Port Curtis and Port Alma Ecosystem Research and Monitoring Program (ERMP)

Document Control

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List of Acronyms

CEO	Chief Executive Officer
DAWE	Department of Agriculture Water and Environment
DCMP	Dredge Construction Management Plan
DoE	Department of Environment
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities
DTRP	Dredge Technical Reference Panel
EIS	Environmental Impact Statement
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EPR	Environmental Performance Report
ERMP	Ecosystem Research and Monitoring Program
ERMPAP	Ecosystem Research and Monitoring Program Advisory Panel
EBSDS	East Banks Sea Disposal Site
FL153	Fisherman's Landing Northern Expansion
GBRMPA	Great Barrier Reef Marine Park Authority
GBRWHA	Great Barrier Reef World Heritage Area
GHHP	Gladstone Healthy Harbour Partnership
GPC	Gladstone Ports Corporation
GSDA	Gladstone State Development Area
HAT	Highest Astronomical Tide
LNG	Liquefied Natural Gas
MNES	Matter of National Environmental Significance
NC Act	*Nature Conservation Act 1992*
NDVI	Normalised Difference Vegetation Index
SDPWO Act	*State Development and Public Works Organisation Act 1971*
SMA	Special Management Area
ToR	Terms of Reference
WBDDP	Western Basin Dredging and Disposal Project
WBRA	Western Basin Reclamation Area
WQMP	Water Quality Management Plan

1. Introduction and Background

1.1 Background

Expansion of the port facilities in the Western Basin was required for the future growth of the Port of Gladstone which is operated by Gladstone Ports Corporation (GPC). These facilities were recognised as a key component of the import and export chain and have and will continue to support further development of emerging industries in the Gladstone region such as Liquefied Natural Gas (LNG). Dredging of the Western Basin, which lies in the northern part of Port Curtis was required in order to provide safe, ongoing and efficient access to existing and proposed port facilities. The dredging activities involved the deepening and widening of existing channels and swing basins and the creation of new channels, swing basins and berth pockets. Stage 1A of dredging started in May 2011 and was completed in September 2013 during which 22.5 million cubic meters of dredge spoil was removed. There is provision for a further dredging of 2.5 Mm^3 under Stages 1A and B of the approval. During proposed Stages, 2, 3 and 4 there will be an additional maximum of 21 million cubic meters of material dredged. The dredge material from Stage 1A was deposited:

- Offshore, at the GPC approved East Banks Sea Disposal Site (EBSDS) and
- Onshore, in the combined Fisherman's Landing Northern Expansion (FL153) and Western Basin Reclamation Area (WBRA), contiguous to the north of the existing Fisherman's Landing reclamation area.

The combined FL153 and WBRA will permit development to meet the import/export and storage needs for industries likely to be established in the Gladstone State Development Area (GSDA) in the future. The Port of Gladstone is within the Great Barrier Reef World Heritage Area (GBRWHA) however, the dredging and reclamation activities do not encroach into State or Commonwealth Marine Parks.

The Coordinator-General declared the Western Basin Dredging and Disposal Project (WBDDP) to be a "significant project for which an Environmental Impact Statement (EIS) was required" under the *State Development and Public Works Organisation Act 1971* (SDPWO Act). The WBDDP EIS followed the assessment and consultation process under the SDPWO Act and was approved by the Coordinator-General on 23 July 2010.

The WBDDP was also determined to be a controlled action under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) on 18 June 2009 (EPBC 2009/4904) and was assessed under the Bilateral Agreement between the State and Commonwealth Governments. The Controlled Action Plan from the Commonwealth Government was received in October 2010 and limits the dredging works for all stages of the project to a total volume of no more than 46 million cubic metres (in situ). Approval for the WBDDP was granted by the Commonwealth Department of Agriculture, Water and Environment (DAWE) (formerly known as the Department of Environment (DoE) and prior to that; Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC)) on the 22 October 2010

Conditions 25 to 36 of the above approval required the development and implementation of a Port Curtis and Port Alma Ecosystem Research and Monitoring Program (ERMP) and the establishment, funding and management of an ERMP Advisory Panel (ERMPAP). The EPBC Act conditions have been varied since their establishment following formal requests from the ERMPAP and GPC. GPC provides secretariat support for the ERMP and ERMPAP and facilitates communications between the ERMPAP members and the DAWE.

It is important to note that both the State and Commonwealth Government Approval conditions for the WBDDP also included the requirement to establish a Dredge Technical Reference Panel (DTRP) to assist in the management of seagrass health, water quality and dredging practices.

1.2 The Ecosystem Research and Monitoring Program (ERMP)

The aim of the ERMP is to meet the Conditions outlined in Appendix 1 of this document. The ERMP is designed to acquire a detailed ecological understanding of the marine environment of Port Curtis and Port Alma that can be used to monitor, manage and/or improve the regional marine environment and to offset potential impacts from the WBDDP on listed threatened and migratory species and values of the GBRWHA and National Heritage Place. The ERMP was developed using a tiered approach (See Appendix 3 for table of projects). The purpose of the initial Tier 1 projects was to review and synthesise existing ecological information for Port Curtis and Port Alma. A key step in this process was to undertake a range of literature reviews on ecological subjects relevant to Port Curtis and Port Alma and identify key information gaps and potential research projects.

The Tier 2 projects form the fundamental core of the ERMP, providing detailed research and monitoring information on the ecology of the region and identifying any potential impacts from the WBDDP on listed threatened and migratory species and values of the GBRWHA and National Heritage Place. Tier 2 projects are also crucial to address the Commonwealth Conditions outlined in Appendix 1.

The ERMP also has the capability to undertake Tier 3 contingency programs for urgent issues that may arise during the lifetime of the ERMP that are not already covered under Tier 2 projects. These Tier 3 projects will be directed towards activities that may need to occur due to both natural and anthropogenic impacts, which will influence (directly or indirectly) the ERMP research.

The boundaries of the ERMP are defined in Appendix 2 and were defined to capture the Port Curtis and Port Alma environments that are relevant to the dredging undertaken during the WBDDP and more importantly, to incorporate the areas utilised by marine megafauna and migratory shorebirds. The coastal boundary is defined to be the Highest Astronomical Tide (HAT) level, and as such includes all intertidal habitats. The boundary encompasses the full range of habitats outlined under ERMP subject matter and are not to be changed without prior consent from the ERMPAP, GPC and other associated Agencies. Should the ERMPAP decide that the area is not a suitable size or shape, detailed written scientific reasoning must be given prior to consideration of changes by GPC, and subsequently the DAWE.

1.2.1 Program Activities

The ERMP region (Port Curtis and Port Alma) contains a range of important nearshore and coastal environments including intertidal and subtidal habitats such as tidal saltmarshes, mangroves, saltpans, mudflats and seagrass meadows. These environments provide important habitats and/or food resources for a range of marine organisms, including EPBC Act listed species such as dugongs, dolphins and turtles. Therefore, improving the current state of knowledge of these animals and their interactions with key habitats and port developments is vital for facilitating adaptive management as the port is developed into the future.

Port Curtis provides important habitat for a relatively small population of dugongs (*Dugong dugon*) with wide use of the region evidenced by observations of dugongs across various sites. In Australia, dugongs are protected as a Migratory Marine species under the EPBC Act and are consequently considered a Matter of

National Environmental Significance (MNES). They are also explicitly listed as a World Heritage Value in the GBRWHA and as Vulnerable under the Queensland *Nature Conservation (Wildlife) Regulation 2006* (under the *Nature Conservation Act 1992* (NC Act)) The seagrass meadows of Port Curtis provide potentially valuable habitat for the dugong population, in particular as connecting habitat between the nationally important dugong populations in Hervey Bay and Shoalwater Bay and dugongs have been tracked traversing between these two bays and from the Gladstone region to Shoalwater Bay. Port Curtis includes a Great Barrier Reef Marine Park Authority (GBRMPA) Special Management Area (SMA) known as a Species Conservation (Dugong Protection) SMA or Dugong Protection SMA. The Rodds Bay Dugong Protection Area (see Appendix 2) is classed as a Zone B, where there are restrictions on the type, size and location of nets, and requirements for attendance at nets.

The Port Curtis and Port Alma regions provide habitat for three species of dolphin (cetacean), mainly the Australian snubfin dolphin (*Orcaella heinsohni*) and the Australian humpback dolphin (*Sousa sahulensis*[1]) and some Indo-Pacific bottlenose dolphins (*Tursiops aduncus*). All dolphin species in Australia are protected and listed as migratory species under the EPBC Act. Australian humpback and snubfin dolphins are also listed as Vulnerable and bottlenose dolphins as Data Deficient under the NC Act. Each species can be found year round in the ERMP region. Australian humpback dolphins occur throughout the entire area specifically in the waters of Port Curtis, with a slightly larger population found in the Keppel Bay/Fitzroy River region. Australian snubfin dolphins are found primarily in the Fitzroy River area and to a lesser extent in Keppel Bay, outside of the ERMP boundary. Indo-Pacific bottlenose dolphins occur primarily off Facing and Curtis Islands, with only rare sightings within Port Curtis.

Seven species of marine turtles are well recognised worldwide, with six species recorded within the ERMP region:

1. Flatback turtle (*Natator depressus*)- Vulnerable, Marine, Migratory
2. Green turtle *(Chelonia mydas*)- Vulnerable, Marine, Migratory
3. Loggerhead turtle (*Caretta caretta*)- Endangered, Marine, Migratory
4. Hawksbill turtle (*Eretmochelys imbricate*)- Vulnerable, Marine, Migratory
5. Olive ridley turtle (*Lepidochelys olivacea*)- Endangered, Marine, Migratory
6. Leatherback turtle (*Dermochelys coriacea*)- Endangered, Marine, Migratory

The flatback turtle, *Natator depressus*, the green turtle, *Chelonia mydas*, the loggerhead turtle, *Caretta caretta*, the hawksbill turtle, *Eretmochelys imbricata*, the olive ridley turtle, *Lepidochelys olivacea* and the leatherback turtle, *Dermochelys coriacea*. Green turtles are the most common species of turtle found in the ERMP region and utilise the area for feeding. They are listed as Vulnerable under the NC Act and the EPBC Act, and prefer a diet of seagrass, algae and mangrove fruits. While green turtles have been recorded nesting within the ERMP region, they prefer the offshore islands of the Great Barrier Reef. The front beach near South End on Curtis Island supports a medium density nesting population of the flatback turtle, a species of turtle found only in Australian waters. Between 30 and 100 females nest on South End, annually. This species is also known to nest at other beaches in the region including Facing Island and Tannum Sands. This species is listed as Vulnerable under the NC and EPBC Acts and prefers offshore coastal waters over the continental shelf where they feed on soft-bodied species such as sea pens, soft corals and sea cucumbers.

Each year, thousands of shorebirds migrate from their breeding grounds in Arctic Russia and Alaska to the coastlines of the ERMP region. The birds feed during the summer months here in Australia before heading

[1] The Australian humpback dolphin was previously known as the Indo-Pacific humpback dolphin (*Sousa chinensis*)

back north to breed again. Consequently, Australia's coastal habitats (low intertidal flats, sand bars, mangroves, tidal saltmarshes, beaches and lagoons) are critically important for maintaining healthy populations of migratory shorebirds.

Port Curtis is home to approximately 12040 ha of seagrass that is found in subtidal, intertidal and deep habitats up to 18 m. Six species of seagrass comprise these monospecific or mixed beds, *Zostera muelleri* subsp. *capricorni*[2] (referred to as *Z. muelleri* for remainder of document), *Halophila ovalis*, *H. decipiens*, *H. spinulosa*, *Halodule uninervis* and *Cymodocea rotundata*. The different species have specific habitat and lighting requirements with Halophila species requiring less light and are able to grow in shallow habitats, intertidal habitats or at greater depths while *Z. muelleri* and *H. uninervis* have the highest light requirements. The majority of seagrass research undertaken in Port Curtis has focused on the most common intertidal species, *Z. muelleri*, *H. uninervis* and *H. ovalis*.

There are over 100,000 ha of intertidal wetlands in the ERMP region, with much of this recognised as nationally significant. The bioregion supports the second largest area of mangroves, tidal saltmarsh and saltflat habitats in Queensland, which contain more than 40 saltmarsh species, accounting for ~18% of the Curtis Coast's intertidal area. Some of the most extensive wetlands are found at The Narrows, South Trees Inlet, Colosseum Creek and the Fitzroy River estuary. Mangroves cover ~30% of the bioregion's intertidal area where *Rhizophora* mangroves are the most abundant communities, with *Avicennia* and *Ceriops* mangrove communities also common. Out of the 41 mangrove species found in Australia, 23 species are found in Central Queensland, and 15 species have been recorded in the Port Curtis and Port Alma regions. These ecosystems provide important habitat for many significant fauna species.

See Appendix 3 for a list of projects that have been developed by the ERMPAP (see below), for the significant habitats and species outlined above, to meet the conditions of the ERMP and gain a greater understanding of the environs of Port Curtis and Port Alma. This will also provide a greater understanding of any potential impact/s on them from, not only activities of the Port of Gladstone, but other anthropogenic and natural events that can affect them throughout their distribution.

Note: Management of the seagrass monitoring and research was being overseen by the DTRP for the duration of the dredging program with reports being submitted to the ERMPAP for information.

1.2.2 Ecosystem Research and Monitoring Program Advisory Panel

To achieve the conditioned requirements of the ERMP, an advisory panel was established and it is formally known as the ERMPAP.

The ERMPAP consists of six (6) members, an Independent chair and five (5) independent scientific experts in dugongs, inshore dolphins, marine reptiles, migratory shorebirds and tropical marine ecology.

These ERMPAP members have been chosen by GPC and approved by the DAWE.

The Terms of Reference (ToR) for the ERMPAP including the roles, membership and governance of the panel are outlined in a separate document.

[2] Revision of *Zostera capricorni* has resulted in classification to subspecies. In Queensland, *Zostera capricorni* has been revised to *Zostera muelleri* subsp. *capricorni*

2. Reporting

According to Condition 35 pertaining to the ERMP, GPC "must make the findings, including related data, of any or all of these studies publicly available upon request by any interested parties". All substantive reports will be made available on the ERMP webpage of GPC's website once the ERMPAP has exercised its governance commitments by reviewing and approving the final outputs of the projects, and GPC are satisfied the outputs have met all commercial requirements. Any data resulting from ERMP research and monitoring will be made available upon request, following GPC's data request procedures, and only once the ERMPAP has completed its approval process. The availability of such data may be subject to contractual terms, the nature and scale of the research and the service provider given the opportunity to publish the findings of the research and monitoring.

The ERMPAP will monitor and review the outcomes of the research and monitoring program and make recommendations to GPC on adaptive management responses related to these outcomes; this will usually be done via the Chair's Letter from the ERMPAP to GPC following each ERMPAP meeting. Any ERMPAP recommendations will be captured in formal correspondence from GPC to DAWE and will include supporting evidence about why recommendations were not followed or how recommendations were implemented. It should be noted that some of these recommendations will be of a broad nature addressing the port and regional geo-spatial area, including industries and private/governmental areas of responsibility not within the ambit or control of GPC. Such recommendations and their supporting science will be made known to other stakeholders including, for example, the Gladstone Healthy Harbour Partnership (GHHP).

GPC is conditioned (Condition 37) to submit an annual Environmental Performance Report (EPR) to the Minister. The EPR will specifically include a summary of ERMP activity for:

a) Dolphins, dugongs and marine turtles, and other megafauna;

b) Migratory shorebirds; and

c) Seagrass.

Further to this, the performance and money spent under the marine megafauna and shorebirds studies of the ERMP is included in a compliance report submitted annually to the Minister.

3. Public Involvement

Due to the high profile nature of the WBDDP, the ERMP will endeavour to foster greater understanding of the project and of the Port Curtis and Port Alma ecosystems in which it will operate. This will be achieved through a number of initiatives such as the development of the ERMP website which will be accessed from the GPC home page and community volunteers becoming involved in monitoring and research programs such as mangrove studies and community based turtle monitoring.

Appendix 1. Commonwealth Conditions

Current Approved Conditions

Research Advisory Panel

Condition 25 The person taking the action must establish, fund and manage a research advisory panel. The research advisory panel must be established according to the following requirements:

a) the research advisory panel must be established prior to and for the duration of the Ecosystem Research and Monitoring Program (ERMP) as described at condition 27, to assist in the design and ongoing review of the ERMP such that the research is relevant and incorporated into the adaptive management of the Western Basin Strategic Dredging and Disposal Project;

b) the members of the research advisory panel must include independent scientific experts of whom at least one must be a scientist with expertise in inshore dolphins, one a scientist with expertise in marine reptiles, one a scientist with expertise in migratory shorebirds and one a scientist with expertise in tropical marine ecology;

c) the membership of the research advisory panel must be approved by the Minister in writing prior to the completion and submission of the Ecosystem Research and Monitoring Program to the Minister for approval; and

d) the terms of reference for the research advisory panel, which must include the frequency of proposed meetings, chairing and quorum arrangements, must be developed by the Panel at its inception and must be approved by the Minister in writing prior to the submission of the ERMP to the Minister for approval.

Condition 26 The person taking the action must provide to the Minister, a copy of all the recommendations made by the research advisory panel and an explanation of how these recommendations have, or will be, implemented. This information must be provided to the Minister within one month of receiving advice from the research advisory panel or within any timeframe recommended by the research advisory panel, should this be less than one month.

Ecosystem Research and Monitoring Program

Condition 27 The person taking the action must develop and implement an Ecosystem Research and Monitoring Program (ERMP) to acquire a detailed ecological understanding of the marine environment of Port Curtis and Port Alma that can be used to monitor, manage and/or improve the regional marine environment and to offset potential impacts from the project on listed threatened and migratory species and values of the Great Barrier Reef World Heritage Area and National Heritage Place.

Condition 28 The ERMP must be submitted to the Department for approval no later than six months from the date of this approval.

Condition 29 After twelve months from the date of this approval the person taking the action must not undertake any dredging activities, land reclamation or construction activities unless the Minister has approved the ERMP in writing.

Condition 30 The ERMP must be implemented for a period of no less than ten years from the date of the Department's initial approval of the ERMP.

Condition 31 The results of the ERMP must be used to inform an adaptive management response to observed impacts or potential impacts identified.

Condition 32 The ERMP must be reviewed and revised (if appropriate) and submitted to the Minister on an

annual basis, or at such other time as might be as otherwise agreed by the Minister from the date of the Department's initial approval for the duration of the ERMP.

Condition 33 The ERMP must include but not be limited to, the following:

Marine Megafauna

a) Conditions 33(b) to (e) below must be undertaken for EPBC Act listed threatened and migratory species, including dugong, turtles and dolphins and other species as relevant to the values of the Great Barrier Reef World Heritage Area and National Heritage Place.

b) Determine measurable population characteristics for key species before the start of dredging and develop appropriate indicators to monitor population changes, especially those associated with dredging project.

c) Monitor the effects of project-related activities including, but not limited to: dredge vessel movement; pile driving; construction dredging; bund wall construction during dredging; construction of the bund wall; and filling of the reclamation area with reference to matters including: noise and, where relevant, associated pressure impacts; light spill; water quality reduction; decreased access to intertidal foreshore habitat; increased sedimentation; displacement.

d) Identify potentially suitable habitats for key megafauna in the region at an ecological scale appropriate for megafauna species.

e) Determine the utilisation and significance of The Narrows for megafauna, and what effects the project may have on utilisation of this area.

f) The person taking the action must fund activities (conditions 33(a) – (e) above) to an amount of no less than $5 million for the duration of the ERMP, expenditure of which is to be detailed in the Compliance report required annually under condition 46 of this approval.

Migratory Shorebirds

g) Comprehensive surveys of Port Curtis and Port Alma before the start of dredging including: population censuses of species present, mapping of feeding and roosting sites, investigation of habitat utilisation relative to the lunar/tide cycles and season, and identification of critical characteristics of important habitat.

h) A minimum of two years of surveys, including two surveys in the December-February period, single surveys during both the northward and southward migration periods and a minimum of one survey during winter (May-August).

i) Single, annual summer surveys (October-March) covering the major high tide roost sites from years three to eight, with a repeat of the comprehensive surveys during years nine and ten.

j) Monitoring the effect of those port development activities potentially affecting migratory shorebirds, including but not limited to: dredge vessel movement; pile driving; construction dredging; bund wall construction during dredging; construction of the bund wall; and filling of the reclamation area and will address matters including noise impacts; light spill; water quality reduction; decreased access to intertidal foreshore habitat; increased sedimentation; displacement.

k) The person taking the action must fund activities (conditions 33(g) to (j) above) to an amount of no less than $2 million for the duration of the ERMP, expenditure of which is to be detailed in the Compliance report required annually under condition 46 of this approval.

Seagrass

l) Annual long term seagrass monitoring surveys of seagrass distribution and abundance in the Western Basin and Port Curtis.

m) Monitor survival and recovery of seagrass and other marine communities in the project area during the construction period and for a minimum of five years following completion of dredging.

Reporting

Condition 34 The person taking the action must publish the ERMP on their website within two weeks of approval in writing by the Department.

Condition 35 The person taking the action must make the findings, including related data, of any or all of these studies publicly available upon request by an interested parties.

Condition 36 The person taking the action must submit to the Minister an annual Environmental Performance Report covering the following topics: Dolphins, dugongs and marine turtles, and other megafauna; Migratory shorebirds and Seagrass.

Condition 37 12 months from the date of approval, a report must be submitted outlining the initial environmental activities for the 12 month period. The report is to be called the Environmental Performance Report and must be submitted within 42 days of the 12 month activity period. The Environmental Performance Report must include proposed environmental management improvements to be implemented through the DCMP, WQMP and other Plans as relevant. Reports are required annually from thereafter.

Conditions – Other

Condition 46 Each year the person taking the action must provide a report to the Minister addressing compliance with each of the conditions of this approval. The date of the first compliance report must be within 42 days after the initial twelve months of the date of approval with each subsequent report 12 months from date of the previous report. The Compliance report must:

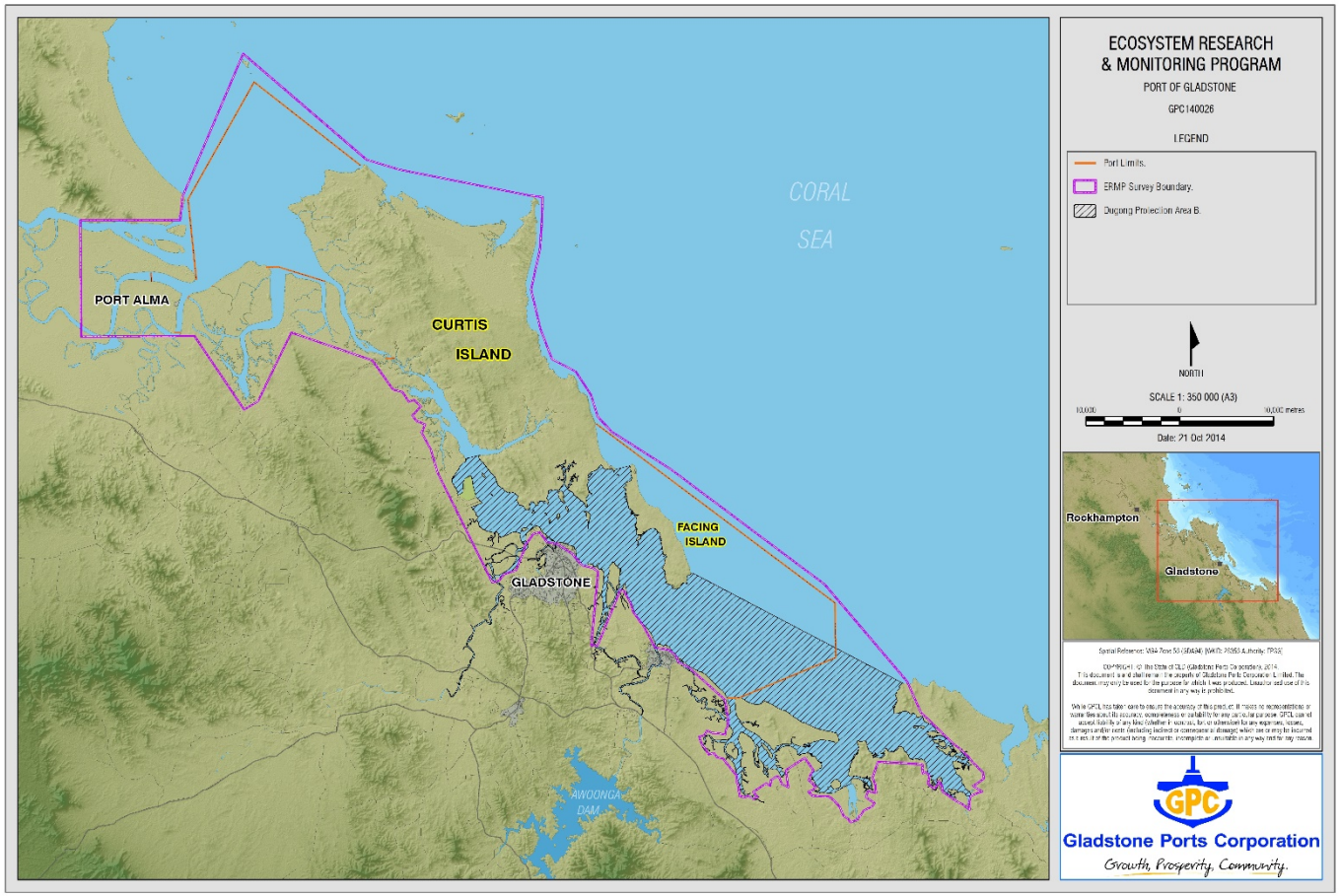
a) be endorsed by the CEO of GPC or a person approved in writing by the Department, delegated to sign on behalf of the CEO or the person taking the action;

b) include a statement as to whether the person taking the action has complied with the conditions;

c) identify any non-compliance and describe corrective and preventative actions taken; and

d) make the compliance report publicly available on the internet within 30 days of it being submitted to the minister.

Appendix 2. Geographical boundary of the ERMP



Appendix 3. ERMP Projects[3]

Relevant Condition/s	Project Tier	Subject Matter	Project Title	Project Strategy/Objective
27, 33(a) to (f)	1	Marine megafauna – Inshore dolphins	Review of coastal dolphins in Central Queensland, particularly Port Curtis and Port Alma regions	Conduct a review and gap analysis of existing data and projects pertaining to dolphins in Central Queensland, particularly Port Curtis and Port Alma. Develop a publicly available website with access to photographic identification data of dolphins in Port Curtis and Port Alma.
27, 33(a) to (f)	1	Marine megafauna – Dugongs	Status of the dugong population in the Gladstone area: gap analysis	Conduct a review and gap analysis of existing data and projects pertaining to coastal sea turtles in Central Queensland, particularly Port Curtis and Port Alma.
27, 33(a) to (f)	1	Marine Megafauna – Turtles	Monitoring of coastal sea turtles: gap analysis. a) Loggerhead turtles, *Caretta caretta*, in the Port Curtis and Port Alma region b) Green turtles, *Chelonia mydas*, in the Port Curtis and Port Alma region c) Hawksbill turtle, *Eretmochelys imbricata*, in the Port Curtis and Port Alma region d) Olive Ridley turtle, *Lepidochelys olivacea*, in the Port Curtis and Port Alma region e) Flatback turtles, *Natator depressus*, in the Port Curtis and Port Alma region f) Leatherback turtle, *Dermochelys coreacea*, in the Port Curtis and Port Alma region	Conduct a review and gap analysis of existing data and projects pertaining to coastal sea turtles in Central Queensland, particularly Port Curtis and Port Alma.
27, 33(g) to (k)	1	Migratory shorebirds	Migratory shorebird monitoring review: gap analysis	Conduct a review and gap analysis of existing data and projects pertaining to migratory shorebirds in Central Queensland, particularly Port Curtis and Port Alma.
27, 33(d), (m)	1	Habitats – Tidal wetlands (mangroves, saltmarshes, saltpans)	Mangrove and saltmarsh monitoring: Literature review	Conduct a review and gap analysis of existing data and projects pertaining to mangroves and saltmarshes in Central Queensland, particularly Port Curtis and Port Alma.

[3] This list of projects is current from the date of the approval of this program byDAWE. Any minor changes to this program or the development of Tier 3 programs will be reported on the ERMP webpage or in the Annual Environmental Performance Reports Any substantive changes to projects will be submitted in a revised ERMP and require DAWE approval.

Relevant Condition/s	Project Tier	Subject Matter	Project Title	Project Strategy/Objective
27, 33(d), (m)	1	Habitats – Seagrass	Research, monitoring and management of seagrass ecosystems adjacent to port developments in Central Queensland: literature review and gap analysis	Conduct a review and gap analysis of existing data and projects pertaining to seagrass in Central Queensland, particularly Port Curtis and Port Alma.
27, 33(d), (m)	1	Habitats – Corals and associated benthos	Central Queensland corals and associated benthos: monitoring review and gap analysis	Conduct a review and gap analysis of existing data and projects pertaining to corals and associated benthos in Central Queensland, particularly Port Curtis and Port Alma.
27	1	Habitats – Water Quality	Review of water quality studies: gap analysis	Conduct a review and gap analysis of existing data and projects pertaining to water quality studies in Central Queensland, particularly Port Curtis and Port Alma.
27, 33(a) to (f)	2	Marine megafauna – ALL	Report for marine megafauna and acoustic monitoring[4] 1. Summer survey June 2011 2. Autumn survey August 2011	Collect baseline information on marine megafauna in Port Curtis and Port Alma. Record background ambient noise measurements to develop an understanding of potential noise impacts on marine megafauna species.
27, 33(c)	2	Marine megafauna – ALL	Monitoring aquatic ambient noise and associated pressure impacts in Port Curtis and Port Alma[5]	Record underwater noise when dredges are in operation and after completion of dredging.
27, 33(c)	3	Marine megafauna	Assessing the impact of dredging operations on megafauna in the Port of Gladstone	Study to identify changes to the population and behaviour of key mega-fauna species in the Port of Gladstone during capital dredging operations. The significant marine megafauna species that have the potential to be impacted by capital dredging activities include: • Green turtle (listed as vulnerable, migratory marine and listed marine under the EPBC Act, and vulnerable under the Nature Conservations Act) • Loggerhead turtle (listed as endangered, migratory marine and listed marine under the EPBC Act, and endangered under the NC Act) • Flatback turtle (listed as vulnerable, migratory marine and listed marine under the EPBC Act, and vulnerable under the NC Act) • Dugong (listed as migratory marine and listed marine under the EPBC Act, and vulnerable under the NC Act) • Australian humpback dolphin and Australian snubfin dolphin (listed as migratory marine under the EPBC Act, and vulnerable under the NC Act)
27, 33(a) to (f)	2	Marine megafauna – Inshore dolphins	Increase understanding of the status of Australian snubfin and Australian humpback dolphins within Port Curtis and Port Alma	Photo-identification repeated surveys including population genetics using mitochondrial and nuclear markers, toxicology analyses of trace and heavy

[4] These surveys were contracted prior to the establishment and DoE approval of the ERMP, the ERMPAP and the ERMPAP ToR. They were not developed and approved in accordance to current approved procedures for undertaking ERMP projects.

[5] While these works were implemented to meet condition 33c, they were done externally to current approved procedures for undertaking ERMP projects

Relevant Condition/s	Project Tier	Subject Matter	Project Title	Project Strategy/Objective
				metals, metalloids and persistent organic pollutants and stable isotope analyses to obtain information on the diets of these species.
27, 33(a) to (f)	3	Marine megafauna – Inshore dolphins	A desktop study to advise on the research to estimate the health impacts of organochlorines and heavy metals in humpback dolphins in Port Curtis	The objective of this desktop study was to understand how further toxicological analysis could be conducted to improve the interpretation of effects of the contaminants (organochlorines and heavy metals) on the health status of the Australian humpback and Australian snubfin dolphins in Port Curtis, Port Alma and Rodds Bay survey areas.
27, 33(a) to (f)	3	Marine megafauna – Inshore dolphins	Assessment of Toxicological Status of Humpback and Snubfin dolphins in the Port Curtis and Port Alma	Dolphin-specific cell-based toxicity bioassays will be used to assess the effects of Persistent Organic Pollutants and heavy metals in humpback and snubfin dolphins. Skin biopsies collected from humpback and snubfin dolphins in Port Curtis and Port Alma will be used to establish primary cell cultures using documented methods. The analysis of the biopsy extracts will identify the toxic effects of the chemical mixtures currently present in these dolphin populations. This will also identify whether there are differences in toxicity between species living in the same location (Port Alma) and/or between locations for the same species (humpback dolphins).
27, 33(a) to (f)	3	Marine megafauna – Inshore dolphins	Monitoring of Australian humpback dolphins at Agnes Water to investigate distribution and movement patterns adjacent to the Gladstone Ports Corporation ERMP study area	As a migratory species under the EPBC and a Vulnerable species in Queensland, the Australian humpback dolphin populations in the Port of Gladstone have been an important component of the ERMP. The project aims to provide baseline information on the movements, habitat, abundance and distribution of Australian humpback dolphins at a site only 20 km from the Port of Gladstone and only 10 km from the boundary of the ERMP survey region. Understanding movements and connectivity of humpback dolphins between the ERMP region and adjacent areas is fundamental to interpreting and predicting the impacts of local disturbances.
27, 33(a) to (f)	2	Marine megafauna – Dugong	Identify potentially suitable habitats for dugongs in the Port Curtis and Port Alma region and determine any temporal changes in their utilisation of these habitats	1. GPS/Acoustic tagging of dugong on opportunistic basis in association with tagging of green turtles. 2. Monitoring of dugong feeding trails in association with low tide helicopter surveys of seagrass.
27, 33(a) to (f)	3	Marine megafauna – Dugong	Study on the cause and health condition of beached dugong	Investigation into the health condition and possible cause of death of a beached dugong, sighted on 19 September 2019,
27, 33(a) to (f)	2	Marine megafauna – Turtles - Foraging	Increase understanding of green turtle habitat usage in the Port Curtis and Port Alma region: using satellite telemetry	Deploy satellite tags on green turtles and examine the movement, behaviour and habitat use in the Port Curtis and Port Alma regions to increase the understanding of green turtle use of marine habitats in the ERMP region.

Relevant Condition/s	Project Tier	Subject Matter	Project Title	Project Strategy/Objective
27, 33(a) to (f)	2	Marine megafauna –Turtles - Foraging	Determine the composition by size, sex, growth rates, survivorship, recruitment, and general health of the green turtle population in Port Curtis	a) Undertake an annual mark-recapture study spanning a minimum of four years at multiple sites within the region, including at least: 1. Rodeo captures, beach jumping, netting or other appropriate methods at Pelican Banks and the Boyne River Estuary; 2. Opportunistic tunnel netting at multiple sites within the Narrows and within the Western Basin of Port Curtis where environmental conditions such as turbidity restricts the effective use of rodeo capturing of turtles. b) Using best practice analyses to interpret these data in the context of data collected in Port Curtis and at other sites in Queensland by EHP, to inform the ongoing assessment and management of impacts on marine turtles in Port Curtis.
27, 33(a) to (f)	2	Marine megafauna –Turtles - Nesting	Increase understanding of flatback turtle habitat usage in the Port Curtis and Port Alma region: using satellite telemetry	Deploy satellite tags on flatback turtles and examine the movement, behaviour and habitat use in the Port Curtis and Port Alma regions to increase the understanding of flatback turtle use of marine habitats in the ERMP region.
27, 33(a) to (f)	2	Marine megafauna - Turtles - Nesting	Monitor marine turtle nesting populations on index beaches in the Port Curtis and Port Alma region and surrounds	Annual tagging-recapture census of the marine turtle nesting populations on Curtis, Peak and Avoid Islands including 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. Quantification of demographic parameters for hatchling production including habitat specific incubation success, hatchling emergence success and hatchling mortality while crossing the beach and sources of mortality.
27, 33(a) to (f)	2	Marine megafauna - Turtles - Nesting	Monitor marine turtle nesting populations on index beaches in the Port Curtis and Port Alma region and surrounds	Annual tagging-recapture census of the marine turtle nesting populations on Curtis, Peak and Wild Duck Islands including 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. Quantification of demographic parameters for hatchling production including habitat specific incubation success, hatchling emergence success and hatchling mortality while crossing the beach and sources of mortality.
27, 33(c)	2	Marine megafauna –Turtles - Light	Monitor the impacts of coastal lighting on marine turtle populations in the Port Curtis and Port Alma regions	Monitoring to determine light levels including characterisation of specific light sources, visual image of low level light pollution (including glow) as distinguishable from ambient light, isophote image of light pollution (including

Relevant Condition/s	Project Tier	Subject Matter	Project Title	Project Strategy/Objective
				glow) as associated with coastal development along the Gladstone-Yeppoon coast.
27, 33(c)	2	Marine megafauna –Turtles - Light	Marine turtle hatchling orientation monitoring program	Monitor the impact of artificial light on the orientation of hatchlings in selected nesting beaches within the ERMP region.
27, 33(g) to (k)	2	Migratory shorebirds	Migratory shorebird monitoring: Shorebird surveys	Identify changes in the abundances and distribution of shorebirds over 10 years by undertaking the conditioned surveys over that time.
27, 33(j) and (k)	2	Migratory shorebirds	Migratory shorebird monitoring: Understanding ecological impact	Determine the capacity of the study area to support migratory shorebirds and determine the size of the potentially impacted population.
27, 33(j) and (k)	3	Migratory shorebirds	Migratory Shorebird Monitoring: Correlates of Changing Shorebird Numbers	Design and conduct an analysis to determine how changing environmental conditions are related to the changing abundances and distributions of migratory shorebirds within the study area over the data collection period (2011 to 2020), involving (i) distinguishing local drivers of change (those operating within the ERMP region) from remote drivers (those operating outside the region, including overseas), and (ii) determining which drivers best explain changing numbers. This desk top study will also address the requirements specific to condition 33j.
27, 33(j) and (k)	3	Migratory shorebirds	Assessing the impact of Reclamation Activities on Migratory Shorebirds at the Western Basin Reclamation Area	Assess the impact of bund filling activities on the number of shorebirds in the Western Basin Reclamation Area (WBRA). The project will involve counting of migratory shorebirds in the WBRA over the high tide period on an approximately fortnightly basis from December 2019 to December 2020. The study will follow established methods for documenting shorebird numbers including recording key project related activities (eg. filling of reclamation area, truck locations etc) during the monitoring period.
27, 33(m)	2	Habitats – Seagrass	Port Curtis/Western Basin seagrass monitoring – seed bank density and viability studies	Monitor changes in the density of *Z. muelleri* seed banks during the pre-dredging, dredging and post-dredging phases of the WBDDP. Monitor changes in the proportion of viable *Z. muelleri* seeds in the seed bank before and after the growing season during the post-dredging phase of the WBDDP. Conduct field experiments to investigate the effects of time, site and sediment characteristics on the persistence of the *Z. muelleri* seed bank.
27, 33(d), (f) and (m)	2	Habitats – Tidal wetlands (mangroves/saltmarsh/ saltpans)	Monitoring the survival and recovery of shorelines, specifically tidal wetlands (mangroves/saltmarsh/saltpans)	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

Relevant Condition/s	Project Tier	Subject Matter	Project Title	Project Strategy/Objective
				Public access and data entry portal for display of current and past mapping.
27, 31, 33(a-m)	2	ALL – Marine megafauna, migratory shorebirds and habitats	ERMP Synthesis Report	A report synthesising findings and outcomes of the ERMP that can be used to identify any potential impacts and inform adaptive management responses to these.
27, 33(a) to (m)	3	ALL – Marine megafauna, migratory shorebirds and habitats	Contingency funds	Provide funding to relevant projects that have not been foreseen as part of the ERMP but will assist in further meeting the conditions of the ERMP in gaining a better understanding of the ecology of the Port Curtis and Port Alma ecosystems.