Amendment to Figure 1.1 required	Refer Figures D1 and D2
	Amendment to EMF objectives required (Section 5.4 of the risk assessment report)	Refer Section D4
	Amendment to potential impacts (Section 5.5 of the risk assessment report)	Refer Section D5
New infrastructure and supply chain corridors precinct	Amendment to Figure 1.1 required	Refer Figures D1 and D2
	Amendment to EMF objectives required (Section 5.4 of the risk assessment report)	Refer Section D4
	Amendment to potential impacts (Section 5.5 of the risk assessment report)	Refer Section D5
	The potential activities, causes, potential impacts and risk ratings for the infrastructure and supply chain corridors precinct have been addressed in the previously named port, industry and supply chain precinct and marine precinct, therefore no amendment to the risk assessment table is required	Not applicable



Source of potential amendment to the risk assessment report	Potential amendment description from existing risk assessment report	Addressed in this addendum to the risk assessment
Minor edits to interface precinct boundaries and interface precinct boundaries	Due to the minor changes in these precincts there is no requirement to amend the EMF objectives, potential impacts or the risk assessment table	Not applicable
New environmental management precinct for Aldoga reserve (Lot 87 SP144431)	Amendment to Figure 1.1 required	Refer Figures D1 and D2
	The potential activities, potential impacts, risk assessment table and EMF objectives within the existing risk assessment report adequately address the inclusion of this additional environmental management precinct area, therefore no amendment is required to the risk assessment report	Not applicable
Local expression of the OUV of the GBRWHA report (Part A of the addendum to the evidence base report)	The environmental values within the risk assessment table have been assessed based on the findings of the local expression of the OUV of the GBRWHA report and with the exception of Mount Larcom landform (refer below) there are no changes to the 'sensitivity' ratings presented in the risk assessment report	Not applicable
	Mount Larcom landform is now identified as having a minor contribution to the OUV of the GBRWHA (ie based on its value as a vegetated mountain and the contribution to the OUV criterion vii – aesthetics and superlative natural phenomena). A review of the PMMs in the preliminary draft port overlay (revision 7) and risk assessment was undertaken and it is considered that no additional PMMs are required to manage the environmental values of the Mount Larcom landform.	Not applicable
	Amendment to the environmental values mapping	Refer Part A, Appendix B
Environmental values monitoring and reporting programs (Part B of the addendum to the evidence base report)	The environmental values monitoring and reporting programs assessment and summary table provides additional information to Tables 4.3 to 4.5 (operational environmental management measures) of the risk assessment report	Part B of this addendum to the evidence base replaces Tables 4.3 to 4.5 of the risk assessment report for operational environmental values monitoring and reporting programs
	The findings of the environmental values monitoring and reporting programs assessment and summary table do not require any amendments to the risk assessment table	Not applicable
	The findings of the environmental values monitoring and reporting programs assessment provides input into the development of PMM 2 (environmental values monitoring and reporting program)	Refer Part B, Section B3

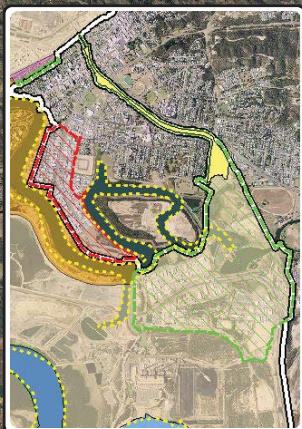
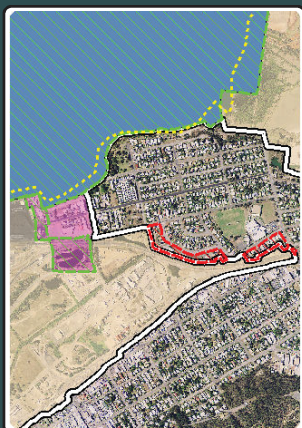
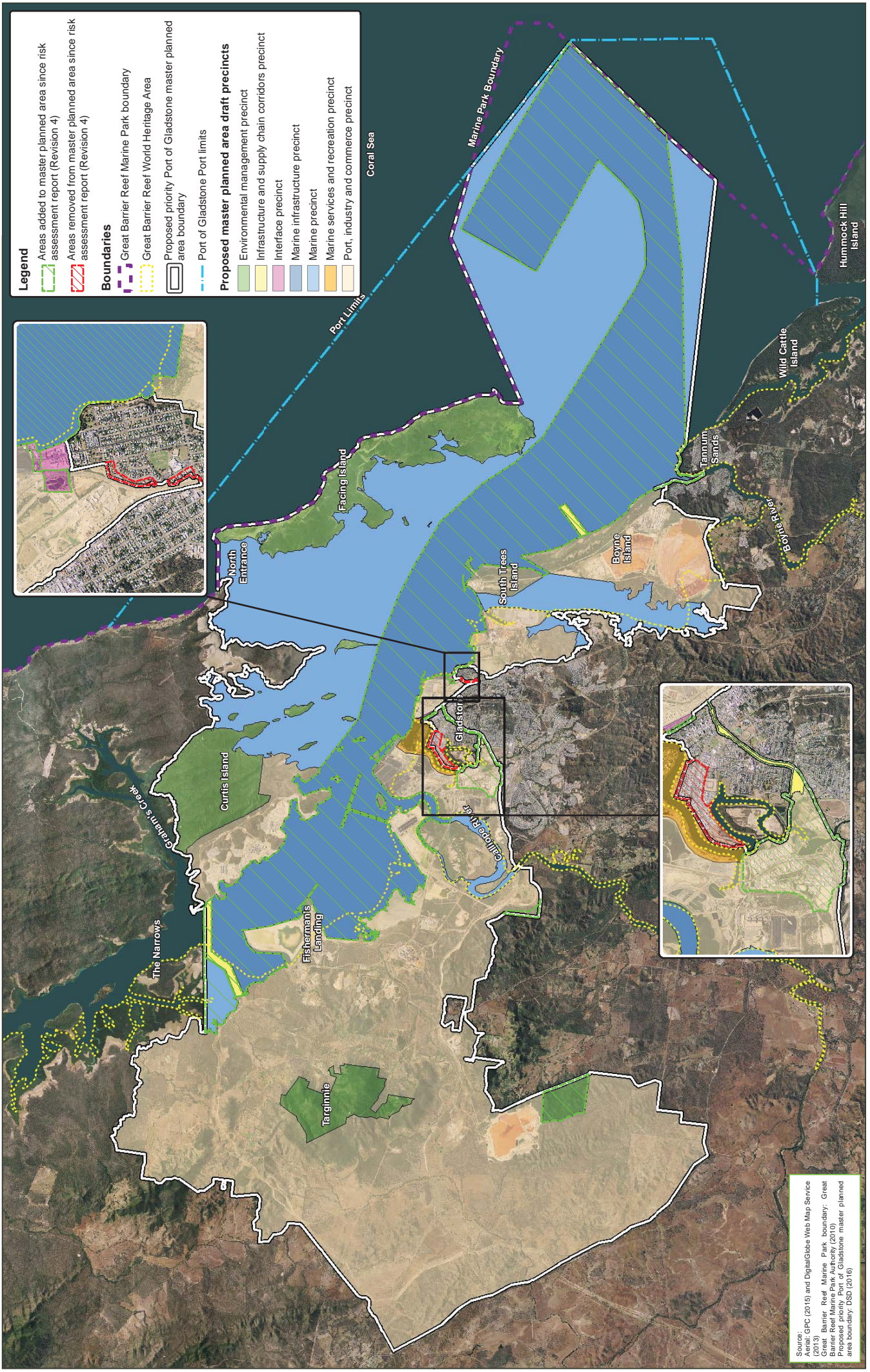
Source of potential amendment to the risk assessment report	Potential amendment description from existing risk assessment report	Addressed in this addendum to the risk assessment
Additional potential material placement area (ie Facing Island (West)) included in the addendum to the infrastructure and supply chain requirements assessment	The potential activities, causes, potential impacts and risk ratings for the potential Facing Island (West) material placement area have been addressed by the other potential material placement areas included in the risk assessment report, therefore no amendment to the risk assessment table is required	Not applicable
Construction and operation of a road and rail bridge from the mainland to the potential West Banks Island material placement area included in the addendum to the infrastructure and supply chain requirements assessment	While the potential activity is not specifically included in the risk assessment table, the relevant causes, potential impacts and risk ratings have been addressed by the construction and operation of a road and rail bridge from the mainland to Curtis Island, therefore no amendment to the risk assessment table is required	Not applicable
Maintenance dredged material has the potential to be placed within potential material placement areas	While the potential activity is not specifically included in the risk assessment table, the relevant causes, potential impacts and risk ratings have been addressed by the capital dredged material placement activity, therefore no amendment to the risk assessment table is required	Not applicable

D4 Amended EMF objectives for the master planned area draft precincts

The EMF objectives below replace Section 5.4 of the risk assessment report.

Port, industry and commerce precinct

- To manage development impacts on the OUV of the GBRWHA and other environmental values below to as low as practically possible
 - Threatened ecological communities listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
 - Endangered and Of concern Regional Ecosystems listed under the *Vegetation Management Act 1999* (VM Act)
 - Conservation significance flora species and fauna species habitat listed under the EPBC Act and *Nature Conservation Act 1992* (NC Act)
 - Migratory shorebird habitat and populations
 - Natural scenic amenity values of the coastal zone
 - Cultural heritage values
- To increase the understanding of the presence and habitat value for EPBC Act and NC Act conservation significant fauna species and migratory species listed under the EPBC Act
- To maintain appropriate access to areas that provide Indigenous cultural heritage values and natural scenic amenity values to residents, recreational users and tourists that contribute towards the OUV of the GBRWHA
- To manage development impacts on cultural heritage and social values.



Legend

- Areas added to master planned area since risk assessment report (Revision 4)
- Areas removed from master planned area since risk assessment report (Revision 4)

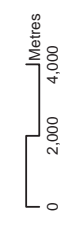
Boundaries

- Great Barrier Reef Marine Park boundary
- Great Barrier Reef World Heritage Area
- Proposed priority Port of Gladstone master planned area boundary
- Port of Gladstone Port limits

Proposed master planned area draft precincts

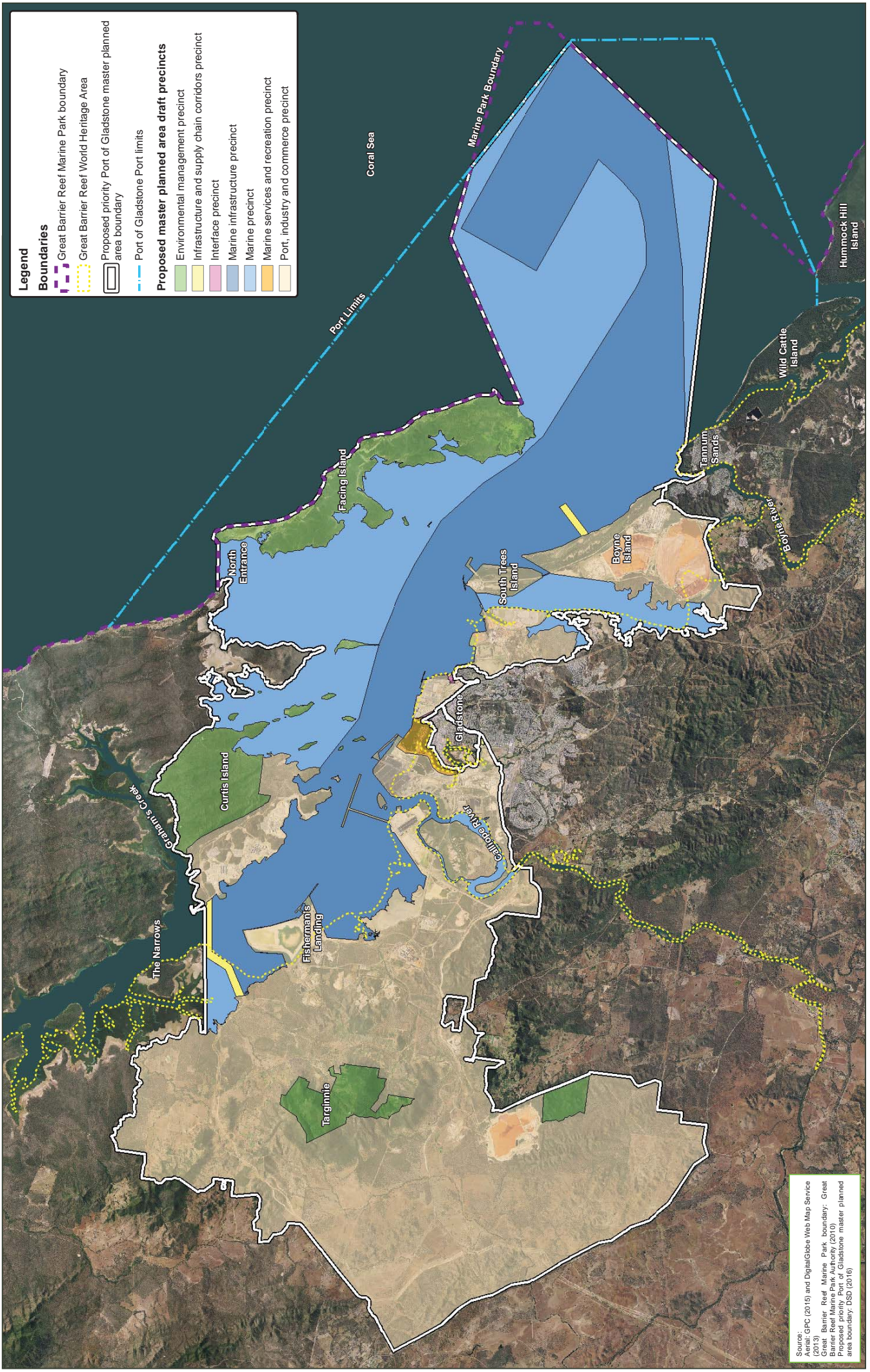
- Environmental management precinct
- Infrastructure and supply chain corridors precinct
- Interface precinct
- Marine infrastructure precinct
- Marine precinct
- Marine services and recreation precinct
- Port, industry and commerce precinct

Source: Aureal, GPC (2015) and DigitalGlobe Web Map Service (2013)
 Great Barrier Reef Marine Park boundary: Great Barrier Reef Marine Park Authority (2010)
 Gladstone master planned area boundary: DSD (2016)



Date: 30/01/2017 Version: 1 Job No: 253916
 Coordinate system: GDA 1994 MGA Zone 56

Priority port of Gladstone master planning addendum to the evidence base
 Figure D1: Amendments to the master planned area draft precincts



Source:
 Aerial: GPC (2015) and DigitalGlobe Web Map Service (2013)
 Great Barrier Reef Marine Park boundary: Great Barrier Reef Marine Park Authority (2010)
 Gladstone master planned area boundary: DSD (2016)



Date: 30/01/2017 Version: 1 Job No: 253916
 Coordinate system: GDA 1994 MGA Zone 56

Priority port of Gladstone master planning addendum to the evidence base
 Figure D2: Priority Port of Gladstone master planned area draft precincts



Infrastructure and supply chain corridors precinct

- To support port developments in the port, industry and commerce precinct to operate efficiently and effectively, in a manner that appropriately balances commercial, recreational and cultural activities, and potential impacts on the OUV attributes of the GBRWHA and other environmental values
- To manage development impacts on the OUV of the GBRWHA and other environmental values to as low as practically possible.

Marine services and recreation precinct

- To manage and mitigate development impacts on the OUV attributes of the GBRWHA and other environmental values below to as low as practically possible
 - Threatened ecological communities listed under the EPBC Act
 - Habitat for conservation significant fauna species listed under the NC Act and/or EPBC Act
 - Migratory shorebird habitat and populations
 - Mangroves and other marine plants
 - Wetlands
 - Marine species diversity (flora and fauna)
 - Marine water quality
 - Cultural heritage values
 - Natural scenic amenity values
- To maintain safe access to the waterfront and harbour for commercial operations, residents, recreational users and tourists.

Interface precinct

- To ensure the design of residential development incorporates design measures and other controls that minimise noise, light, visual amenity and air quality impacts from adjoining port and industrial land uses.

Environmental management precinct

- To minimise potential direct disturbance and indirect impacts from development on the following Facing Island OUV attributes of the GBRWHA:
 - Marine turtle nesting beaches and habitat
 - Threatened ecological communities under the EPBC Act
 - Endangered and Of concern Regional Ecosystems under the VM Act
 - Conservation significant fauna habitat
 - Migratory shorebird habitat
 - Coral reefs
 - Island vegetation and fauna species diversity
 - Natural scenic amenity values
 - Dune systems and beaches
- To minimise potential direct disturbance and indirect impacts from development on the following Curtis Island OUV attributes of the GBRWHA:

- Island vegetation and fauna species diversity and
- Natural scenic amenity values
- Marine turtle nesting beaches and habitat
- Migratory shorebird habitat
- Threatened ecological communities under the EPBC Act
- Endangered and Of concern Regional Ecosystems under the VM Act
- Conservation significant fauna habitat
- Coral reefs
- To minimise and mitigate direct and indirect development impacts on the inshore islands, Mount Larcom landform and Aldoga reserve OUV attributes of the GBRWHA and/or other environmental values within this precinct listed below:
 - Threatened ecological communities under the EPBC Act
 - Endangered and Of concern Regional Ecosystems under the VM Act
 - Conservation significance flora species and fauna species habitat under the EPBC Act and NC Act (including migratory species under the EPBC Act)
 - Cultural heritage values
 - Natural scenic amenity values
- To increase the understanding of the presence and contribution of local attributes that contribute to the OUV of the GBRWHA
- To limit future development to low impact recreational and nature-based activities or essential infrastructure with community benefit that does not reduce the OUV of the GBRWHA and other environmental values
- To maintain appropriate access to areas that provide Indigenous cultural heritage values and natural scenic amenity values to residents, recreational users and tourists that contribute towards the OUV of the GBRWHA.

Marine precinct

- To protect the OUV attributes of the GBRWHA below from direct disturbance from development
 - Pelican Banks North, Pelican Banks South, Facing Island and Quoin Island seagrass meadows
 - Inshore turbid reefs and fringing reefs, including: coral reefs on the seaward side of Curtis Island and Facing Island, coral reefs associated with Seal Rocks, Turtle Island Reef, Bushy Reef and Manning Reef
 - Kangaroo Island wetland and important shorebird roosting habitat at Friend Point, North Passage and South Passage Islands, Boyne Island Beach, shorebird habitat associated Curtis Island, Facing Island and the other inshore islands
- To minimise and mitigate direct and indirect development impacts on the following OUV attributes of the GBRWHA and other environmental values:
 - Pelican Banks North, Pelican Banks South, Facing Island and Quoin Island seagrass meadows and deep water seagrass meadows
 - Mangroves and other intertidal marine plants
 - Migratory shorebird habitat and populations
 - Marine faunal groups diversity

- Marine water quality
- Cultural heritage values
- Natural scenic amenity values
- Ongoing sustainable use of the marine waters by marine turtles and other marine reptiles, dugongs, dolphins, seabirds, whales, coral reefs, benthic communities, fish and other nekton
- Ongoing sustainable use of marine waters and near shore intertidal areas for recreational and commercial fishing
- To increase the understanding of the presence and habitat value for EPBC Act and NC Act conservation significant fauna species
- To continue to collect water quality information that monitors changes to the water quality and confirms the associated impact on the OUV attributes of the GBRWHA and other environmental values
- Allow port development to occur where it is necessary to support development within the marine infrastructure precinct and/or the port, industry and commerce precinct in a manner that appropriately balances commercial, recreational and cultural activities and potential impacts on OUV attributes of the GBRWHA and other environmental values
- Maintain and protect the OUV attributes of the GBRWHA and other environmental values currently expressed within this precinct.

Marine infrastructure precinct

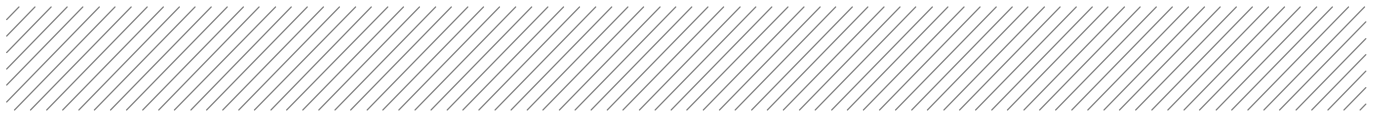
- To maintain port access to and continued development of shipping channels and waterside areas in a manner that appropriately balances commercial, recreational and cultural activities and potential impacts on the OUV attributes of the GBRWHA and other environmental values
- Where practical to manage the OUV attributes of the GBRWHA below from direct disturbance from development
 - Facing Island and Quoin Island seagrass meadows
 - Inshore turbid reefs and fringing reefs, including coral reefs associated with East Banks (East and West)
 - Important shorebird roosting habitat at North Passage and South Passage Islands, Boyne Island Beach, shorebird habitat associated Curtis Island, Facing Island and the other inshore islands
- To minimise and mitigate direct and indirect development impacts on the following OUV attributes of the GBRWHA and other environmental values:
 - Seagrass meadows and deep water seagrass meadows
 - Mangroves and other intertidal marine plants
 - Migratory shorebird habitat and populations
 - Marine faunal groups diversity
 - Marine water quality
 - Cultural heritage values
 - Natural scenic amenity values
 - Ongoing sustainable use of the marine waters by marine turtles and other marine reptiles, dugongs, dolphins, seabirds, whales, coral reefs, benthic communities, fish and other nekton
 - Ongoing sustainable use of marine waters and near shore intertidal areas for recreational and commercial fishing.

D5 Amended potential impacts for the master planned area precincts

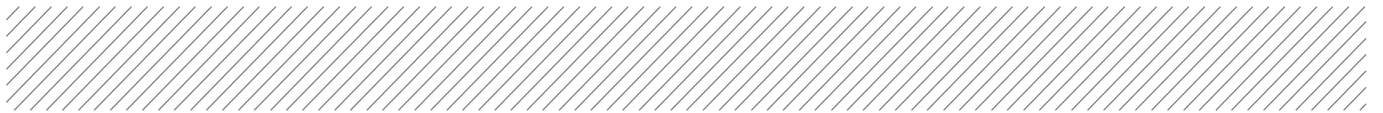
Table D2 replaces Table 5.5 in the risk assessment report.

Table D2 Summary of relevant potential impacts within each of the master plan draft precincts

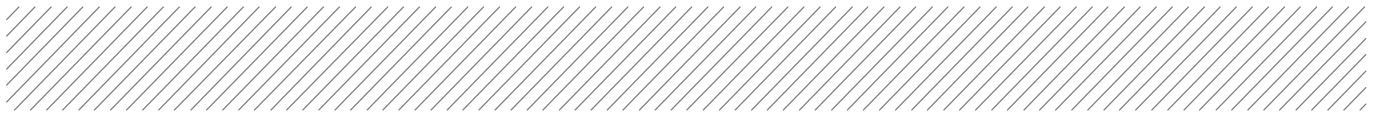
Potential impacts	PICP	ISCCP	MSRP	IP	EMP	MP	MIP
Terrestrial flora and fauna							
Direct disturbance resulting in the loss, fragmentation or loss of connectivity values of terrestrial flora species, vegetation communities and/or fauna habitat	Yes	Yes	Yes	No	Yes	No	No
Direct mortality and/or injury to terrestrial fauna	Yes	Yes	No	No	Yes	No	No
Increase in noise, vibration, light and/or other disruption to behaviour/life-cycle of terrestrial fauna	Yes	Yes	Yes	No	Yes	Yes	Yes
Disruption to terrestrial fauna behaviour and/or life-cycle due to increased potential for human interaction	No	No	No	No	Yes	No	No
Increase in operational lighting impacting on terrestrial fauna	Yes	Yes	Yes	No	Yes	No	No
Increase in dust impacts on adjacent terrestrial vegetation communities and/or fauna habitat , reducing the condition and quality of adjacent habitats	Yes	Yes	Yes	No	Yes	Yes	Yes
Increased levels of waste materials resulting in reduced terrestrial fauna habitat condition and/or quality	No	No	No	No	Yes	No	No
Increased edge effects on adjacent terrestrial vegetation communities and/or fauna habitat , reducing the condition and/or quality of adjacent environments	Yes	Yes	Yes	No	Yes	No	No
Introduction or spread of pest and weed species resulting in reduced condition and/or quality of terrestrial vegetation communities and/or fauna habitat	Yes	Yes	Yes	No	Yes	Yes	Yes
Intertidal flora and fauna							
Direct disturbance resulting in the loss, fragmentation or loss of connectivity values of intertidal flora species, vegetation communities and/or fauna habitat	Yes	Yes	Yes	No	Yes	Yes	Yes
Direct mortality and/or injury to intertidal fauna	Yes	Yes	Yes	No	Yes	Yes	Yes
Increase in noise, vibration, light and/or other disruption to behaviour/life-cycle of intertidal fauna	Yes	Yes	Yes	No	Yes	Yes	Yes



Potential impacts	PICP	ISCCP	MSRP	IP	EMP	MP	MIP
Disruption to intertidal fauna behaviour and/or life-cycle due to increased potential for human interaction	No	Yes	Yes	No	Yes	No	No
Increase in operational lighting impacting on intertidal fauna	Yes	Yes	Yes	No	Yes	Yes	Yes
Increase in dust impacts on adjacent intertidal vegetation communities and/or fauna habitat , reducing the condition and quality of adjacent habitats	Yes	Yes	Yes	No	Yes	Yes	Yes
Increased levels of waste materials resulting in reduced intertidal fauna habitat condition and/or quality	No	Yes	Yes	No	Yes	No	No
Increased edge effects on adjacent intertidal vegetation communities and/or fauna habitat , reducing the condition and/or quality of adjacent environments	Yes	Yes	Yes	No	Yes	Yes	Yes
Introduction or spread of pest and weed species resulting in reduced condition and/or quality of intertidal vegetation communities and/or fauna habitat	Yes	Yes	Yes	No	Yes	Yes	Yes
Increased edge effects and/or direct loss of important foraging/roosting habitat for shorebirds	Yes	Yes	Yes	No	Yes	Yes	Yes
Marine flora and fauna							
Direct disturbance resulting in the loss, fragmentation or loss of connectivity values of marine flora species, vegetation communities and/or fauna habitat (including benthic communities, coral reefs and seagrass meadows)	Yes	Yes	No	No	No	Yes	Yes
Direct mortality and/or injury to marine fauna	No	Yes	Yes	No	No	Yes	Yes
Increase in noise, vibration, light and/or other disruption to behaviour/life-cycle of marine fauna	Yes	Yes	Yes	No	No	Yes	Yes
Increase in operational lighting impacting on marine fauna	Yes	Yes	Yes	No	Yes	Yes	Yes
Increase in dust impacts on adjacent marine vegetation communities and/or fauna habitat , reducing the condition and quality of adjacent habitats	Yes	Yes	Yes	No	No	Yes	Yes
Increased edge effects on adjacent marine vegetation communities and/or fauna habitat , reducing the condition and/or quality of adjacent environments	Yes	Yes	No	No	No	Yes	Yes
Introduction or spread of pest and weed species resulting in reduced condition and/or quality of marine vegetation communities and/or fauna habitat	Yes	Yes	No	No	No	Yes	Yes



Potential impacts	PICP	ISCCP	MSRP	IP	EMP	MP	MIP
Increased edge effects on important nesting habitat for marine turtles	No	No	No	No	Yes	No	No
Beneficial impact that increases the opportunities for establishment of benthic communities and associated marine fauna	No	Yes	No	No	No	Yes	Yes
Water quality impacts							
Sedimentation and decreased water quality in terrestrial areas resulting in decreased condition and/or quality of environments and downstream areas	Yes	Yes	Yes	No	Yes	Yes	Yes
Sedimentation and decreased water quality in intertidal and/or marine areas resulting in decreased condition and/or quality of environments	Yes	Yes	Yes	No	Yes	Yes	Yes
Alteration of groundwater levels and quality resulting in impacts to surrounding terrestrial environments	Yes	Yes	Yes	No	Yes	Yes	Yes
Alteration of groundwater levels and quality resulting in impacts to surrounding intertidal environments	Yes	Yes	Yes	No	Yes	Yes	Yes
Alteration of groundwater levels and quality resulting in impacts to surrounding marine environments	Yes	Yes	Yes	No	Yes	Yes	Yes
Changes to marine water velocities and potential erosion, sedimentation and decreased water quality impacts resulting in decreased condition and/or quality	Yes	Yes	No	No	No	Yes	Yes
Social and cultural heritage impacts							
Decrease in visual amenity for residents, recreational users and tourists	Yes	Yes	Yes	No	Yes	Yes	Yes
Direct impacts on cultural heritage sites during vegetation clearing and land disturbance	Yes	Yes	Yes	No	Yes	Yes	Yes
Loss of Traditional Owner access to land as a result of construction and/or operation of infrastructure	Yes	Yes	No	No	Yes	Yes	Yes
Increased dust impacts in surrounding areas resulting in reduced air quality	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Access impacts on residents and tourists	No	Yes	No	No	Yes	No	No
Increase in light, dust, noise and vibration impacts resulting in a decreased level of social amenity for residents and tourists	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Beneficial impact from an increase in public awareness of the OUV of the GBRWHA and other environmental values	No	No	No	No	Yes	No	No



Potential impacts	PICP	ISCCP	MSRP	IP	EMP	MP	MIP
Increase in the number of residents and/or tourists experiencing social amenity impacts as a result of construction and/or operation of industrial and port industries within the port, industry and supply chain precinct	No	No	No	Yes	No	No	No
Increased dust impacts in adjacent areas resulting in reduced air quality and/or increased odour impacts	No	Yes	No	Yes	No	No	No
Increase in pressure on community infrastructure and services (eg airport; health and emergency services; food, water and electricity supply)	Yes	Yes	No	No	Yes	No	No
Increase in demand for rental/sale properties which may result in decrease in housing affordability if the demand exceeds the supply of housing	Yes	Yes	No	No	No	No	No
Decrease in social/community cohesion due to influx of temporary workforce, potentially leading to increased social and health related issues	Yes	Yes	No	No	No	No	No

Table notes:

Draft precincts: PICP = Port, industry and commerce precinct
 ISCCP = Infrastructure and supply chain corridors precinct
 MSRP = Marine services and recreation precinct
 IP = Interface precinct
 EMP = Environmental management precinct
 MP = Marine precinct
 MIP = Marine infrastructure precinct

D6 References

AECOM 2016, Evidence Base Report for the Proposed Gladstone Port Master Planned Area, Prepared for the Queensland Department of State Development, AECOM, Brisbane

Aurecon 2016 Priority Port of Gladstone master planning – Risk assessment, Prepared for the Queensland Department of State Development, Aurecon, Brisbane

Department of State Development (DSD) 2016, *Draft master plan for the priority Port of Gladstone*, State of Queensland, Department of State Development, Brisbane.

PSA Consulting 2016, Priority Port of Gladstone Master Planning – Infrastructure and Supply Chain Requirements Assessment Final Report, prepared for the Queensland Department of State Development, PSA Consulting, Brisbane

Part E

Evidence base key issues incorporated into master planning





Part E

Evidence base key issues incorporated into master planning

Existing evidence base background

The priority Port of Gladstone evidence based documents that have informed the key issues for incorporating into the master planning process included:

- Evidence Base Report for the Proposed Gladstone Port Master Planned Area (AECOM 2016)
- Priority Port of Gladstone growth scenarios (DSD 2016a)
- Priority Port of Gladstone master planning – Infrastructure and Supply Chain Requirements Assessment (PSA Consulting 2016)
- Priority Port of Gladstone master planning – Risk Assessment (Aurecon 2016).

The findings of the additional investigations contained in this addendum report have also confirmed the key issues for incorporating into the master planning process and development of port overlay content.

Key evidence base issues incorporated into master planning

Table E1 provides a summary of the key issues and recommendations raised by the evidence base, including reference to the specific individual report which raised the issue or recommendation.

Furthermore, to illustrate how these key issues and recommendations have been considered in the master planning process, detail is provided on the specific provisions of the master plan (including the objectives, desired outcomes, state interests and PMMs) and port overlay content (with supporting justification emphasising the current 'gap' in existing planning provisions and/or operational environmental management).

Table E1 Priority Port of Gladstone – evidence base key issues for consideration in master planning

Evidence base key issue	Evidence base document (section/map number)	Objectives	Desired outcomes	State interests	Priority management measures (PMMs)	Addressed in preliminary draft port overlay	Justification
Outstanding Universal Value of the Great Barrier Reef World Heritage Area (OUV of the GBRWHA) and all other environmental values							
Development activities within the master planned area that have the potential to impact on the OUV of the GBRWHA and other environmental values	RA (Table 5.6) Addendum to the EB (Part A)	Manage the OUV of the GBRWHA Recognise and manage potential impacts on all environmental values, including the natural, social and cultural environments within and surrounding the master planned area	Manage potential development impacts on all environmental values, including those that contribute to the OUV of the GBRWHA Manage potential impacts of development on the scenic amenity of land and marine areas	Environment – OUV of the GBRWHA and all other environmental values Community – wellbeing of the community of the Gladstone region	Not applicable	Yes Other port overlay content – assessment benchmarks – environmental values management code Inclusion of mapping of the key OUV of the GBRWHA and other environmental values including seagrass meadows, coral reefs, turtle nesting beaches and migratory shorebird habitat	Provisions in existing planning instruments do not consistently or adequately address OUV of the GBRWHA and other environmental values identified as having a significant, moderate or minor notable contribution to local expression of the OUV of the GBRWHA in the Port of Gladstone. In addition, a number of these OUV of the GBRWHA and other environmental values are identified as being outside of the Gladstone Regional Council Planning Scheme (GRC Planning Scheme) and/or Gladstone Ports Corporation Port Land Use Plan (GPC Port LUP) areas
Information and mapping in relation to the OUV of the GBRWHA must be reviewed and updated on a regular basis in order to: <ul style="list-style-type: none"> Identify gaps in knowledge or monitoring efforts Support improvements in data collection and management Develop and set appropriate environmental objectives for the future Department of State Development (DSD) to review the Reef 2050 Integrated Monitoring and Reporting Program Strategy (GBRMPA 2015) and liaise with GBRMPA and other relevant stakeholders to ensure that the monitoring and reporting requirements PMM that relates does not duplicate that of the Reef 2050 Integrated Monitoring and Reporting Program (RIMReP)	Addendum to the EB (Part B)				PMM 2 – Environmental values monitoring and reporting program	Yes Operational matters – PMM 2	Implementation of PMM 2 assists in reducing the potential environmental impacts/risks of development activities A number of existing research and monitoring programs within the Port of Gladstone are proposed to finish in the foreseeable future Future surveys beyond current committed programs are required to continue during the master plan timeframe to monitor, report and increase the understanding of the health and presence of key environmental values (eg seagrass meadows, coral reefs and marine fauna and shorebird habitat) within and surrounding the master planned area
The PMM that relates to the impact assessment guideline requirements should be incorporated into the terms of reference for an Environmental Impact Statement (EIS) prepared under the <i>State Development and Public Works Organisation Act 1971</i> (SDPWO Act), <i>Environmental Protection Act 1994</i> (EP Act) and/or <i>Planning Act 2016</i> (Planning Act)	RA (Section 5.8.4 additional general conclusions)				PMM 2 – Environmental values monitoring and reporting program	Yes Operational matters – PMM 2	The findings of the surveys undertaken in PMM 2 will assist in the development of actions and measures for the future management of the OUV of the GBRWHA and other environmental values within the master planned area
					PMM 3 – environmental assessment guideline	Yes Operational matters – PMM 3	Implementation of this PMM seeks to ensure consistency between an EIS prepared under the SDPWO Act and the EP Act, and other environmental assessments undertaken under the Planning Act

Evidence base key issue	Evidence base document (section/map number)	Addressed in master plan Objectives	Desired outcomes	State interests	Priority management measures (PMMs)	Addressed in preliminary draft port overlay	Justification
Land management inconsistencies across the master planned area	RA (Section 5.8.4 additional general conclusions)	Manage the OUV of the GBR/WHA Recognise and manage potential impacts on all environmental values, including the natural, social and cultural environments within and surrounding the master planned area	Manage potential development impacts on all environmental values, including those that contribute to the OUV of the GBR/WHA	Environment – OUV of the GBR/WHA and all other environmental values	PMM 4 – Land management plan guideline	Yes Operational matters – PMM 4	Existing land management practices are inconsistent across the master planned area. Development of a guideline will support the preparation and implementation of consistent land management plans across the draft environmental management precinct
Inclusion of Lot 87 on SP144431 at Aldoga into the proposed environmental management precinct					PMM 5 – Facing Island land management plan	Yes Operational matters – PMM 5	Existing land management practices are inconsistent across the master planned area. PMMs 5-9 identify the areas within the draft environmental management precinct where land management plans should be prepared (in accordance with the guideline)
Environmental management of the portion of Curtis Island within the environmental management precinct					PMM 6 - Inshore islands land management plan	Yes Operational matters – PMM 6	Ensures consistent land management practices are developed and implemented for non-freehold properties within the group of Inshore islands
					PMM 7 – Mount Larcom landform area	Yes Operational matters – PMM 7	Ensures consistent land management practices are developed and implemented for land within the Mount Larcom landform area
					PMM 8 – Aldoga reserve land management plan	Yes Draft precinct mapping in preliminary draft port overlay amended Operational matters – PMM 8	Ensures consistent land management practices are developed and implemented for land within the Mount Larcom landform area. The land has a restricted tenure based on its environmental value and is recognised in the Gladstone SDA Development Scheme
					PMM 9 – Curtis Island land management plan	Yes Operational matters – PMM 9	Ensures consistent land management practices are developed and implemented for the portion of Curtis Island that is within the draft environmental management precinct
Include PMM implementation and approvals timeframes, and a prioritisation framework for all PMMs to identify the required order of PMM implementation	RA (Section 5.8.3 port overlay matters)				All PMMs	Yes Operational matters - PMM provisions include reference to timeframes, and prerequisite PMMs where appropriate	Including PMM implementation timeframes provides certainty on when these provisions of the port overlay become a statutory requirement However, the preliminary draft port overlay has sought to avoid being too prescriptive regarding timeframes, instead opting in most instances to ensure timeframes are agreed between DSD and the relevant responsible entity

Evidence base key issue	Evidence base document (section/map number)	Addressed in master plan Objectives	Desired outcomes	State interests	Priority management measures (PMMs)	Addressed in preliminary draft port overlay	Justification
The port overlay should consider including a marine precinct code which includes measures and other controls to be implemented by development within the master plan marine precinct	RA (Section 5.8.3 port overlay matters)	Manage the OUV of the GBRWHA Recognise and manage potential impacts on all environmental values, including the natural, social and cultural environments within and surrounding the master planned area	Manage potential development impacts on all environmental values, including those that contribute to the OUV of the GBRWHA	Environment – OUV of the GBRWHA and all other environmental values	Not applicable	Yes Other port overlay content – assessment benchmark – environmental values management code Measures and controls relating to the draft marine precinct have been included within 'issues' based codes rather than being precinct based The previously named 'marine precinct' has now been revised and divided into the 'marine precinct' and 'marine infrastructure precinct'	There is no existing planning instrument for the marine component of the master planned area. These provisions are required to ensure: <ul style="list-style-type: none">Consistency between the design, construction and operation of expanded or new developments within the draft marine precinct and draft marine infrastructure precinctTo ensure that expansions and new development and operations within the draft marine precinct are appropriately located, designed and implemented mitigation measures with due consideration of the OUV of the GBRWHAOther areas identified as part of confirming, addressing information gaps and documenting the spatial extent and conservation significance of the other environmental values via field surveys and/or recognised expert advice
Renaming the draft environmental protection precinct to the draft environmental management precinct	RA (Section 5.8.4 additional general conclusions) Addendum to the EB (Part D)	Manage the OUV of the GBRWHA Recognise and manage potential impacts on all environmental values, including the natural, social and cultural environments within and surrounding the master planned area	Manage potential development impacts on all environmental values, including those that contribute to the OUV of the GBRWHA	Environment – OUV of the GBRWHA and all other environmental values	Not applicable	Yes Draft precinct mapping in the preliminary draft port overlay	Consistent with the terminology used in the Gladstone SDA Development Scheme and GRC Planning Scheme. This proposed change in terminology also better reflects the broader management intent (in accordance with the principles of Ecologically Sustainable Development (ESD)) for these areas and associated environmental values
DSD and the Department of Infrastructure, Local Government and Planning (DLGP) to update the State Planning Policy (SPP) and associated mapping to include the OUV of the GBRWHA and other environmental values so that these values can be included in other planning instruments adjoining the GBRWHA	RA (Section 5.8.4 additional general conclusions)	Manage the OUV of the GBRWHA Recognise and manage potential impacts on all environmental values, including the natural, social and cultural environments within and surrounding the master planned area Maintain quality of life for community in the Gladstone region	Manage potential development impacts on all environmental values, including those that contribute to the OUV of the GBRWHA	Environment – OUV of the GBRWHA and all other environmental values	Not applicable	No	To allow all relevant local government planning schemes to consider the inclusion of the OUV of the GBRWHA and other environmental values as part of their planning scheme review and amendment process DSD will work cooperatively with DLGP to ensure the SPP is appropriately updated
Department of Transport and Main Roads (TMR) (Maritime Safety Queensland (MSQ)) undertake a review of its existing policies and procedures for emergency response and disaster management within the draft marine and draft marine infrastructure precincts and update to include consideration of the OUV of the GBRWHA. This may include identification of the OUV of the GBRWHA within the marine precinct and planned response, monitoring and reporting requirements for emergency response and disaster management actions	RA (Section 5.8.4 additional general conclusions)	Maintain quality of life for community in the Gladstone region	Manage potential development impacts on sensitive uses and areas surrounding the master planned area	Environment – OUV of the GBRWHA and all other environmental values Community – wellbeing of the community of the Gladstone region	Not applicable	No	DSD will work cooperatively with TMR (MSQ) to support TMR's review and updating of these existing policies and procedures

Evidence base key issue	Evidence base document (section/map number)	Addressed in master plan Objectives	Desired outcomes	State interests	Priority management measures (PMMs)	Addressed in preliminary draft port overlay	Justification
PMM 3 – An environmental assessment guideline should be incorporated into the Gladstone SDA Development Scheme, GPC Port LUP and GRC Planning Scheme during their next review and amendment processes	RA (Section 5.8.4 – additional general conclusions)	Manage the OUV of the GBRWHA Recognise and manage potential impacts on all environmental values, including the natural, social and cultural environments within and surrounding the master planned area	Manage potential development impacts on all environmental values, including those that contribute to the OUV of the GBRWHA	Environment – OUV of the GBRWHA and all other environmental values	PMM 3 – Environmental assessment guideline	Yes (where stated under justification) Operational matters – PMM 3 However, the port overlay cannot direct GRC or GPC to amend the GRC Planning Scheme or GPC Port LUP, respectively in a particular way Yes Other port overlay content - assessment benchmark – environmental values management code However, the port overlay cannot direct GRC or GPC to amend the GRC Planning Scheme or GPC Port LUP, respectively in a particular way No (for Gladstone SDA Development Scheme)	Under the Ports Act, the port overlay requires that the port overlay content must be considered by: <ul style="list-style-type: none"> GRC in making or amending the planning instrument, and the port overlay overrides the planning instrument to the extent of any inconsistency GPC in making or amending the land use plan, and the port overlay overrides the land use plan to the extent of any inconsistency <p>The port overlay does not regulate development within the Gladstone SDA where assessable under the Gladstone SDA Development Scheme</p> <p>However, in accordance with the Ports Act, the Coordinator-General is required to consider whether the Gladstone SDA Development Scheme is inconsistent with the port overlay after the port overlay takes effect. Where there is an inconsistency, the Coordinator-General must decide whether to amend the Gladstone SDA Development Scheme to remove the inconsistency, or table a report in the Legislative Assembly detailing the reasons should the Coordinator-General decide not to amend the Development Scheme.</p>
The OUV of the GBRWHA and other environmental values and master plan EMF objectives (where relevant) should be incorporated into the Development Scheme for the Gladstone SDA, GPC Land Use Plan and GRC Planning Scheme during the next review and amendment process					Not applicable		
Consideration should be given to the management of stormwater runoff within the master planned area and upstream catchment areas					Not applicable	Yes Other port overlay content - assessment benchmark – environmental values management code Measures and controls relating to the management of stormwater and avoiding/reducing impacts on waterways	Potential improvement in stormwater quality runoff into the marine waters of the master planned area and surrounds
Shipping channels							
The expansion of existing channels and berths is critical to ensuring that deep draft vessels (eg import and export cape size) are not limited in their movement in and out of the priority Port of Gladstone	IS CRA (Section 4.2) Addendum to the EB (Part C, Section 6)	Facilitate the economic growth of the state and the Gladstone region Enable the ongoing sustainable growth of trade through the Port of Gladstone	Provide for adequate supply chain development infrastructure, including connections between land and marine areas Provide economic benefit and employment opportunities for the Gladstone region	Planning – operation of the priority Port of Gladstone and its growth and development Economic – sustainable economic growth of the priority Port of Gladstone and the surrounding region	Not applicable	Yes Other port overlay content – assessment benchmarks – marine infrastructure management code Inclusion of provisions to ensure development does not compromise or adversely impact on the operation of the port navigable waterway The previously named 'marine precinct' has now been revised and divided into the 'marine precinct' and 'marine infrastructure precinct'	Provisions in existing planning instruments do not provide adequate planning or management of the potential impacts of development upon future activities within marine areas (eg port navigable waterways), resulting in potential conflicts between constructed infrastructure and shipping movements
The operation of cape size vessels in the main shipping channel is the primary control on the capacity of the priority Port of Gladstone to grow in line with the potential for industrial growth							
Master planning should address the need to protect marine berth areas and shipping channels	Addendum to the EB (Part C, Section 6)						

Evidence base key issue	Evidence base document (section/map number)	Addressed in master plan Objectives	Desired outcomes	State interests	Priority management measures (PMMs)	Addressed in preliminary draft port overlay	Justification
Capital dredging It is critical that capital dredging requirements within the priority Port of Gladstone are addressed by master planning Capital dredging underpins the medium and long term growth of the port and industries in the master planned area Industries are reliant upon the growth of the port facilities to significantly increase their import, export and production The master plan should recognise requirements for the placement of dredged material from capital dredging	ISCR (Section 4.2) Addendum to the EB (Part C, Section 3.6)	Enable the ongoing sustainable growth of trade through the Port of Gladstone	Dredging is undertaken where necessary to support the ongoing operation and growth of the Port of Gladstone	Planning – operation of the priority Port of Gladstone and its growth and development Economic – sustainable economic growth of the priority Port of Gladstone and the surrounding region	Not applicable	Yes Other port overlay content – assessment benchmarks – marine infrastructure management code Inclusion of provisions to ensure development does not compromise or adversely affect the undertaking of dredging and associated activities	Provisions in existing planning instruments do not address the requirement to consider future needs to support the undertaking of dredging works and associated activities There are existing statutory assessment processes and approval requirements that address potential environmental impacts of capital dredging
Maintenance dredging Recognition of existing approvals for maintenance dredged material to be placed at sea at the East Banks dredged material placement area (DMPA) Maintenance dredging is essential to the ongoing operation and growth of the port Maintenance dredging is required for shipping channels, berth pockets and swing basins A section outlining long term maintenance dredging requirements should be included in the master plan The master plan should recognise requirements for the placement of dredged material from maintenance dredging	ISCR (Section 4.2) ISCR (Sections 4.2.2, 5.1.1 and 5.1.2.2)	Enable the ongoing sustainable growth of trade through the Port of Gladstone	Dredging is undertaken where necessary to support the ongoing operation and growth of the Port of Gladstone	Planning – operation of the priority Port of Gladstone and its growth and development Economic – sustainable economic growth of the priority Port of Gladstone and the surrounding region	Not applicable	Yes Other port overlay content – assessment benchmarks – marine infrastructure management code Inclusion of provisions relating to the placement of dredged material (from capital and maintenance dredging) and beneficial reuse	The Maintenance Dredging Strategy for Great Barrier Reef World Heritage Area Ports released on 30 November 2016 addresses the maintenance dredging requirements for the priority Port of Gladstone Reference to the Maintenance Dredging Strategy for GBRWHA Ports has been included through the desired outcomes There are existing statutory assessment processes and approval requirements that address potential environmental impacts of maintenance dredging
Beneficial reuse or onshore placement of dredged material Due to prohibitions under the <i>Sustainable Ports Development Act 2015</i> (Ports Act), capital dredged material will need to be beneficially reused within the GBRWHA or placed onshore The master plan should where possible, identify the extent of potential material placement areas for capital dredged material and the long term use of these areas Identification of potential dredged material placement areas considered as part of the GPC Port of Gladstone Gatcombe and Gilding Cutting Channel Duplication Project EIS Dredge Material Placement Options Investigation (DMPOI) Inclusion of additional potential dredged material placement area (Facing Island (West)	ISCR (Sections 4.2.3 and 5.1.1) Addendum to the EB (Part C, Section 3)	Enable the ongoing sustainable growth of trade through the Port of Gladstone Manage the OUV of the GBRWHA Recognise and manage potential impacts on all environmental values, including the natural, social and cultural environments within and surrounding the master planned area	Material generated from dredging is beneficially reused or placed in an appropriate location	Planning – operation of the priority Port of Gladstone and its growth and development Environment – OUV of the GBRWHA and all other environmental values	Not applicable	Yes Other port overlay content – assessment benchmarks – marine infrastructure management code Inclusion of mapping of potential material placement areas which includes existing and potential areas Inclusion of provisions to ensure that the potential material placement areas are appropriately managed to avoid impacts from future development Inclusion of provisions to allow the identification of alternative areas for the placement of dredged material where the material placement areas are determined to be beneficial	Provisions in existing planning instruments do not identify or reflect existing or potential material placement areas Including existing and potential material placement areas within the preliminary draft port overlay provides greater transparency around the requirements for the placement of dredged material which complies with the Ports Act

Evidence base key issue	Evidence base document (section/map number)	Addressed in master plan Objectives	Desired outcomes	State interests	Priority management measures (PMMs)	Addressed in preliminary draft port overlay	Justification
Infrastructure and supply chain Allow existing and potential berths and wharf centres to be maintained and developed to a standard capable of handling the necessary infrastructure and supply chain required to allow industries to continue to operate and grow, or new industries to emerge	IS CRA (Section 4.2.4 and Map 1) Addendum to the EB (Part C, Section 3.4)	Continue to use and develop land and marine infrastructure efficiently Enable the ongoing sustainable growth of trade through the Port of Gladstone	Use of infrastructure is optimised prior to any expansion or development of infrastructure	Planning – operation of the priority Port of Gladstone and its growth and development Economic – sustainable economic growth of the priority Port of Gladstone and the surrounding region	Not applicable	Yes Other port overlay content – assessment benchmarks – marine infrastructure management code Inclusion of mapping of existing and potential port berths and wharf centres as per IS CRA Map 1	Provisions in existing planning instruments do not adequately identify existing and potential berths and wharves Including existing and potential berths and wharves within the preliminary draft port overlay provides greater transparency regarding the need to maintain and develop the necessary infrastructure to support ongoing port operations and growth of the port
Identification of marine infrastructure crossings within the master planned area from the mainland to islands which have existing and/or the potential to be developed for industry (eg bridges for road/rail, submarine pipelines, electricity transmission, distribution lines)	IS CRA (Section 5.1.2,3 and Maps 9, 10 and 11)	Continue to use and develop land and marine infrastructure efficiently	Infrastructure corridors and nodes are protected from encroachment of incompatible uses		Not applicable	Yes Other port overlay content – assessment benchmarks – supply chain infrastructure management code Inclusion of provisions which support the management of areas within and adjoining the draft infrastructure and draft supply chain corridors precinct. The draft infrastructure and supply chain corridors precinct has been defined to include areas for future supply chain infrastructure.	Provisions in existing planning instruments do not identify infrastructure crossings within marine areas Incorporating areas for existing and potential marine infrastructure crossings in master planning provides for necessary planning and management There are existing statutory assessment processes and approval requirements that address potential environmental impacts of infrastructure crossings
Upgrades and additional infrastructure links are required to ensure the port can service industries within the master planned area and sub-regionally, including: <ul style="list-style-type: none"> Port Access Road extension Gladstone SDA link to the Bruce Highway Curtis Island Road and Rail Bridge West Banks island material placement area road and rail link Infrastructure links would provide strong dedicated freight routes that enhance the port's accessibility and allow over-size and over-mass loads that are destined for central Queensland coal and gas fields	IS CRA (Section 4.3) EBR (Section 6.1.11) Addendum to the EB (Part C, Section 4.2)	Enable the ongoing sustainable growth of trade through the Port of Gladstone	Provide for adequate supply chain development, infrastructure, including connections between land and marine areas		Not applicable	Yes Other port overlay content – assessment benchmarks – supply chain infrastructure management code Inclusion of provisions which support the management of areas within and adjoining the draft infrastructure and supply chain corridors precinct. The draft infrastructure and supply chain corridors precinct has been defined to include areas for future supply chain infrastructure.	Provisions in existing planning instruments do not identify corridors for some of the infrastructure links and upgrades that have been determined as being necessary to support growth at the Port of Gladstone over the master plan timeframe
The Office of the Coordinator-General is currently preparing a road infrastructure study for the Gladstone SDA The timing of development in the Gladstone SDA needs to be carefully managed so that the number of development fronts and associated demand for access roads is both reasonable and affordable Potential roadworks within the Gladstone SDA include: <ul style="list-style-type: none"> Upgrade of Landing Road Complete duplication of Gladstone-Mt Larcom Road/Port Curtis Way Second crossing of the Calliope River New Aldoga South Road Intersection of the Bruce Highway and Gladstone-Mt Larcom Road 	EBR (Section 6.2.1)	Enable the ongoing sustainable growth of trade through the Port of Gladstone			Not applicable	Yes Other port overlay content – assessment benchmarks – supply chain infrastructure management code Inclusion of provisions which support the management of areas within and adjoining the draft infrastructure and supply chain corridors precinct. The draft infrastructure and supply chain corridors precinct has been defined to include areas for future supply chain infrastructure.	Provisions in existing planning instruments do not identify corridors for some of the infrastructure links and upgrades that have been determined as being necessary to support growth at the Port of Gladstone over the master plan timeframe

Evidence base key issue	Evidence base document (section/map number)	Addressed in master plan Objectives	Desired outcomes	State interests	Priority management measures (PMMs)	Addressed in preliminary draft port overlay	Justification		
Land uses adjoining and in proximity to infrastructure and services corridors critical to the functioning of the priority Port of Gladstone must be appropriately managed to avoid incompatible development impacting upon the future capacity and functioning of the port supply chain	EBR (Section 11.1)	Facilitate the economic growth of the state and the Gladstone region Enable the ongoing sustainable growth of trade through the Port of Gladstone	Provide for adequate supply chain development infrastructure, including connections between land and marine areas Port and supply chain infrastructure meets the needs of changing user requirements and has capacity to meet market demand Infrastructure corridors and nodes are protected from encroachment of incompatible uses	<p>Planning – operation of the priority Port of Gladstone and its growth and development</p> <p>Economic – sustainable economic growth of the priority Port of Gladstone and the surrounding region</p>	Not applicable	<p>Yes</p> <p>Other port overlay content – assessment benchmarks – supply chain infrastructure management code</p> <p>Inclusion of provisions which support the management of areas within and adjoining the draft infrastructure and supply chain corridors precinct. The draft infrastructure and supply chain corridors precinct has been defined to include areas for future supply chain infrastructure.</p> <p>Inclusion of provisions which require consideration of port optimisation principles for both land and marine based supply chain infrastructure</p>	<p>Whilst existing planning instruments require consideration of potential incompatible land uses adjoining and in proximity to some infrastructure and services corridors, these provisions are not consistently applied to all infrastructure corridor types and do not account for potential infrastructure links and upgrades determined as potentially being necessary to support growth at the Port of Gladstone over the master plan timeframe</p> <p>Provisions in existing planning instruments do not require consideration of port optimisation principles as part of development assessment</p>		
								Protection of and planning for marine and land based infrastructure	IS CRA (Section 6)
								Optimisation of port infrastructure is a specific action of Reer 2050 and needs to be addressed in the master planning for each of the priority ports	Addendum to the EB (Part C, Section 5)
Economic and infrastructure									
The continued attraction of industry with import and/or export requirements is recognised as a strong growth opportunity for the Port of Gladstone. There is significant potential to expand upon existing bulk materials handling at the Port of Gladstone, particularly at Port Central and Fisherman's Landing. Port Central has the potential to accommodate new imports and exports of new or temporary commodities following the winding down of the construction of the LNG facilities on Curtis Island	EBR (Section 11.5) Addendum to EBR (Part C, Section 4 and 5)	Facilitate the economic growth of the state and the Gladstone region Enable the ongoing sustainable growth of trade through the Port of Gladstone	Land and marine areas are available for the development of the port and port related industries Major industries of regional, state, national and global significance are appropriately located Provide economic benefit and employment opportunities for the Gladstone region	<p>Planning – operation of the priority Port of Gladstone and its growth and development</p> <p>Economic – sustainable economic growth of the priority Port of Gladstone and the surrounding region</p>	Not applicable	<p>Yes</p> <p>Other port overlay content – assessment benchmarks – marine infrastructure management code</p> <p>Inclusion of mapping of existing and potential port berths</p> <p>Other port overlay content – assessment benchmarks – supply chain infrastructure management code</p> <p>Inclusion of provisions which require consideration of port optimisation principles for both land and marine based supply chain infrastructure</p>	<p>Provisions in existing planning instruments do not consistently identify existing and potential future berths or require consideration of port optimisation principles to ensure efficient land and marine port operations</p> <p>Including existing and potential port berths and wharves within the port overlay provides greater transparency and certainty regarding the need to maintain and develop the necessary infrastructure to support ongoing port operations as well as potential future port growth</p>		

Evidence base key issue	Evidence base document (section/map number)	Addressed in master plan Objectives	Desired outcomes	State interests	Priority management measures (PMMs)	Addressed in preliminary draft port overlay	Justification
Optimisation of port infrastructure is a specific action of Reef 2050 and needs to be addressed in the master planning for each of the priority ports	Addendum to the EB (Part C, Section 5)	Facilitate the economic growth of the state and the Gladstone region Enable the ongoing sustainable growth of trade through the Port of Gladstone	Use of infrastructure is optimised prior to any expansion or development of infrastructure	Planning – operation of the priority Port of Gladstone and its growth and development Economic – sustainable economic growth of the priority Port of Gladstone and the surrounding region	Not applicable	Yes Other port overlay content – assessment benchmarks – supply chain infrastructure management code Inclusion of provisions which require consideration of port optimisation principles for both land and marine based supply chain infrastructure	Provisions in existing planning instruments do not require proponents to consider port optimisation principles as part of development assessment
Land use interfaces							
In some instances, land use planning instruments do not provide adequate separation distances between incompatible land use interfaces. This is highlighted in the context of the residential interfaces of Barney Point and Gladstone Central with port development.	EBR (Section 11.1)	Maintain quality of life for community in the Gladstone region	Manage potential impacts of development on sensitive uses and areas surrounding the master planned area	Community – wellbeing of the community of the Gladstone region Planning – operation of the priority Port of Gladstone and its growth and development Economic – sustainable economic growth of the priority Port of Gladstone and the surrounding region	Not applicable	Yes Other port overlay content – assessment benchmarks – residential and port industry interface code The draft interface precinct has been expanded to include part of the strategic port land at Barney Point	Provisions in existing planning instruments do not consistently or adequately address interface issues between port industry areas and adjoining residential and sensitive receptors
Increased residential density resulting in an increase in the number of residents living adjacent to existing industrial areas and potential for increase in associated construction and operational impacts	RA (Table 5.6)						
Ensure compatibility in the location and design of future residential development within the draft interface precinct, and give due consideration to the close proximity of existing and future port and industrial development	RA (Section 5.8.4, additional general conclusions)						
Future expansions and new port and industrial developments must be appropriately designed to minimise and/or mitigate potential impacts on residential and other sensitive land uses	RA (Section 5.8.2)						
Cultural heritage							
Potential impacts to Aboriginal cultural heritage sites within the master planned area	EBR (Section 11.4)	Recognise and manage potential impacts on all environmental values, including the natural, social and cultural environments within and surrounding the master planned area	Manage potential impacts of development on cultural heritage values, including listed cultural heritage sites	Community – wellbeing of the community of the Gladstone region	PMM 1 – Aboriginal cultural heritage notification	Yes Operational matters – PMM 1	Inclusion of notification requirements for development applications triggering operational works to ensure consistent: <ul style="list-style-type: none"> Management of cultural heritage across planning and approvals processes within the master planned area Involvement of relevant Aboriginal party/ies in the management of cultural heritage within the master planned area Management of cultural heritage across terrestrial, intertidal and marine areas within the master planned area Education and awareness of cultural heritage management.
Direct impacts on cultural heritage sites during vegetation clearing and land disturbance	RA (Tables 5.6 and 5.7)						
Further consultation with the Gidarjil Cultural Heritage Corporation will need to be undertaken for planned future development activities							
Aboriginal cultural heritage notification	RA (Section 5.8.4 additional general conclusions)	Maintain quality of life for community in the Gladstone region					

Evidence base key issue	Evidence base document (section/map number)	Addressed in master plan		State interests	Priority management measures (PMMs)	Addressed in preliminary draft port overlay	Justification
		Objectives	Desired outcomes				
Community and social The Social Infrastructure Strategic Plan (SISP) and Needs Assessment undertaken for the Gladstone region found that significant investment in social infrastructure would be required to meet the needs of Gladstone's projected population growth to 2031 Maintaining public access to the foreshore and marine areas	EBR (Section 11.3)	Maintain the quality of life for community in the Gladstone region	-	Community – wellbeing of the community of the Gladstone region	Not applicable	No	Provision of planning for social infrastructure is considered outside of the scope of the preliminary draft port overlay and is more appropriately addressed through local, state and regional planning mechanisms
	EBR (Section 6.1.12)	Enhance community use of public space	Provide appropriate public access to waterfront and harbour	Community – wellbeing of the community of the Gladstone region	Not applicable	Yes Other port overlay content – assessment benchmarks – marine infrastructure management code The previously named 'marine precinct' has now been revised and divided into the 'marine precinct' and 'marine infrastructure precinct'	Inclusion of provisions to ensure adverse impacts on public safety or public access and use of the foreshore of the adjoining area are avoided unless it is contrary to the protection of coastal resources or public safety

Table notes:

ISCR: Infrastructure and Supply Chain Requirements Assessment Report (PSA Consulting Australia 2016)

EBR: Evidence Base Report (AECOM 2016)

RA: Risk Assessment (Aurecon 2016)

Addendum to EBR: Addendum to the Evidence Base (Aurecon 2017)



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