1 ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ASSESSMENT REPORT: ADDITIONAL INFORMATION

1.1 INTRODUCTION

Volume 13 of the Queensland Curtis LNG (QCLNG) Project draft environmental impact statement (EIS) provided a stand-alone Environment Protection and Biodiversity Conservation (EPBC) Assessment Report, which addressed the requirements of *Section 1.9* of the EIS joint terms of reference (ToR) prepared by the Queensland Co-ordinator General and Commonwealth Government. It also addressed issues relevant to the controlling provisions for the nine referrals that were submitted to the Commonwealth Department of Environment, Water, Heritage and the Arts (DEWHA) for the Queensland Curtis LNG (QCLNG) Project.

This supplementary EIS volume updates and provides further information to the EPBC Assessment Report in the light of the continued evolution of the Project design since publication of the EIS, and the availability of additional information regarding potential impacts to Matters of National Environmental Significance (MNES).

As with the draft EIS, this update to the EPBC Assessment Report should be read in conjunction with the following sEIS volumes and chapters;

- *Gas Field Component: Volume 1 Chapter 5, Volume 2 Chapter 4,Volume 3, Chapters 7* and *8*
- *Pipeline Component: Volume 1 Chapter 5, Volume 2, Chapter 4, Volume 4 Chapters 7* and *8*
- *LNG Marine Facilities Component: Volume 1 Chapter 5, Volume 2 Chapter 4, Volume 5 Chapters 7, 8, 11* and *16, and Volume 6 Chapter 1 and 2*
- *LNG Plant and Onshore Facilities: Volume 1 Chapter 5, Volume 2 Chapter 4, Volume 5 Chapters 7, 8, 11* and *16 Volume 5 Chapters 7, 8* and *16*
- *Shipping Activity Volume 1 Chapter 5, Volume 2 Chapter 4, Volume 5 Chapters 7, 8, 11* and *15.*

2 EPBC ACT REFERRALS

2.1 BACKGROUND

On 8 August 2008, BG International Limited (BGIL) and Queensland Gas Company Limited (QGC) lodged nine separate EPBC referrals with DEWHA for the following actions proposed for, and in support of, the QCLNG Project[1]:

- *EPBC 2008/4398 – CSG Field*
- *EPBC 2008/4399 – Gas Pipeline Network*
- *EPBC 2008/4400 – Curtis Island Bridge*
- *EPBC 2008/4401 – LNG Marine Facilities*
- *EPBC 2008/4402 – LNG Plant and Associated Onshore Facilities*
- *EPBC 2008/4403 – Mainland Road and Bridge Approach*
- *EPBC 2008/4404 – Curtis Island Road*
- *EPBC 2008/4405 – Shipping Activities*
- *EPBC 2008/4406 – Swing Basin and Channel Dredging*

On 15 September 2008, all nine EPBC referrals were declared "controlled actions" under the Australian Government's *EPBC Act,* as they may have a significant impact on MNES.

Subsequent to the submission of the nine referrals, further studies by QGC determined that the preferred method for transporting personnel, materials, equipment and waste to and from the LNG Facility on Curtis Island is via marine transport from Gladstone. The reasons for this are discussed in the EIS in *Volume 2, Chapter 9*. As such, the development of the Curtis Island Bridge, Mainland Road and Bridge Approach and Curtis Island Road is no longer QGC's preferred method, and the following three referrals were therefore withdrawn on 31 July 2009:

- *EPBC 2008/4400 – Curtis Island Bridge*
- *EPBC 2008/4403 – Mainland Road and Bridge Approach*
- *EPBC 2008/4404 – Curtis Island Road*

In addition, regarding *EPBC 2008/4406, Swing Basin and Channel Dredging*, potential impacts to matters of MNES have not been assessed within the QCLNG sEIS or this EPBC Assessment Report, because these infrastructure components have been addressed in Gladstone Ports Corporation's EIS for the WBDD project. As such, further consideration of the assessment for the works identified in *EPBC 2008/4406* will be undertaken by the appropriate party at the conclusion of discussions with GPC.

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1 Referrals for each action along with the accompanying *EPBC Act* Protected Matters Reports are available on the DEWHA website: http://www.environment.gov.au/epbc/assessments/refer.html

In the meantime, no decision either way is sought by QGC in relation to referral *EPBC 2008/4406* i.e., it would remain in abeyance for the time being. The GPC however will seek approval pursuant to its referral for the WBDD project which includes work contemplated by referral *EPBC 2008/4406* as well as other work.

2.2 *RELEVANT CONTROLLING PROVISIONS*

The controlling provisions for the remaining referrals are listed below.

For referrals 2008/4399, 2008/4401, 2008/4402, 2008/4405:

- World Heritage (sections 12 & 15A)
- National Heritage Places (sections 15B & 15C0)
- Listed Threatened species and communities (sections 18 & 18A)
- Listed Migratory species (sections 20 & 20A)

For referral 2008/4398:

- Listed Threatened species and communities (sections 18 and 18A)
- Listed Migratory species (sections 20 & 20A)

For referral 2008/4406:

- World Heritage (sections 12 & 15A)
- National Heritage places (sections 15B & 15C)
- Listed Threatened species and communities (sections 18 & 18A)
- Listed Migratory species (sections 20 & 20A)
- Commonwealth Marine (sections 23 & 24A)

2.3 *EPBC REFERRAL AND SUMMARY OF CONTROLLED ACTIONS*

Table 13.2.1 sets out the six referrals for the Project that remain for consideration by DEWHA pursuant to this EIS, along with a brief description of the action and the MNES that may be significantly impacted on, and cross-references to MNES in the sEIS.

Table 13.2.1 Summary of EPBC Act Referrals, Identified MNES and Changes from EIS

Referral No.	Project Component/ Referral Name	Summary Description and Action Referred	Comments / Inclusions and Exclusions	Controlling Provisions	Key Change from Draft EIS	QCLNG sEIS cross-reference to MNES[2]
EPBC 2008/4398	**Gas Field Component** **BG Group and QGC energy generation and supply (non-renewable)/Surat Basin/QLD/development of existing coal seam gas fields.**	Expansion of the QGC-operated CSG fields in the Surat Basin to supply gas for the QCLNG Project.	Includes development, production, decommissioning and associated activities (e.g. water management). Does not include existing QGC exploration and production activities relating to ongoing CSG commercialisation programs and for existing contracted gas supplies.	Listed threatened species and communities (*Sections 18 & 18A*) Listed migratory species (*Sections 20 & 20A*).	420 ha of borrow pits required Gathering-line easement increased from 3,750 ha to 15,600 ha Trunkline easements decreased from 3,600 ha to 1600 ha Collection lateral easement 400 ha removed from Project Introduction of electrification of gas processing facilities and associated infrastructure Increase in field compression station (FCS) footprint from 130 ha to 430 ha Ponds increased from 550 ha to 665 ha Access tracks increased from 800 ha to 1,600 ha.	*Vol 1 Ch 5 s.5.2* *Vol 2 Ch 3, Ch 4 s.4.1, Ch 7 s.7.3-7.4, Ch 11 s.11.2-11.3, Ch 15* *Vol 3, Ch 7, and Ch 8*

2 Includes Appendices referenced in these volumes and chapters

Referral No.	Project Component/ Referral Name	Summary Description and Action Referred	Comments / Inclusions and Exclusions	Controlling Provisions	Key Change from Draft EIS	QCLNG sEIS cross-reference to MNES[2]
EPBC 2008/4399	**Pipeline Component** **BG Group and QGC energy generation and supply (non-renewable)/Miles to Gladstone, 380 km (extending to Tara and Fairview)/QLD/QCLNG - Pipeline network.**	Development, construction, operation and decommissioning of a Pipeline network of approximately 800 km to link CSG fields in the Surat Basin to the proposed QCLNG Plant on Curtis Island, adjacent to Gladstone. Pipeline network will include: • Main Pipeline (gas)[3] • Collection Lateral(s) (gas) Interconnection Network (gas and water)[4].	Does not include existing QGC field pipelines under development now or in the future that are associated with QGC's ongoing CSG commercialisation programs. Includes main pipeline crossing of The Narrows at the northern end of the Port of Gladstone.	World Heritage (*Sections 12 & 15A*) National Heritage Places (*Sections 15B & 15C*) Listed Threatened species and Communities (Sections 18 & 18A) Listed Migratory species (*Sections 20 & 20A*).	Lateral Pipeline removed from Project Inclusion of the Woleebee Creek collection header route.	*Vol 1 Ch 5 s.5.2* *Vol 2 Ch 3, Ch 4 s.4.2, Ch 8, Ch 12 s.12.2, and Ch 16 s.16.3* *Vol 4 Ch 7, and Ch 8.*
EPBC 2008/4401	**LNG Component - Marine Facilities** **BG Group & QGC energy generation and supply (non-renewable)/Curtis Island and mainland, adjacent to Gladstone/QLD/QCLNG Project - LNG Marine Facilities.**	Development, construction, operation and decommissioning of LNG Marine Facilities for: • receiving and loading of LNG tankers (Curtis Island) • receiving equipment barges and personnel ferry	Includes LNG Terminal (i.e. jetty and associated marine infrastructure), docking and associated facilities on the mainland and Curtis Island to provide ferry and barge services.	World Heritage (Sections 12 & 15A) National Heritage Places (Sections 15B & 15C) Listed Threatened species and communities (Sections 18 & 18A) Listed Migratory species (Sections 20 & 20A).	Relocation of the product-loading jetty further south Inclusion of a construction dock south of the jetty.	*Vol 1 Ch 5 s.5.2* *Vol 2 Ch 3, Ch 4 s.4.3, Ch 9 s.9.2, and Ch 13 s.13.2-13.3* *Vol 5 Ch 7 s7.3-7.7 and Ch 8 s8.2-8.17.*

3 Also referred to as the ''Export Pipeline'' in the EIS.

4 Also referred to as the ''Gas Collection Header'' and ''Water Collection Header'' in the ''Upstream Infrastructure Corridor (UIC)'' in the EIS.

Referral No.	Project Component/ Referral Name	Summary Description and Action Referred	Comments / Inclusions and Exclusions	Controlling Provisions	Key Change from Draft EIS	QCLNG sEIS cross-reference to MNES[2]
		services to and from the LNG Facility and Gladstone (Gladstone and Curtis Island) • Construction docks to despatch and receive heavy equipment.				
EPBC 2008/4402	**LNG Component- Plant and Onshore Facilities** **BG Group and QGC energy generation and supply (non-renewable)/Curtis Island adjacent to Gladstone/QCLNG Project - LNG Plant and onshore facilities.**	Development, construction, operation and decommissioning of a multi-train LNG Plant and associated onshore facilities on Curtis Island, adjacent to Gladstone.	Includes approximately 270 ha onshore footprint (above high water mark), of which approximately 140 ha will be cleared for the LNG Plant. (plus fence lines, roads, firebreaks and spoil disposal areas). Onshore footprint may include temporary construction camp(s). The LNG Plant and associated onshore facilities will have a capacity of up to 12 million tonnes per annum (mtpa), nominally comprising three LNG trains, each of up to 4 mtpa production capacity.	World Heritage (*Sections 12 & 15A*) National Heritage Places (*Sections 15B & 15C*) Listed Threatened species and communities (*Sections 18 & 18A*) Listed Migratory species (*Sections 20 & 20A*).	Adjustment of LNG Plant footprint within the LNG Facility boundary, Propane storage removed from EIS Reference Case.	*Vol 1 Ch 5 s.5.2* *Vol 2 Ch 3, Ch 4 s.4.3, Ch 9 s.9.2, and Ch 13 s.13.2-13.3* *Vol 5 Ch 7 s7.3-7.7 and Ch 8 s8.2-8.17.*

Referral No.	Project Component/ Referral Name	Summary Description and Action Referred	Comments / Inclusions and Exclusions	Controlling Provisions	Key Change from Draft EIS	QCLNG sEIS cross-reference to MNES[2]
EPBC 2008/4405	**Shipping Operations** **BG Group and QGC energy generation and supply (non-renewable)/Port of Gladstone Ship route Capricorn Channel/QLD/shipping activity associated with QCLNG Project.**	Shipping activities associated with the QCLNG Project, including: • regular transit of LNG tankers • transit of construction equipment barges and personnel ferries between Gladstone and Curtis Island • associated shipping activities.	Shipping conducted within the Australian Exclusive Economic Zone comprising Australian waters (including the Great Barrier Reef Marine Park, Great Barrier Reef World Heritage Area and Gladstone Port) limits up to mean high water mark. Includes: 1. Barge/ferry to and from the construction docks/ferry terminals on the mainland and Curtis Island associated with the transportation of construction and operations equipment and personnel 2. Tug and pilot boat operation to support safe passage of LNG shipping 3. Ship refuelling operations 4. LNG ship operation, including disposal of ballast 5. Any other associated shipping and navigational aids and activities.	World Heritage (*Sections 12 & 15A*) National Heritage Places (*Sections 15B & 15C*) Listed Threatened species and communities (*Sections 18 & 18A*) Listed Migratory species (*Sections 20 & 20A*).	The Project no longer proposes ‘‘spiking’’ of LNG with propane. Bulk LPG carriers to deliver and unload propane have therefore been removed from the EIS Reference Case and are no longer included as part of the Project impact assessment.	*Vol 1 Ch 5 s.5.2* *Vol 2 Ch 3, Ch 4 s.4.3, Ch 9 s.9.2, and Ch 13 s.13.2-13.3* *Vol 5 Ch 15 s.15.2 and . Ch 8 s.8.2-8.17.*

Referral No.	Project Component/ Referral Name	Summary Description and Action Referred	Comments / Inclusions and Exclusions	Controlling Provisions	Key Change from Draft EIS	QCLNG sEIS cross-reference to MNES[2]
EPBC 2008/4406	**Swing Basin and channel dredging** **BG Group and QGC energy generation and supply (non-renewable)/Port of Gladstone/QCLNG Project - Swing Basin and channel dredging.**	Dredging works (including associated spoil disposal) within the Port of Gladstone to construct a Swing Basin, channel extensions and deepening required for shipping associated with the QCLNG Project and other LNG projects..	This will include dredging within existing shipping channels (as required) as well as in new channels, Swing Basin and ship berths along the western side of Curtis Island (south of Laird Point). Does not include dredging undertaken by GPC as part of ongoing maintenance or development of the Port of Gladstone.	World Heritage (*Sections 12 & 15A*) National Heritage Places (*Sections 15B & 15C*). Listed Threatened species and communities (*Sections 18 & 18A*) Listed Migratory species (*Sections 20 & 20A*) Commonwealth marine (*Sections 23 & 24A*).	Impacts to matters of NES not assessed within this EPBC Assessment Report as these infrastructure components have been addressed in Gladstone Port Corporation's EIS for the FLNE and WBDD project.	n/a

2.4 DESCRIPTION OF THE PROJECT

An overview of the QCLNG Project, reflecting developments and modifications undertaken since the release of the draft EIS, is provided in *Volume 1, Chapter 2* of the sEIS. A comprehensive description of the Project, encompassing each of the controlled actions, is provided in *Volume 2*.

2.5 DESCRIPTION OF THE AFFECTED ENVIRONMENT RELEVANT TO THE CONTROLLING PROVISIONS

The supplementary information provided in this report regarding MNES that could be affected by the different components of the QCLNG Project is based on the findings of the following specialist studies commissioned for the QCLNG EIS:

- *Supplementary Flora and Fauna Assessment, undertaken by Unidel for the Gas Field (Volume 3, Chapters 7* and *8* and *Appendix 3.1)*
- *Supplementary Flora and Fauna Assessment, undertaken by Unidel for the Pipeline Component (Volume 4, Chapters 7* and *8* and *Appendix 4.1)*
- *Supplementary Landscape and Visual Impact Assessment, undertaken by Environmental Resources Management (ERM) Australia for the LNG Facility (Volume 5, Chapter 16* and *Appendix 5.11)*
- *Supplementary Surveys for Powerful Owl and Migratory Shorebirds, undertaken by Wildsearch Environmental Services and Sandpiper Ecological Surveys (Volume 5, Chapter 7* and *Appendices 5.5, 5.6, 5.7* and *5.8)*
- *SVT QCLNG Gladstone Channel underwater Noise Assessment (Volume 5 Chapter 8, Appendix 5.3)*
- *Maritime Harbour Movements within Port Curtis 2009, undertaken by the Centre for Environmental Management, CQ University (Volume 5 Chapter 8, Appendix 5.5).*

2.6 UPDATE OF ASSESSMENT OF IMPACTS ON MNES AND MITIGATION MEASURES

2.6.1 EPBC 2008/4398 – CSG Field

Since the release of the draft EIS, refinements to the Project design have led to an increase in the amount of infrastructure proposed to be sited within the Gas Fields. Potential impacts on *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (*EPBC Act*) flora and fauna values as a result of these design changes are presented in the following sections.

Additionally, the gas tenements ATP 768 and PL 171 were included in the Project design after the field work was complete and as such, the flora and fauna assessment of these tenements presented in the draft EIS was limited to a desktop assessment. These tenements have since been subject to flora and fauna surveys and the findings of these studies in relation to *EPBC Act* flora and fauna values are discussed hereafter.

The report of the additional field surveys of relevance for EPBC 2008/4398 – Gas Field are presented in sEIS *Appendix 3.1*.

2.6.1.1 *Flora*

Gas tenements ATP 768 and PL 171

There are two Threatened ecological communities that occur within the gas tenements ATP 768 and PL 171 which are listed as Endangered under the Commonwealth *EPBC Act*. These are:

- Brigalow (*Acacia harpophylla* dominant and co-dominant), represented by two regional ecosystems (Res), namely RE 11.9.5 and RE 11.9.6
- Semi-evergreen vine thicket (SEVT) communities, represented by two REs, namely RE 11.8.3 and RE 11.9.4.

The Queensland Herbarium RE mapping indicates that approximately 612 ha of Brigalow communities occur within both tenements and approximately 54 ha of SEVT communities within PL 171. There are no SEVT communities within ATP 768.

Field survey indicates that the Brigalow communities within ATP 768 were generally long narrow roadside remnants. Overall, the condition of these remnants was considered to be average, being heavily grazed and containing several weed species.

The Brigalow and SEVT communities within gas tenement PL 171 were found to be in good condition, owing to their location along the edge of the Cherwondah State Forest which allows for restricted cattle access.

Due to the small size of the SEVT fragments that occur within the lower eastern section of PL 171 it is expected that Gas Field infrastructure will be able to avoid these areas. Thus no clearing is anticipated to occur within these SEVT remnants.

Brigalow communities within ATP 768 and PL 171 which are relatively small in size are likely to be avoidable. In some cases, thin linear shaped Brigalow remnants which extend along fencelines or occur within the road reserves may be unavoidable and gathering lines and associated infrastructure may be required to cross them. The condition of these linear-shaped remnants is generally poorer than other areas. Many of these suffer from edge effects and have been invaded by Buffel Grass and other environmental weeds which compromise their integrity as native habitats.

Due to the progressive nature of gas field development, it is not possible to state the exact area of each Brigalow remnant that may be required to be cleared for the siting of linear infrastructure.

Gas Field (whole)

Since the release of the draft EIS the amount of infrastructure to be sited in the QCLNG Gas Fields has increased from 15,387 ha to 26,764 ha. As a result, the estimated worst case area of remnant vegetation that may be cleared has also increased from 4,966 ha to 9,577 ha.

However, the clearing extent estimates for *EPBC Act*-listed ecological communities (Brigalow and SEVT) presented in the draft EIS were worst case scenarios. Additional analysis of remnant shapes and the refinement of locations for some infrastructure has resulted in the worst case estimate for clearing extent within this sEIS being less than that presented in the draft EIS (as shown in *Table 13.2.2 below)*.

The data presented in *Table 13.2.2* provides a comparison of the worst case clearing areas presented in the draft EIS and the worst case clearing areas as they now stand.

Table 13.2.2 Comparison of the draft EIS and sEIS worst case vegetation loss areas for EPBC Act threatened ecological communities

Threatened ecological community status	Clearing extent draft EIS (ha)	Clearing extent sEIS (ha)
EPBC Act listed[5]	117	73

Due to the small and non-linear shape of the remnants of SEVT, it is anticipated that the Gas Field infrastructure will be able to avoid these areas. As a result, the worst case clearing footprint of SEVT areas is expected to be nil. However, due to the unavoidability of some Brigalow remnants, the worst case clearing footprint for this community is estimated to be 73 ha. It should be noted however, that this is a worst case scenario and the actual amount of clearing is expected to be less. As detailed in the original guidelines described in *Annex 13.1* of the draft EIS, *EPBC Act*-listed remnant vegetation will be avoided where possible.

Table 13.2.3 highlights the potential impacts on *EPBC Act* threatened ecological communities from a local and bioregional perspective, focusing specifically on the following:

- estimated extent of impact
- total area within the tenements
- total area within the bioregion
- percentage of area that may be impacted on.

5 EPBC Act-listed communities are overlapping (and not additional to) VM Act REs

Table 13.2.3 Worst case EPBC Act threatened ecological communities clearing areas within the Gas Fields

Ecological Community Status	Estimate extent within Gas Fields (ha)	Estimated vegetation loss (ha)	Estimated extent remaining (ha)	Estimated % cleared in the QGC Field	Estimated % cleared in the bioregion
EPBC listed Total	4,039	73	3,966	1.7	0.018

Although there is some potential for pipelines and access roads to fragment or increase fragmentation of Brigalow remnants, the table above indicates that less than 0.02 per cent of the area of the bioregion is expected to be impacted on. Considering the degraded nature of these remnants and the implementation of mitigation measures (discussed in *Volume 3, Chapter 7, Section 7.6* of the draft EIS), it is considered that impacts on this threatened ecological community will not be significant.

The increase in the area of remnant vegetation to be cleared (from 4,966 ha to 9,577 ha) has the potential to impact on habitat of *EPBC Act*-listed flora species. In particular there are three flora species that are known to occur across the Gas Fields. These species, all listed as Vulnerable under the *EPBC Act*, are *Acacia curranii* (Curly-barked wattle), *Calytrix gurulmundensis* and *Philotheca sporadica*.

For the species *Acacia curranii* and *Calytrix gurulmundensis*, the only significant populations that have been recorded within the Gas Fields are restricted to Gurulmundi State Forest. As this area has been assigned a ‘‘very high’’ ecological constraints zone, construction of non-linear infrastructure will only take place in these areas after Commonwealth and State Government endorsement of detailed development plans. Where possible, non-linear infrastructure will follow existing tracks and/or be situated in previously disturbed areas.

Queensland Herbarium records and previous QGC flora field surveys indicate that the species *Philotheca sporadica* occurs throughout the Gas Fields. Ecological surveys will be undertaken during the detailed design phase to detect the presence of this species and avoid disturbance where possible.

In the unlikely event that impacts on *EPBC Act*-listed flora species are unavoidable, offsets will be proposed in accordance with the requirements of the EPBC Draft Environmental Offsets Policy[6].

In summary, due to the controls referred to above that will be applied in all areas of highest conservation value, and the relatively fragmented nature of these areas, it is concluded that the Project will not:

6 Department of the Environment, Water, Heritage and the Arts (2007) Draft Policy Statement Use of Environmental Offsets under the *Environment Protection and Biodiversity Conservation Act, 1999*

- lead to a long-term decrease in the size of an important population
- fragment an existing important population into two or more populations.

It is therefore considered that no threatened flora species listed under the *EPBC Act* will be significantly impacted by the Gas Field development for the QCLNG Project.

2.6.1.2 *Fauna*

Gas tenements ATP 768 and PL 171

No fauna species listed under the *EPBC Act* were identified within the Gas Fields during additional fauna survey work.

Gas Field (whole)

No significant populations of *EPBC Act* fauna species are located within the Gas Fields and as there are no known fauna species with restricted distributions, significant impacts on EPBC *Act*-listed fauna species are not expected.

2.6.1.3 *Conclusion*

From the above assessment and the findings of the Draft EIS and sEIS, it is concluded that actions under EPBC Referral 2008/4398 are not considered to cause significant impacts, as specified in the DEWHA MNES EPBC Policy Statement 1.1, to listed Threatened species and communities or listed Migratory species.

2.6.2 *EPBC* 2008/4399 – Gas Pipeline Network

The report of the additional field surveys of relevance to EPBC 2008/4399 – Pipeline up to crossing of The Narrows is presented in sEIS *Appendix 4.3*.

2.6.2.1 *Pipeline Network from the CSG Field to The Narrows*

Flora

A walk-through flora and fauna habitat survey was conducted from approximately KP 0 to KP 300 of the Export Pipeline over a period of 20 days from September to November 2009. The survey was aimed at ground truthing Queensland Herbarium vegetation mapping and detecting the presence of *EPBC Act*-listed vegetation communities, endangered, vulnerable or rare (EVR) flora species and significant habitat trees. This field survey involved the walk-through of all vegetated areas along the alignment.

This survey confirmed that the majority of the areas to be traversed by the proposed Export Pipeline alignment were cleared grazing properties.

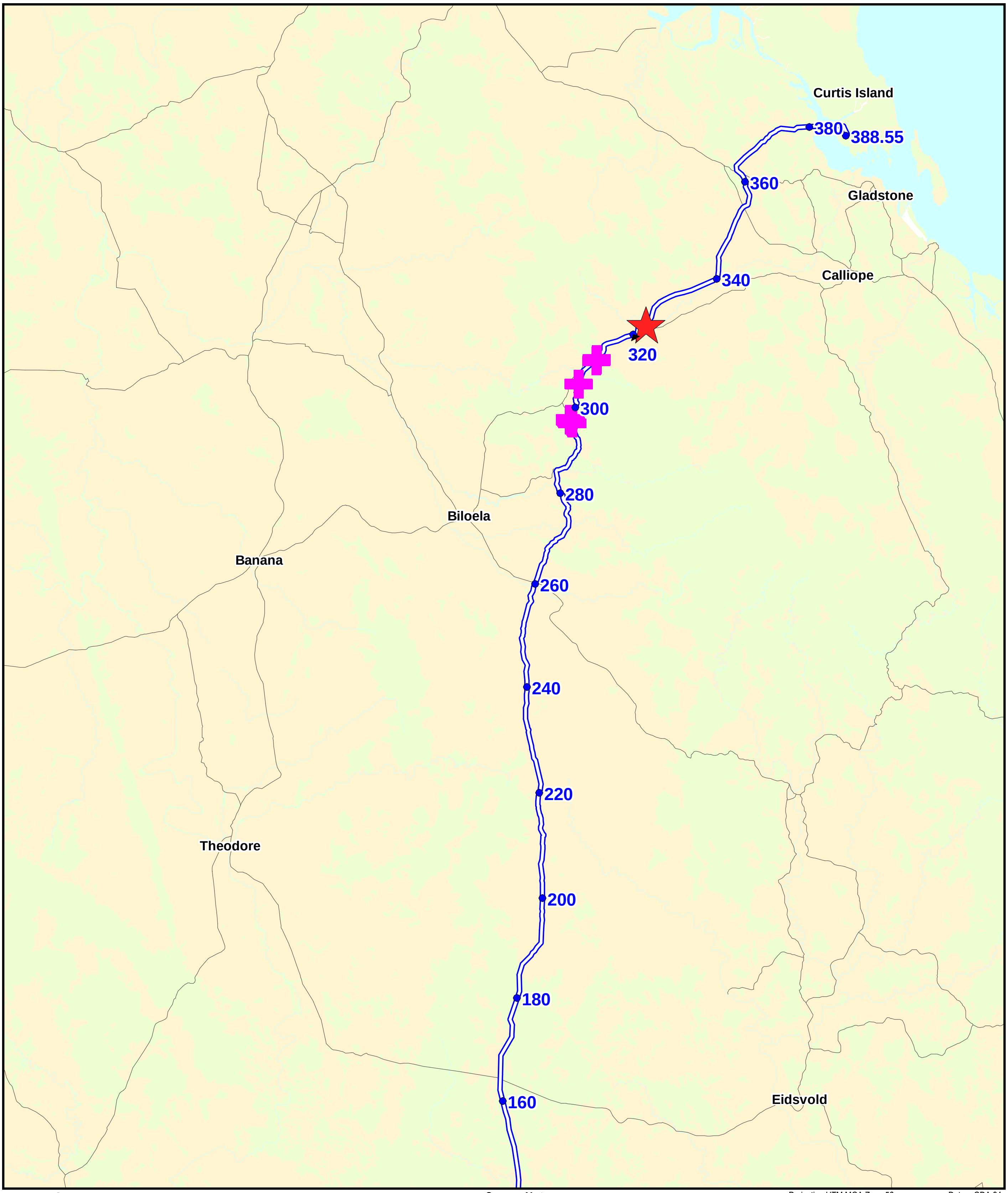
The flora species *Cycas megacarpa* (Large-fruited Zamia) was the only threatened species recorded along the Export Pipeline corridor. This species is listed as endangered under the *EPBC Act*. Approximately 150 of this species were recorded within the proposed Export Pipeline corridor and occurred across three separate locations. The approximate locations of these populations are KP 297, 305, and 310 (see *Figure 13.2.1*). These plants are part of the large populations of this species that are known to occur along ranges within this region.

In 2007 the Queensland Herbarium found that the total number of adult *Cycas megacarpa* within Queensland was greater than 372,900 individuals. In comparison to this number and the numbers (some thousands) of Zamia plants immediately adjacent to the proposed corridor, the total number of individuals that could potentially be impacted on by the Project is unlikely to lead to a long-term decrease in population size and/or fragment an existing population into two or more populations. It is therefore considered that the proposed action will not have a significant impact on this species.

Notwithstanding the above conclusion, management measures to reduce impacts on *Cycas megacarpa* will be implemented. Where practical, the proposed Export Pipeline has been aligned to avoid this species. Where avoidance is not possible, a Threatened Species Management Plan that proposes specific remedial actions will be developed. This management plan will be developed in accordance with the guidelines proposed by the *Draft Cycad Recovery Plan* (Forster and Holland 2005). The plan will identify overall goals, such as no net loss of viable populations, and experts will be consulted throughout the development of appropriate management measures.

Where unavoidable, impacts on *Cycas megacarpa* will be compensated through the creation of offset areas that meet the criteria of the EPBC Draft Environmental Offsets Policy. For further information on the QCLNG proposed offsetting program see *Appendix 2.3*.

Since the submission of the draft EIS, the Export Pipeline alignment has been further refined, the Fairview Lateral has been removed from the Project description, and the Woleebee Creek Pipeline has been added.



Legend:

- Export Pipeline & 20 Kilometre Point
- Woleebee Creek Route & 20 Kilometre Point
- Upsteram Infrastructure Corridor & 20Km Point
- Cycads survey points
- Squatter Pigeon location

Source Note:
1:250,000 Topographic vector copyright Geoscience Australia

Projection UTM MGA Zone 56 | Datum GDA 94

0 20 40 60 80
Kilometres

N

QUEENSLAND CURTIS LNG
A BG Group business

ERM
Environmental Resources Management Australia Pty Ltd

Project	Queensland Curtis LNG Project		
Client	QGC - A BG Group business		
Drawn	Mipela	sEIS Volume 13	Figure S13.2.1
Approved	CDP	File No	EO5-P-MA-96261
Date	20.01.10	Revision	Supplementary

Title **Cycads points overview and Squatter Pigeon location.**

Disclaimer:
Maps and Figures contained in this Report may be based on Third Party Data, may not be to scale and are intended as Guides only.
ERM does not warrant the accuracy of any such Maps and Figures.

Table 13.2.4 highlights the potential impacts of pipeline construction on *EPBC Act* threatened ecological communities in relation to clearing extent. The following information is given:

- estimated clearing extents
- total area impacted within 5 km
- total area impacted within the Bioregion
- percentage of area that may be impacted on.

Table 13.2.4 Worst Case EPBC Act threatened ecological communities clearing areas along the Pipeline alignments

Ecological Community Status	Clearing extents (ha)	Extent within 5 km (ha)	% of that within 5 km to be cleared	Extent in bioregion (ha)	% of that within Bioregion to be cleared
EPBC-listed	12	4,642	0.26	389,100	0.003

Given the very limited extent of clearing of *EPBC Act*-listed threatened ecological communities along the Pipeline alignment in relation to the area of communities present within 5 km of the Pipeline and within the Brigalow Belt Bioregion, significant impacts to these ecological communities are not anticipated.

Desktop analysis of environmental values present along the Woleebee Creek Pipeline corridor has also been undertaken. No *EPBC Act*-listed threatened ecological communities or threatened species along the proposed alignment were identified.

Fauna

During the additional field surveys along the northern portion of the Export Pipeline, an additional *EPBC Act*-listed fauna species, the Squatter Pigeon (*Geophaps scripta scripta*), was observed within the study area. This species is listed as vulnerable under the *EPBC Act* and was observed at approximately KP 322 along the Callide-Gladstone Corridor alignment.

The Squatter Pigeon is recognised as a nomadic and highly mobile species which occupies very large home ranges. When identified along the corridor, this species has invariably been found in open grazing lands (non-remnant) and in close association with cattle. Very little remnant vegetation occurs in these areas, other than along creeklines which the species may visit for water. Given the small area of habitat that may be cleared for Pipeline construction (anticipated to be less than 1 ha in the Squatter Pigeon's identified habitat area), it is expected that the proposed corridor will not modify, destroy, remove, isolate or decrease the availability or quality of habitat to the point of species decline. Thus it is considered that impacts upon the Squatter Pigeon will not be significant.

MNES for the CSG Field relate only to listed Threatened species and ecological communities and listed Migratory species.

2.6.2.2 *Pipeline Crossing of The Narrows*

Additional Studies

Additional marine-based research was undertaken to assist in understanding potential impacts on *EPBC Act*-listed Migratory and Threatened species in the Port Curtis region. This research included effects of noise on marine mammals, and vessel movement surveys to provide input to assessment of the likelihood of vessel and marine mammal interactions, as discussed in *Section 2.6.3* below.

The conclusions of the draft EIS in relation to the Pipeline crossing of The Narrows remain current; namely that: the Pipeline crossing of The Narrows is considered unlikely to have a significant impact on *EPBC Act*-listed Threatened and Marine species.

2.6.2.3 *Conclusion*

From the above assessment and the findings of the draft EIS and sEIS, it is concluded that actions under EPBC Referral 2008/4399 are not considered to cause significant impacts, as specified in the DEWHA MNES EPBC Policy Statement 1.1, to World Heritage, National Heritage Places, listed Threatened species and communities or listed Migratory species.

2.6.3 *EPBC 2008/4401 – LNG Marine Facilities*

Since the release of the draft EIS, QGC's understanding of the elements of dredging necessary for the QCLNG Project has evolved, as explained in *Volume 2 Chapter 14.* As such, the sEIS has assessed in greater detail the potential impacts of dredging for the Construction Dock, and stages 1 and 2 of the Materials Offloading Facility (MOF), and the pipeline crossing of The Narrows.

The dispersal of sediment plumes from these works has been modelled and reported in *Volume 6* of the sEIS, and their potential effects on marine ecological resources, and those of other aspects such as underwater noise and vessel movements associated with the dredging works are discussed in *Volume 5 Chapter 8*. These assessments have included a number of additional studies which are outlined below, after which, their implications for the listed Threatened and Migratory species relevant to this referral are discussed.

2.6.3.1 *Additional Studies*

Following the release of the draft EIS, additional marine-based research was undertaken to assist in understanding potential impacts on listed migratory and threatened species in the Port Curtis region. This research included the following:

Occurrence of listed Migratory and Threatened species – further information regarding the presence of, and potential impacts to dolphin, dugong, turtles and ray-finned fish in the Port Curtis region.

Underwater noise model – developed to determine expected impacts on marine fauna from construction activities and LNG tanker operations.

Maritime harbour movements within Port Curtis – provides specific information to contribute to the assessment of the likelihood of interactions between vessels and marine mammals.

Sedimentation and Total Suspended Solids dispersion modelling and light attenuation modelling – provides further information regarding the potential effects of dredging, in particular to sea grass and algal communities.

A brief summary of the approach and methodology of the underwater noise and maritime harbour movement studies is provided below, followed by a discussion of potential impacts on marine mammals, marine reptiles and ray-finned fish.

Underwater Noise

An underwater noise model was developed to determine expected impacts on marine fauna from construction activities and LNG tanker operations.

Underwater noise models use bathymetric data, geoacoustic information and oceanographic parameters as inputs to produce estimates of the acoustic field at any depth and distance from the source.

Five different sources were used to assess underwater noise impacts. These include an LNG tanker, tug boat, cutter suction dredge (CSD), and two pile-driving operations. The seabed parameters entered into the model were based on estimates obtained from core samples and seismic surveys.

Zones of interest for the underwater noise assessment include the following:

- **area of possible physical injury**: possibility that the animal may suffer physical injury and/or permanent hearing damage
- **area of possible avoidance**: possibility that the animal may experience masking and/or behavioural change and/or avoid the area.

Turtles

Little is known about the source levels and associated frequencies that cause physical injury to a turtle. For the purpose of this assessment, frequencies are based on empirically-based safety ranges from studies which have examined the effects of explosions on turtles. The estimated received levels at which there is a possibility of physical injury or behavioural effect for turtles is detailed in *Table 13.2.5* below.

In general, it is estimated that a pressure value of 222 dB re 1µPa should not be exceeded for adult turtles to avoid physical injury. Hatchlings were evaluated using the same auditory sensory (sound) values for fish, at 198 dB re 1μPa^{2}s.

Table 13.2.5 *Estimated received levels at which there is a possibility of physical injury or behavioural effect for turtles.*

Effect	Possible physical injury	Possible avoidance
Peak pressure	222 dB re 1μPa	175 dB re 1μPa
Sound level (SEL)	198 dB re 1μPa	No data available

Cetaceans and Dugongs

Values which were used to assess the possibility of physical injury or behavioural effect of underwater noise on cetaceans and dugongs are provided in *Table 13.2.6*. They are based on the criteria recommended by Southall *et al*[7] and the *EPBC Act* Policy Statement 2.1[8].

It is estimated that to avoid physical injury to dugongs and cetaceans a pressure value of 222 dB re 1μPa and sound level of 198 dB re 1μPa^2.s should not be exceeded.

Table 13.2.6 *Estimated received levels at which there is a possibility of physical injury or behavioural effect for cetaceans and dugongs*

Effect	Possible physical injury	Possible avoidance
Peak pressure	230 dB re 1μPa	224 dB re 1μPa
SEL	198 dB re 1μPa^2.s	160 dB re 1μPa^2.s

Findings

In general, results indicate that sound levels (SEL) from all sources will be below 198 dB re 1μPa2.s at 2 m below the surface. That is, the level at which possible injury to dugongs, cetaceans, and turtles might occur. The largest sound levels will come from piling of the jetty and the Materials Offloading Facility (MOF) and these are highlighted in the figures below.

The furthest distance from piling of the jetty and MOF to the zone of possible physical injury is 55 m for turtles and 22 m for dugongs and cetaceans (see *Table 13.2.7*). The maximum distances between noise sources and the zone

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7 Southall BL, Bowles AE, Ellison WT, Finneran JT, Gentry RL, Greene Jr CR, Kastak D, Ketten DR, Miller JH, Nachtigall PE, Richardson WJ, Thomas JA and Tyack PL. (2007). Marine Mammal Noise Exposure Criteria: Initial Scientific Recommendations Aquatic Mammals, Volume 33, Number 4, 2007, ISSN 0167-5427

8 DEWHA (2008). EPBC Act Policy Statement- Interaction between offshore seismic exploration and whales. http://www.environment.gov.au/epbc/publications/pubs/seismic-whales.pdf accessed December 2009.

of avoidance for turtles range from 160 m to 1,500 m, while for cetaceans and dugongs, distances range of 5 m to 205 m.

The relatively short ranges can be attributed to the fact that the jetty and MOF pile-driving activities take place in very shallow water (approximately 5 m), which implies that only a small portion of the pile is in the water during the pile-driving and that most of the acoustic energy is transferred into the seabed.

Table 13.2.7 summarises the maximum distances between noise sources and the zones of avoidance and possible physical injury for turtles, cetaceans and dugongs.

Table 13.2.7 Furthest distance to zones of avoidance and possible physical injury

Animal class	Source(s)	Furthest distance from source to zone of avoidance	Furthest distance from source to zone of possible physical injury	Furthest distance from source to *EPBC Act* policy level (160 dB re 1μPa^2.s)
Turtles	Piling at jetty	1,500 m	55 m	N/A
	Piling at MOF	1,200 m	55 m	N/A
	Cutter suction dredge	55 m	-	N/A
	Tug boat	-	-	N/A
	LNG tanker and tug boat	160 m	-	N/A
Cetaceans and dugongs	Piling at jetty	205 m	22 m	205 m
	Piling at MOF	160 m	22 m	160 m
	Cutter suction dredge	5 m	-	5 m
	Tug	-	-	-
	LNG tanker and tug	-	-	-

Mitigation

Piling

The potential for exposure of marine mammals and turtles to harmful levels of underwater noise from piling activity is expected to be minor as the levels likely to cause harm are very localised and the species which may be impacted are likely to be transitory.

The proposed management measures to further mitigate potential impacts, in line with best practice, are:

- prior to commencement of activity carry out observation for marine mammals and turtles within exclusion zone of 250 m for turtles and marine mammals for 20 minutes
- if no turtles or marine mammals are observed within the zone, commence a slow start to operations gradually building to full activity over a 15-minute

period to allow any unseen turtles or marine mammals time to exit the zone

- during operations maintain a watch for turtles and marine mammals; if they approach within 250 m operators are to be advised and to prepare to stop activities if animals continue to approach within 100 m
- if a procedural stoppage is required then recommencement follows the steps from point 1 above
- for night-time operations, if there have been no procedurally required stoppages during the preceding day, no observation requirements are imposed.

Any marine mammals and turtles observed will be recorded and reported.

Dredging and Vessel Operations

The potential for exposure of marine mammals and turtles to harmful levels of underwater noise from dredging activity or vessel activity is expected to be minor as the noise source will only cause a very localised avoidance zone. Other than the proposed management measures referred to above, no mitigation measures are considered to be required for dredging to further reduce the risk from noise to marine fauna.

Maritime Harbour Movements

The draft EIS identified approximate frequencies for the movement of larger commercial vessels within the Port of Gladstone. The latest maritime harbour movements study provides a broader context of vessel movements, including breakdowns by types of vessel, vessel speed, navigation zones and daily patterns of use.

The study indicates the following with relevance to marine fauna and vessel interactions in Port Curtis:

- There are approximately 150, 70 and 35 vessel movements per day for Auckland Point, the Calliope River and The Narrows, respectively.
- These numbers increase by about 30 per cent to 40 per cent on ‘‘fair weather’’ days.

Other findings specific to The Narrows include:

- For weekdays and weekends, respectively, 42 per cent and 70 per cent of the vessels transiting The Narrows do so while travelling at higher than planing speeds.
- Between 41 per cent and 54 per cent of these vessels run down the Curtis Island coastline, passing between the QCLNG site and the Passage Islands.
- There is no significant ‘‘within-day’’ pattern to boating levels – hourly activity levels are similar for all daylight hours.

Even if all vessels counted in The Narrows or Calliope zones had originated in the Auckland Point area, the implied annual number of vessel movements will be significantly greater than 55,000, for the following reasons:

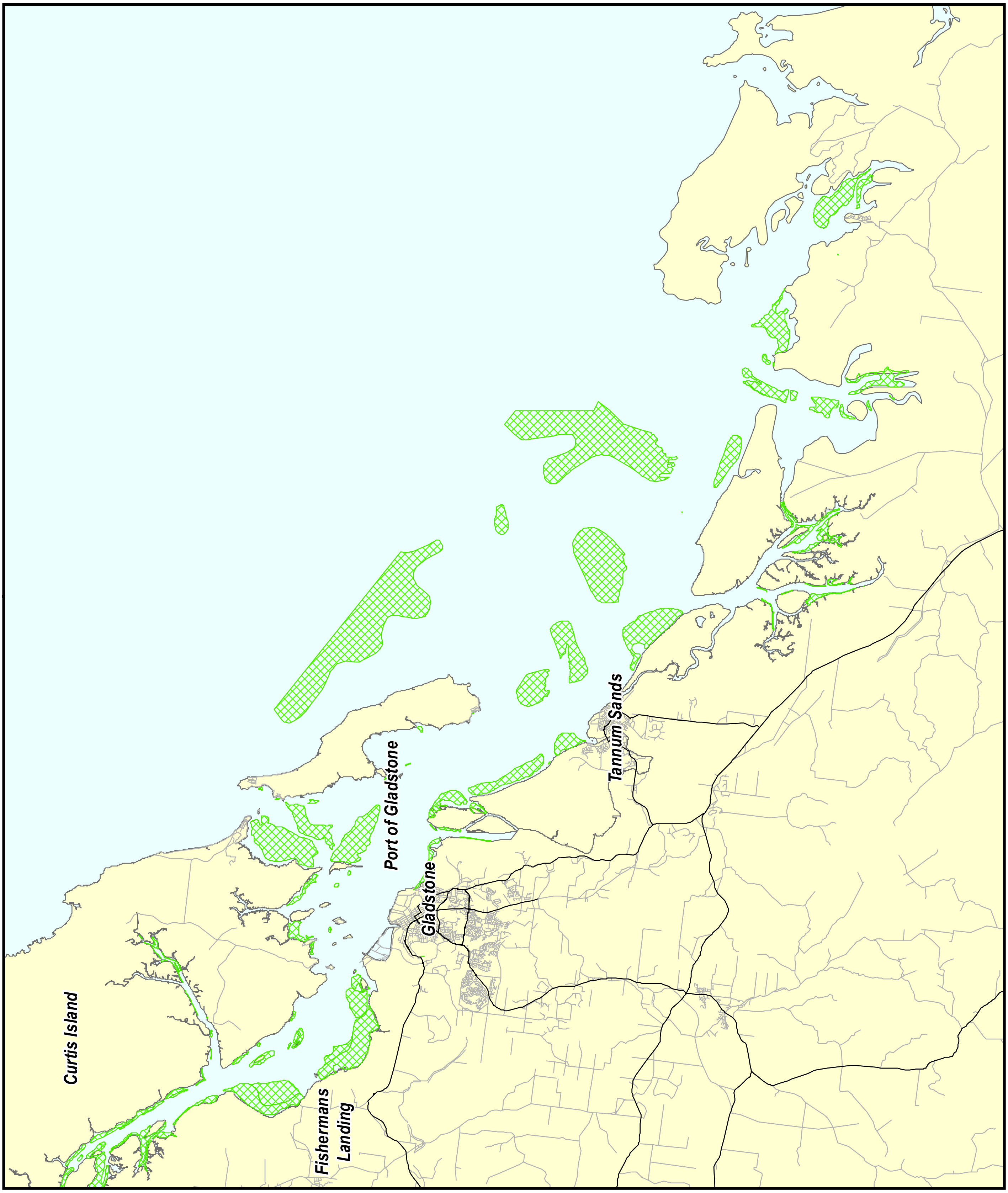
- ''Fair weather'' days were excluded from the averages, while being recognised as having 30 to 40 per cent greater vessel movements
- The results are only for 12 hours of daylight, and therefore exclude night-time and dawn/dusk operations.

On this basis it is reasonable to assume that vessel movements within the Port of Gladstone fall in the range of 70,000 to 80,000 movements per year. QCLNG vessel movements are therefore expected to produce an increase in movements of approximately 12 per cent at the peak construction period, and by less than 5 per cent.during LNG Facility operations.

The impact assessment of the risk of vessel collisions with marine fauna, as described in the *Sections 2.6.3.2* and *2.6.3.3* below, takes account of the many thousands of high-speed vessel movements occurring each year within the portions of Port Curtis that will be used by QCLNG Project vessel traffic.

Seagrass and Algal Communities

Seagrasses are an important habitat for marine fauna including dugong, dolphin and syngnathids (seahorses and pipefish) within Port Curtis. It is recognised that future activities within Port Curtis have the potential to impact on these communities. The total area of seagrass meadows within the Port of Gladstone region has been estimated to be 6118 ha, comprising 2998 ha (49 per cent) in aggregated patches, 871 ha (14 per cent) in continuous seagrass cover and 132 ha (2 per cent) in isolated patches (refer to *Figure 13.2.2).*



Legend

Seagrass

Source Note:
Seagrass Distribution; Produced by Queensland Department of Primary Industries and Fisheries: 2002, Updated 2003

Projection: UTM MGA Zone 56

Datum: GDA 94

0 2 4 8 km

N

QUEENSLAND CURTIS LNG A BG Group business	Project	Queensland Curtis LNG Project	Title: **Seagrass in the Port of Gladstone Region, 2003**
	Client	QGC - A BG Group business	
ERM Environmental Resources Management Australia Pty Ltd	Drawn KP	sEIS Volume 13 Figure 13.2.2	Disclaimer: Maps and Figures contained in this Report may be based on Third Party Data, may not to be to scale and are intended as Guides only. ERM does not warrant the accuracy of any such Maps and Figures.
	Approved BK	File No: 0086165b_SUP_GIS025_S13.2.2	
	Date 19.01.10	Revision 0	

Impacts to seagrasses within Port Curtis due to the proposed QCLNG activities may arise through the construction of the MOF and Construction Dock facilities (direct loss of habitat), The Narrows Pipeline crossing and through altered water quality conditions due to dredging and disposal (indirect loss of habitat). The direct loss of seagrasses associated with the construction of proposed infrastructure will be an irrecoverable loss of habitat; however, the potential indirect loss of seagrass due to altered water quality is expected to be temporary with recovery of the seagrass following re-establishment of ambient water quality conditions post-dredging.

Direct impacts from infrastructure

Predicted direct and indirect losses of seagrasses: EIS Volume 6, Section 1.3 presents the results of modelling of suspended sediment levels arising from the dredging scenarios considered for the Project

Based upon the 2002 seagrass mapping data[9], no seagrass is estimated to be lost to the proposed MOF infrastructure, while approximately 0.004 ha of seagrass will be lost due to the Construction Dock. An area of 1 ha to 2 ha may be directly impacted on by the Pipeline crossing of The Narrows, predominantly at Friend Point. Relative to the approximately 6200 ha total area of seagrass habitat present within the Port Curtis area, the direct loss of seagrasses due to the proposed infrastructure is considered negligible.

Indirect impacts from dredging activities

Seagrasses rely on an optimal light climate for photosynthetic production. The level of optimal light may vary both within and between species, depending on the prevailing conditions at a particular location. Consequently, the sensitivity of seagrass to changes in light associated with deteriorating water quality (i.e. through increased turbidity and sedimentation due to dredging and material disposal), may differ within and between species depending on the prevailing conditions at a particular location. The impacts of deteriorating water quality on seagrass also show seasonal variance[10].

The primary detrimental effect of increased turbidity on seagrass is the increased attenuation of light, which affects the amount of light available for photosynthetic production[11]. Increased turbidity can reduce light to levels that cause sub-lethal stress or mortality.

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9 Queensland Department of Primary Industries and Fisheries Seagrass Distribution,2002,Updated 2003

10 Erftemeijer PLA, Lewis RRR (2006) Environmental impacts of dredging on seagrasses: a review. Marine Pollution Bulletin, 52:1553–1572

11 Ralph PJ, Durako MJ, Enríquez S, Collier CJ, Doblin MA (2007) Impact of light limitation on seagrasses. Journal of Experimental Marine Biology and Ecology. 350: 176–193

Seagrasses can cope with temporary fluctuations in turbidity if the period of light reduction is limited. The threshold timelength is species-specific and also depends on other environmental conditions[12]. Thresholds for light deprivation for seagrasses range from a few weeks to several months[13].

Increased turbidity due to dredging operations may be short-lived, but reworking and resuspension of unconsolidated deposited sediments in shallow areas may result in long-term impacts, which may cause a decline in seagrass habitat through prolonged light reduction[14]. Impacts to seagrasses exposed to pulsed turbidity events lasting a month or more are well documented[15].

Sediment plume modelling was conducted to identify the impact of any sediment plume(s) as a result of early works dredging and the likelihood of the sediment plume migrating and settling in environmentally sensitive areas, or remaining suspended but shading plants and animals that rely on light.

While sediment plume modelling was presented in the draft EIS, and has been performed by GPC and others for other development proposals within Gladstone harbour, additional modelling was performed for the supplementary EIS for the purpose of refining impact assessments. These most recent models incorporated the following refinements:

- improved estimates of source rates, based on particular dredging method scenarios for QGC's proposed dredging
- three-dimensional modelling
- better detail on the different behaviours of a range of finer sediments
- ambient turbidity and resuspension of settled particles
- modelling of light attenuation directly, rather than just inferring light attenuation from suspended sediment concentrations.

Modelling was undertaken for MOF and Construction Dock dredging, as well as for the Narrows pipeline crossing. Modelling for the MOF and Construction Dock described three key scenarios and the different ways in which plumes migrate, based on known currents which occur in Port Curtis. Modelling for the Narrows pipeline crossing assessed scenarios for both the BHD and jetting construction methods . The modelling assessed how the sediments would settle based on the types of sediments likely to be dredged and how these particular sediments settle in time.

Modelling of sediment plume migration and settlement was undertaken by BMT WBM (water movement) and APASA (sediment and light). Copies of

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12 Ibid

13 *Op Cit.*

14 Onuf CP (1994) Seagrasses, Dredging and Light in Laguna Madre, Texas, U.S.A. Estuarine, Coastal and Self Science, 39:75-91

15 Moore KA, Wetzel RL, Orth RJ (1997) Seasonal pulses of turbidity and their relations to eelgrass (*Zostera marina*L.) survival in an estuary. Journal of Experimental Marine Biology and Ecology, 215: 115-134; Longstaff BJ, Dennison WC (1999) Seagrass survival during pulsed turbidity events: the effects of light deprivation on the seagrasses *Halodule pinifolia* and *Halophila ovalis*. Aquatic Botany, 65:105-121.

these reports are attached as *Appendix 5.4, 6.2 and 6.3,* however, the results and assessment of impacts are summarised below.

Three scenarios were modelled for the development of the MOF and Construction Dock. Two relate to the earliest dredging works required for the Construction Dock and the MOF Stage One. These two scenarios reflect the two alternative dredging methods that may be employed in these shallow areas, pending availability of particular dredgers. The third scenario, appropriate for MOF Stage Two, uses larger equipment better suited to the greater size of this stage. These scenarios are described below.

Scenario One (53 days duration) – This is the preferred scenario for removal of sediment from MOF Stage 1 and the Construction Dock. It assumes that Fishermans Landing is available as a receiving site in the required timeframe (mid 2010), and that the appropriate equipment is available at that time. It assumes the use of a small-medium CSD (removing approximately 500 m^3/hr), with spoil pumped to a Fishermans Landing reclamation site via a floating or submerged hydraulic pipeline. Excess water (tail-water) is returned to the marine environment from the north-west corner of the proposed Western Basin reclamation site via a series of outflow pipes.

Scenario Two (90 days duration) – This is a fall-back scenario, which would be implemented if the Fishermans Landing receiving area is not available when required, or if a small-medium CSD is not available at that time. It assumes the use of two BHD to remove material within the MOF and Construction Dock areas. Each BHD would deposit sediments directly into three supporting (six in total) split hopper barges (SHB). These barges would dispose of the dredged material to an existing approved offshore spoil ground.

Scenario Three (64 days duration) – This scenario is effectively a fall-back scenario for MOF Stage 2, as it is intended that GPC would have completed dredging of the access channel by the time MOF Stage 2 is required. If this has not been done, then QGC would remove the sediment from MOF Stage 2 using a large CSD (approximately 1,500 m^3/hr) with spoil pumped to an approved Fishermans Landing receiving site via a floating or submerged hydraulic pipeline. Again, tail-water would be returned to the marine environment through a series of overflow pipes.

Maximum potential indirect losses have been calculated for seagrasses that will be exposed to depth-averaged total suspended solids (TSS) concentrations greater than 25 mg/L (including forecast ambient TSS) for 50 per cent of the time (50^{th} percentile), 20 per cent of the time (80^{th} percentile) and 5 per cent of the time (95^{th} percentile). Indirect losses have been estimated for each of the modelling scenarios one to three (*Table 13.2.8*), and for the percentile plots of the median, 50th 80th and 95th for each of these scenarios.

Seagrass shading experiments commenced in November 2009 to characterise the light environment that seagrasses are accustomed to within the Port of Gladstone. Incorporation of the results of the field study shading experiments and light attenuation modelling will further refine predictive capacity.

Table 13.2.8 ***Indirect loss risk estimates as a percentage and area cover of seagrasses due to depth averaged TSS concentrations exceeding a threshold of 25 mg/L***

Dredge Scenario	Percentile	Equivalent no. of days exceeding TSS threshold	Area of seagrass (ha)	% of Port Curtis* seagrass
1: CSD dredge (~500 m^3/hr), spoil pumped to the reclamation, duration of ~53 days	50	26	244.3	4.0
	80	11	262.9	4.3
	95	3	363.2	5.9
2: BHD at MOF and Construction Dock, spoil barged to offshore, duration of ~ 90 days	50	45	304.5	5.0
	80	18	328.6	5.4
	95	4	429.9	7.0
3: Large CSD dredge (~1500 m^3/hr), spoil pumped to the reclamation, duration of ~64 days	50	32	248.8	4.1
	80	13	290.4	4.7
	95	3	381.3	6.2

* Areas based on 2002 habitat mapping, as illustrated by *Figure 13.2.2*

The percentile plots presenting contours of depth-averaged TSS on which the data in *Table 13.2.8* was derived are based on the maximum depth-averaged TSS occurring in each cell over the duration of the dredging operation. It is therefore considered that the estimated impact areas are conservative and that actual area affected may be less than those predicted.

No indirect losses were predicted for the dredging associated with The Narrows Pipeline crossing. This is due to the relatively short duration of individual operations (trenching across The Narrows is expected to take three weeks), with periods between these operations during which there will be no discharges, resulting in median increases in depth-averaged TSS concentrations within the range of natural background estimates when calculated over the full duration of the operation. During construction of The Narrows Pipeline crossing, TSS concentrations above 25 mg/L are only predicted to occur 5 per cent of the time (95^{th} percentile).

QGC will base monitoring and management zones on the areas encompassed by depth-averaged TSS concentrations. Specifically, within the area encompassed by the 50th percentile of 25 mg/L TSS (the seagrass impact area or SIA) impacts are expected and therefore monitoring will only be undertaken for the purposes of validating outcomes and refining predictive capacity. *Table 13.2.8* identifies this area as being 244 ha for dredging Scenario One, 305 ha for dredging Scenario Two and 250 ha for dredging Scenario Three. No management criteria are specified for this zone in the Draft Dredge Management Plan (DDMP).

It is expected that the seagrasses within the SIA will regrow or recolonise within one to three years of cessation of dredging.

Within the area that the 80^{th} and 95^{th} percentiles encompass (Seagrass Management Area 1, SMA 1), impacts are possible but unlikely, and so monitoring for reactive management purposes will be implemented in this zone. This represents a further 119 ha to 133 ha, depending upon the dredging scenario (*Table 13.2.8*). Reactive management criteria for this zone are outlined in the DDMP.

For areas outside the 95th percentile (Seagrass Management Area 2, SMA 2), no impacts are predicted. Therefore, monitoring will only be undertaken to confirm this, and to serve as a comparison zone for interpreting any changes within SMA 1. If necessary, management criteria for SMA 1 will be used for SMA 2, and additional reference sites further afield would be used for comparative purposes.

Seagrass recovery from sediment burial and erosion following natural disturbances is relatively independent of their specific burial thresholds, dependent strongly on their longer-term colonisation capacity and patch dynamics[16]. These characteristics represent different strategies for survival in the face of stress or disturbance. Smaller fast-growing (short-lived) species such as *Halophila ovalis* or *Halodule wrightii* generally do not survive long once their environmental thresholds have been breached. However, these species tend to recolonise more rapidly following disturbance. Rasheed (1999)[17] found that experimentally cleared plots in meadows dominated by the relatively slow-colonising species *Z. capricorni* recovered to the level of the uncleared controls after 12 months.

The predicted levels of sedimentation for the areas of risk for Scenario One are low. The 95th percentile map for sedimentation rate shows two distinct areas; along the western shoreline of Curtis Island from the MOF site to areas surrounding Hamilton Point and adjacent to the tail-water discharge site, predicted to be influenced by sedimentation rates in the order of 2 and 5 g/m^2/day, (net sedimentation of approximately 0.06 mm to 0.16 mm/month of continuous exposure), respectively. This order of sedimentation rate is unlikely to cause mortalities or preclude recolonisation by seagrass once water turbidity has recovered to normal conditions.

In Scenario Two the 95th percentile map for sedimentation rate shows extended areas of increased sedimentation rates resulting from the backhoe dredge (BHD) operations, ranging between 2 and 100 g/m^2/day (3.1 mm/month). Sedimentation rates surrounding Hamilton Point and the small group of adjacent islands are predicted to be > 5 g/m^2/day with rates as high as 100 g/m^2/day, adjacent to the MOF. Again this sedimentation rate is unlikely to cause mortalities or preclude recolonisation by seagrass once water turbidity has recovered to normal conditions.

Modelling of Scenario Three predicted, for the 95th percentile (worst case), sedimentation rates ranging between 2 and 100 g/m^2/day. Predicted sedimentation rates of 2 g/m^2/day occur in a predominantly continuous contour from waters between Barney Point and South Trees Island, to Friend Point and Laird Point in the north of the estuary. Sedimentation rates of 5 g/m^2/day or greater were scattered among Laird Point, and waters near the tail-water

16 Ibid

17 Rasheed MA (1999) Recovery of experimentally created gaps within a tropical Zostera capricorni (Aschers.) seagrass meadow, Queensland Australia. Journal of Experimental Marine Biology and Ecology, 235 (1999) 183–200

discharge site on the western side of Port Curtis. Regions between the MOF and Picnic Island on the eastern side of the port were characterised by typically more continuous areas. Predicted zones of sedimentation rates 25 g/m^2/day (0.78 mm/month) or greater were concentrated at the entrance of Grahams Creek, North Passage Island and immediately adjacent to the proposed land reclamation site in the northern region of the port and surrounding Hamilton Point and Picnic Island with the central port region. As with other cases modelled, the predicted rates of sedimentation are unlikely to cause mortalities or preclude recolonisation by seagrass once water turbidity has recovered to normal conditions.

Because of the short (three-week) period of works for the trenching across The Narrows, the accumulation of sediments associated with The Narrows Pipeline crossing is minimal. Fine sediments are predicted to be spread widely but thinly throughout Targinie Creek and the adjacent estuary, with a downstream bias. The highest sedimentation rates area indicated to equate to an average thickness of a approximately 5 mm, while the lowest concentrations equate to an average thickness of 6 µm. Again this sedimentation rate is unlikely to cause mortalities or preclude recolonisation by seagrass once water turbidity has recovered to normal conditions.

Conclusion

Dredging

Dredging activities considered in this sEIS associated with the QCLNG Project are predicted to result in the direct loss of up to approximately 2 ha seagrass which represents approximately 0.03 per cent of the approximately 6,200 ha of seagrass in the Port of Gladstone region.

Conservative (worst case) estimates of indirect impacts to seagrasses as a result of increased TSS concentrations are predicted to be up to between approximately 360 and 430 ha, depending upon the dredging scenario, representing between approximately 5.9 per cent and 7 per cent of the seagrass in Port of Gladstone region. As explained above, it is anticipated that the indirect areas of seagrass will recover within one to three years of the dredging works. Overall, the QCLNG dredging works are therefore not considered to give rise to significant impacts to the seagrass habitat of the Port of Gladstone.

Spoil Disposal

The sediment dispersion modelling of the dredge scenarios described above included consideration of the sediment plumes resulting from discharge of tailwater for those scenarios involving the disposal of dredged spoil to reclamations, and the sediment losses to the water column during dumping for the scenario involving disposal at sea. The modelling concluded that sediment deposition and Total Suspended Solids (TSS) levels from sediment dispersion were generally within the range of natural variation encountered in Port Curtis and that impacts to marine ecological resources are minor.

Further potential sources of direct and indirect impacts from the disposal of dredge spoil upon the MNES associated with this referral are the transport of the spoil to its disposal location, and the 'landtake' of the spoil when emplaced.

These sources are discussed below, but in summary are not expected to cause significant impacts to MNES because the construction and operation of the spoil disposal locations proposed for the QCLNG Project, by virtue of their either being approved for receipt of dredged material, or by having been impact assessed by others, have been established as not having, or being likely to have, significant impacts upon MNES.

The disposal options associated with each of the three scenarios examined for the dredging of the Construction Dock, MOF Stage One and MOF Stage Two and their implications for MNES are summarised below;

Scenario One: Dredged material has been assumed to be pumped via a floating or submerged hydraulic pipeline into Fisherman's Landing, either to fill void space or raise site levels within the existing reclaimed area, or to provide material for the Fisherman's Landing Northern Extension (FLNE) reclamation.

The pumping of the dredged spoil directly from the dredger to the disposal location avoids the need for delivery vessel movements and 'overflow' plumes from the filling of spoil hoppers, and hence potential transport impacts are avoided.

With regard to spoil placement within Fisherman's Landing, the existing reclamation area is a cleared site and is not considered to provide suitable habitat for or otherwise support listed Threatened species or communities, or Migratory species. The FLNE reclamation project was the subject of a referral under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act), and the Commonwealth Minister for the Department of Environment, Water, Heritage and the Arts determined (30 January 2001) that the project was not a 'controlled action'.

The Queensland Government Coordinator-General declared (14 October 2005) the Fisherman's Landing Port Expansion proposal a 'significant project' for which an environmental impact statement (EIS) was required in accordance with Part 4 of the *State Development and Public Works Organisation Act 1971* (SDPWO Act). The EIS has been prepared and is currently under consideration by the Queensland Government. If the EIS is approved, the construction impacts, including to any MNES, can be considered to be acceptable and hence not significant, while QGC's placement of material during the operation of the facility has been assessed as described above and identified as also not causing significant impacts to MNES.

Spoil disposal associated with Scenario One, whether to existing or to approved disposal locations at Fisherman's Landing is thus not expected to have significant impacts upon MNES.

Scenario Two: Involves dredged material being transported by barge to an existing approved offshore spoil ground, such as the existing East Banks Sea Disposal Site. Transport of spoil to the disposal ground would involve barge movements, the potential impacts and mitigation measures for which are discussed with respect to MNES in *sections 2.6.3.2* and *2.6.3.3* below.

The emplacement of dredged spoil within a licensed disposal area is not considered likely to cause significant impacts to MNES, for example, at the East Banks Sea Disposal Site. The East Banks Sea Disposal ground has been in use for approximately 30 years, and in that time has received approximately 18 million m3 of material. Over the last two years GPC has conducted several maintenance dredging programs which have used this disposal ground, and has been granted approval for the disposal of 600,000m^3 of capital dredging material from the Clinton Bypass.

An investigation of environmental values undertaken for the QCLNG project established that the area supported sparse epifauna on both soft sediment and rocky substrates, leading to the conclusion that the disposal of spoil to the offshore disposal ground in continuation of previous practice (the site was established in 1980) was unlikely to lead to significant adverse environmental impacts.

Scenario Three: Spoil disposal arrangements for this scenario are the same as for Scenario One, although the timing of the MOF Stage Two works are more likely to align with spoil disposal to the FLNE rather than to the existing reclamation. The conclusions regarding potential impacts to MNES are as for Scenario One.

The Narrows: If a trenched construction method is adopted, spoil from the emplacement of the buried pipeline across The Narrows is also anticipated to be disposed either to the Fisherman's Landing area or to a licensed offshore site, and hence draws upon elements of the scenarios above. The other installation method under consideration, jetting, does not generate spoil, and thus the conclusion for this activity is the same as for Scenarios One to Three, that significant impacts to MNES are not expected.

As such, the proposed methods for the disposing of dredged materials from the QCLNG Construction Dock and Stages One and Two of the MOF construction are not considered to result in significant impacts to MNES.

2.6.3.2 Marine Mammals

One *EPBC Act*-listed Threatened Marine Mammal and six listed Migratory Marine mammals were predicted to occur within the area of the proposed Marine Facilities (refer to *Volume 5, Chapter 8* and *Annex 13.3* of the draft EIS for a complete list). Given the habitat preferences of the species listed, the Snubfin dolphin (*Orcaella heinsohni),* Indo-Pacific Humpback dolphin (*Sousa chinensis*), and dugong are considered the species most likely to be found within the Port of Gladstone.

Potential Impacts on Australian Snubfin Dolphin and Indo-Pacific Humpback Dolphin

The Australian Snubfin dolphin (*Orcaella heinsohni)* (previously listed as Irrawaddy dolphin, *Orcaella brevirostris)* and the Indo–Pacific Humpback dolphin *(Sousa chinensis)* together with the Bottlenose dolphin (*Tursiops aduncus*), are the only strictly coastal dolphin species found in northern Australia. Australian Snubfin dolphin and the Indo–Pacific Humpback dolphin are listed as rare under the *Queensland Nature Conservation Act 1992*, and are classified as Near Threatened by the International Union for Conservation of Nature (IUCN). They are both listed as ‘‘Cetacean’’ and ‘‘Migratory’’ species under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999.

Dolphins of the *Sousa* and *Orcaella* genera share a similar shallow coastal-water distribution in northern Australian and South-east Asia, with both occurring mainly in waters less than 15 m deep and greater than 5 km from shore. The Australian Snubfin dolphin was only recently described as a new species[18.] Recent genetic studies on Indo-Pacific Humpback dolphins indicate Australian populations may also represent a different species only found in Australia[19]. *Figure 13.2.3* and *Figure 13.2.4* illustrate the known distributions of the Indo-Pacific Humpback dolphin and Australian Snubfin dolphin.

Habitat and Distribution

Both the Indo-Pacific Humpback and Australian Snubfin dolphins inhabit coastal, estuarine, and occasionally riverine areas, in tropical and subtropical regions. The species occur mostly in waters less than 15 m deep and within 10 km of the coast and 20 km from the nearest river mouth[20].

Site fidelity and residence time in an area are important components in assessing potential risk from activities. Studies from Cleveland Bay (Townsville) have indicated that both species are not permanent residents. Rather, they both used the area regularly from year to year following a model of emigration and re-immigration. Individuals of both species spend periods of days to a month or more in coastal waters of Cleveland Bay before leaving, and periods of over a month outside the study area before entering the bay again[21]. Recent work by Cagnazzi *et al.* (2009)[22] at Tin Can Inlet found separate groups of Humpback dolphin; a northern group that appear to be

18 Beasley I, Robertson KM. and Arnold P. 2005. Description of a new dolphin, the Australian Snubfin Dolphin Orcaella heinsohni sp. n. (Cetacea, Delphinidae). Marine Mammal Science 21: 365-400

19 Frère CH. Hale PT, Porter ., Cockcroft VG and Dalebout ML. 2008. Phylogenetic analysis of mtDNA sequences suggests of Humpback dolphin (Sousa spp.) taxonomy is needed. Marine and Freshwater Research, 59: 259–268

20 Jefferson, T. A. and Karczmarski, L. 2001. Sousa chinensis. Mammal Species 655: 1-9.; Parra, G J. 2005. Behavioural ecology of Irrawaddy, Orcaella brevirostris (Owen in Gray, 1866), and Indo-Pacific Humpback dolphins, Sousa chinensis (Osbeck, 1765), in northeast Queensland, Australia: a comparative study. Ph.D. thesis, School of Tropical Environment Studies and Geography, James Cook Univ., Townsville; Corkeron PJ, . Morissette NM, . Porter LJ, and Marsh H. 1997. Distribution and status of Humpbacked dolphins, Sousa chinensis, in Australian waters. Asian Marine Biology 14: 49-59;

21 Parra GJ, Corkeron PJ and Marsh H. 2006. Population sizes, site fidelity and residence patterns of Australian Snubfin and Indo-Pacific Humpback dolphins: Implications for conservation. Biological Conservation, 129, 167–180

22 Cagnazzi DB, Harrison PL and Ross GJB. 2009. Abundance and site fidelity of Indo-Pacific Humpback dolphins in the Great Sandy Strait, Queensland, Australia. Marine Mammal Science unpublished.

permanent residents within a relatively small geographical area, and a southern group that ranged over a much wider area, the full extent of which was not determined but considered to be about 20 km.

Little is known about the local distribution and abundance of Humpback dolphin or Snubfin dolphins in the Port Curtis region apart from isolated records of mortalities and sightings. These records are:

- Humpback dolphin: a single specimen found dead in 2003, two in 2004 and two in 2005
- Snubfin dolphin: a single juvenile specimen found dead in 2007.

The results of GPC's aerial and boat-based surveys[23], which covered an area from north of Curtis Island to south of Rodds Bay, are consistent with current literature that acknowledges the importance of Rodds Bay as a key habitat area for significant marine megafauna species. A total of 163 Indo-Pacific Humpback dolphins and 81 dugong were observed. The surveys identified a range of age classes using the region, suggesting that it is not only an important foraging area but an area important for calving of these marine mammals. No Australian Snubfin dolphins were observed.

The low number of Snubfin dolphin records and the lack of sightings from surveys suggest that they are irregular visitors to the port rather than resident in the port area.

23 GPC Wester Basin Dredging Project Draft EIS

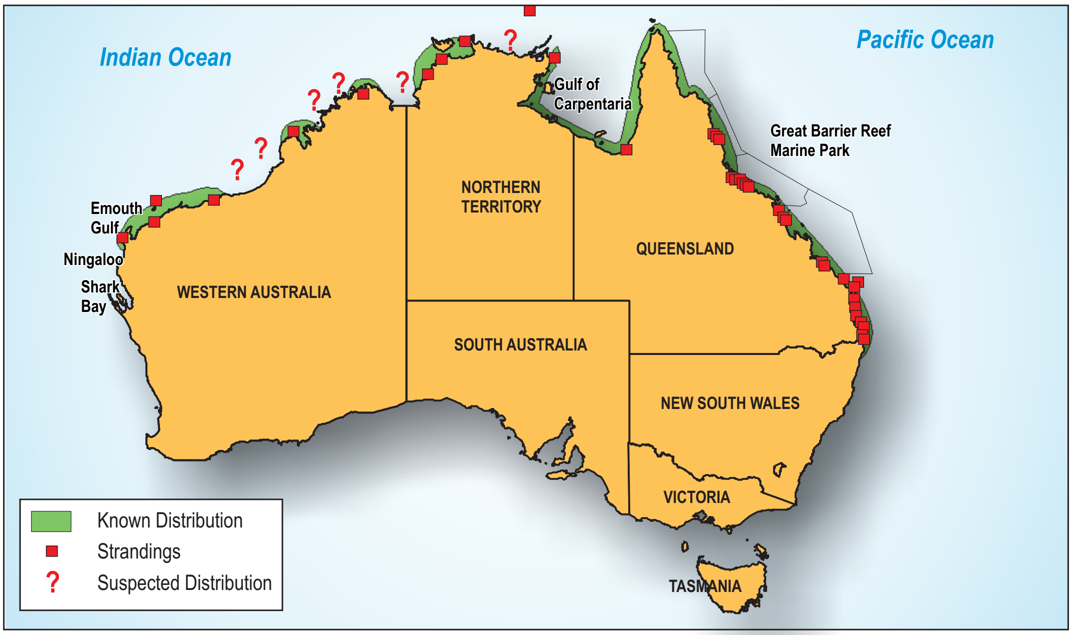

Figure 13.2.3 - Known and Suspected distribution of *Sousa chinensis* in Australian waters

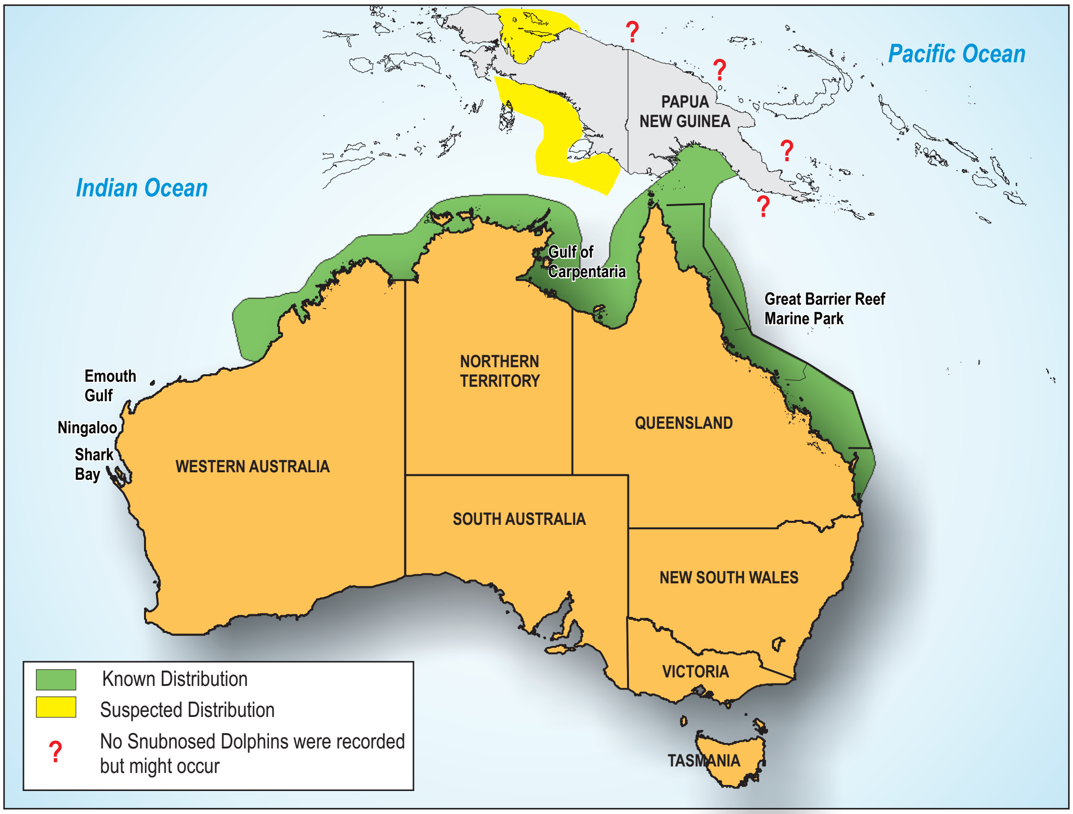

Figure 13.2.4 - Known and suspected distribution of *Orcaella heinsohni* in Australian waters

Source:
Parra GJ, Corkeron PJ and Marsh H. 2004.
The Indo-Pacific Humpback Dolphin, Sousa chinensis (Osbeck, 1765), in Australian Waters: A Summary of Current Knowledge.
Aquatic Mammals, 30(1), 197-206
Beasley I, Robertson, KM and Arnold P. 2005.

0 500 1000 km

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Project	Queensland Curtis LNG Project		
Client	QGC - A BG Group business		
Drawn	JB	sEIS Volume 13	Figure S13.2.3 & S13.2.4
Approved	RS	File No: 0086165b_SUP_CDR004_S13.2.3_S13.2.4	
Date	20/01/10	Revision 0	

Title: Known and Suspected Distribution of Dolphin in Australian Waters

Feeding Ecology

Little information exists on the feeding habits of Humpback dolphins and Snubfin dolphins. The following text is taken directly from Parra *et al.* (2009), which is the only known study of their feeding habitats[24]. Snubfin and Humpback dolphins appear to be opportunistic-generalist feeders, eating a wide variety of fish and cephalopods associated with coastal-estuarine waters. Bottom-dwelling and pelagic fishes were consumed by both species, indicating Snubfin and Humpback dolphins capture fish throughout the water column. Humpback dolphins appear to feed primarily on fish, while Snubfin dolphins also included cephalopods in their diet. The most important prey in numerical terms for Snubfin dolphins was the Cardinal fish, Cuttlefish and the Tooth Pony fish. Grunts, Cardinal fishes and Smelt-whitings were found to be the most important fish prey for Humpback dolphins. Several fish prey, including the most important, were common in the diet of both dolphin species indicating some partial dietary overlap. Differences in diet likely reflect some of the morphological and ecological differences between both species. The diet of Snubfin and Humpback dolphins included taxa that are targeted by net and trawling fisheries in Queensland. Interactions with these fisheries are expected, particularly in areas where fishing operations overlap with dolphins' high-use areas.

Population Size

There are no current estimates of population sizes for either the Indo-Pacific Humpback dolphin or Australian Snubfin dolphin in Australian waters. The few available estimates of abundance for both species throughout their range indicate that populations of both species tend to be small. Riverine populations of Snubfin dolphin are all below 100 individuals with the total species population number likely to be in the 1,000s rather than 10,000s[25].

The sparse data available for selected areas indicate that Humpback dolphins occur in discrete, geographically localised populations. Key localities include Moreton Bay, Queensland, and the lower reaches of the Brisbane River and adjacent offshore waters, where a resident population occurs in water less than 10 m in depth, and offshore to 6 km. Tin Can Inlet, Queensland, features a group estimated to number approximately 150 individuals[26].

The Indo-Pacific Humpback dolphin has been found by recent surveys[27] to be the most common coastal dolphin in the Port Curtis area with observed distribution from north of Curtis Island to south of Rodds Bay. In contrast no Snubfin dolphin was observed and the only record of the species in the region is a single juvenile specimen found dead in 2007. Given the low number of

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24 Parra, G. J. and Jedensjö, M. (2009) Feeding habits of Australian Snubfin (Orcaella heinsohni) and Indo-Pacific Humpback dolphins (Sousa chinensis). Project Report to the Great Barrier Reef Marine Park Authority, Townvsille and Reef & Rainforest Research Centre Limited, Cairns (22pp.).

25 Parra GJ, Corkeron PJ and Marsh H. 2006. Population sizes, site facility and residence patterns of Australian Snubfin and Indo-Pacific Humpback dolphins: Implications for conservation. Biological Conservation, 129, 167-180

26 Cagnazzi DB, Harrison PL and Ross GJB. 2009. Abundance and site fidelity of Indo-Pacific Humpback dolphins in the Great Sandy Strait, Queensland, Australia. Marine Mammal Science unpublished.

27 GPC Wester Basin Dredging Project Draft EIS

Snubfin dolphin records and the lack of sightings from surveys, it is considered unlikely that the Snubfin dolphin occurs in the port other than as a transitory or irregular visitor.

Impact Assessment

Habitat

The QCLNG Project will cause direct loss of up to 0.03 per cent of seagrass meadows with indirect and temporary disturbance to approximately 4 to 7 per cent of seagrass meadows, depending on the dredging scenario, which form a part of the feeding area of the dolphins as well as habitat for their prey species. The loss of habitat is not considered to represent a significant impact for either the Indo-Pacific Humpback dolphin or the Australian Snubfin dolphin.

Underwater Noise

The predicted levels of underwater noise are discussed *Section 2.6.3.1.* This indicates that sound levels from all sources will be below the level at which possible injury might occur to either the Indo-Pacific Humpback dolphin or the Snubfin dolphin.

The frequencies of communications produced by the Indo-Pacific Humpback dolphins include whistles (1.2-16 kHz)[28] and broad band clicks (2-22 kHz)[29] (no data is available for the Snubfin dolphin and it is assumed that their hearing range is similar to the Humpback dolphin). This overlaps the upper range of frequencies emanating from piling and approximately coincides with frequencies emanating from boat traffic.

Würsig *et al*. (2000)[30] recorded the impact of pile driving (6 m to 8 m water depth) on Humpback dolphin behaviour. No overt behavioural changes were observed in response to the pile-driving activities, but the animals' speed of travel increased and some dolphins remained within the vicinity while others temporarily abandoned the area. The noise levels for piling associated with the QCLNG Project are predicted to have a behavioural effect on dolphins out to about 200 m from the source. The predicted outcome is that Humpback dolphins and any Snubfin dolphins will avoid approaching within about 200 m of piling activity, the significance of this temporary displacement from a small portion of habitat is considered to be slight.

The source levels of noise emanating from vessels are below the threshold for avoidance and it is predicted that although there may be some occasions of behavioural avoidance, the significance of this will be slight.

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28 Schultz, K.W. and Corkeron, P.J. (1994). Interspecific differences in whistles produced by inshore dolphins in Moreton Bay, Queensland, Australia. Canadian Journal of Zoology 72: 1061-1068, cited in Ross GB (2006) Review of the Conservation Status of Australia's smaller Whales and Dolphins

29 Van Parijs, S. and Corkeron, P.J. (2001). Boat traffic affects the acoustic behaviour of Pacific Humpbacked dolphins Sousa chinensis. Journal of the Marine Biological Association of the United Kingdom 81: 533-538, cited in Ross GB (2006) Review of the Conservation Status of Australia's smaller Whales and Dolphins

30 Würsig, B., Greene, C.R. and Jefferson, T.A. (2000) Development of an Air Bubble Curtain to Reduce Underwater Noise of Percussive Piling. Marine Environ. Res., 49, 79–93

Vessel Interactions

Collisions between dolphins and vessels are relatively rare, due to the speed and mobility of dolphins, but have been recorded. Small inshore dolphins are most vulnerable to high-speed vessels[31] however, they are not considered to be at risk from collision with larger slower-moving ships.

In a recent study of vessel movements in Port Curtis, Alquezar[32] identified total traffic in the vicinity of Auckland Point, the Calliope River and The Narrows as averaging 128 to 183, 37 to 98, and 20 to 37 movements during daylight hours, for weekdays and weekends, respectively. Numbers were observed to rise significantly higher than this during fair weather, and the daylight-only survey frame clearly underestimated total port movements.

Alquezar also noted that 42 to 81 per cent of all vessel movements (across all parts of the port) were at planing speed or greater.

Ferries and delivery barges will be used during construction and operation phases of the QCLNG Project. These will travel between Auckland Point or RG Tanna and the Curtis Island site, a distance of about 5 to 7 km.

Very few of the vessel movements arising from QCLNG Project maritime traffic will travel faster than displacement speed, and QCLNG peak vessel movements during construction are expected to produce an increase in movements of approximately 12 per cent, and during LNG Facility operations by less than 5 per cent. It is therefore considered QCLNG traffic is unlikely to significantly increase the risk of collisions with marine fauna.

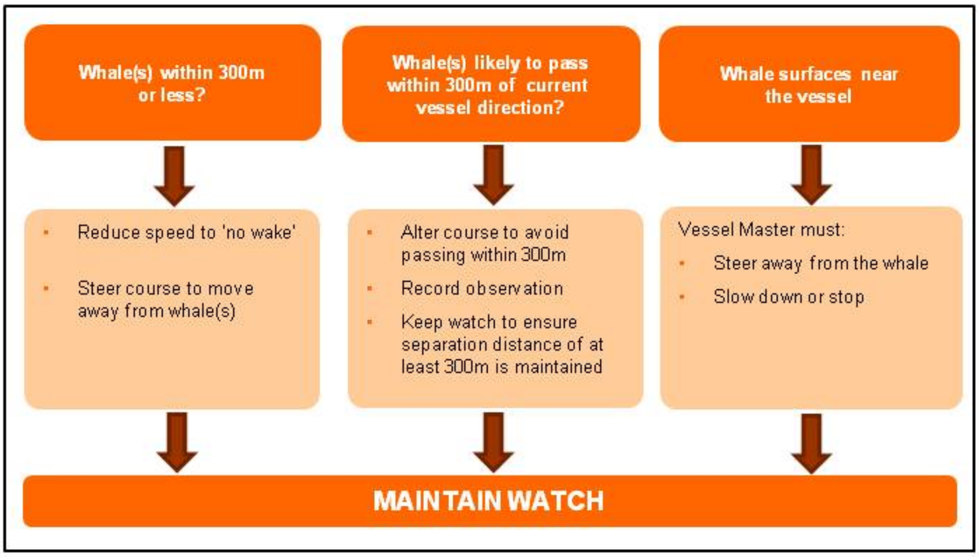
Although the likelihood of collision is low, the protocol illustrated in *Figure 13.2.5* will be implemented to further reduce the potential for collisions with dolphins.

31 Ross GB (2006) Review of the Conservation Status of Australia's smaller Whales and Dolphins

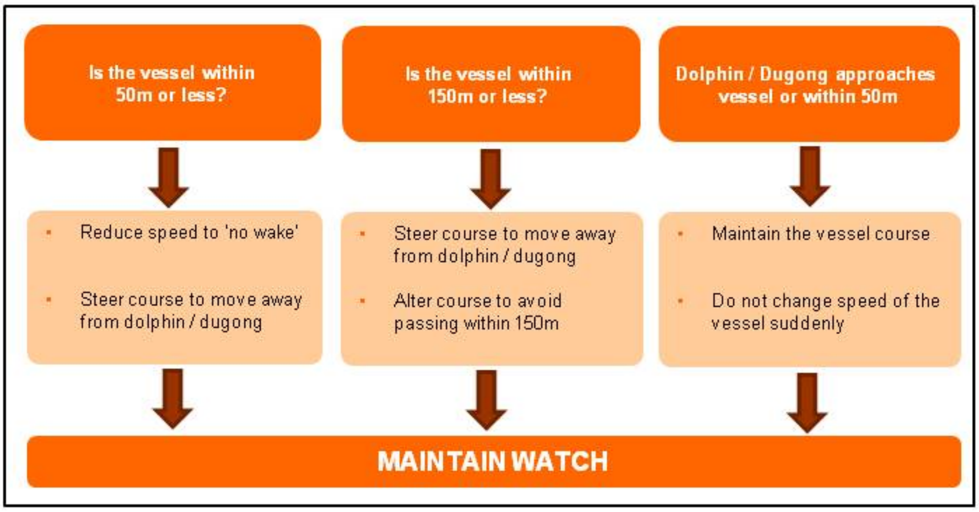
32 Alquezar, R (2009). Maritime Harbour Movements of Port Curtis 2009. A report to BG-LNG. Centre for Environmental Management, CQ University, Gladstone, Australia.

Figure 13.2.5 Protocol for avoiding vessel – whale/dolphin/dugong collisions

Whale sighting



Dolphin / Dugong sighting



Conclusion

Based on predicted levels of habitat disturbance, vessel activity and underwater noise, it is considered unlikely that the cetacean populations in the Port of Gladstone will be significantly impacted on by dredging and material disposal activities for the QCLNG Project.

Specifically, the scale of loss of seagrass habitat is not considered to represent a significant impact upon either the Indo-Pacific Humpback dolphin or the Australian Snubfin dolphin. Underwater noise from all sources is predicted to be below the level at which possible injury might occur to the either the Indo-Pacific Humpback dolphin or the Australian Snubfin dolphin.

Similarly, underwater noise from all sources is predicted to be below the thresholds for avoidance in these dolphin species, and although occasional behavioural avoidance may occur, the significance of this is considered to be minor. The likelihood of collisions between dolphins and vessels used in QCLNG operations is considered low. However, protocols to further reduce potential collisions will be implemented.

Potential Impacts on Dugong

Habitat

Dugongs are known to utilise seagrasses within Port Curtis. In particular, seagrasses in this area have been declared locally significant on the basis of dugong feeding behaviour. Loss of about 0.02 per cent of seagrass meadow habitat is predicted to occur through direct impacts of dredging. A further 4 to 7 per cent of seagrass meadows (depending on the dredging scenario) will be indirectly affected with a predicted temporary loss or reduction in seagrass biomass due to dredging activities.

The total area of seagrass that would be directly affected is approximately 2 ha. Relative to the approximately 6,200 ha of seagrass meadows present within the Port Curtis area, the direct loss of seagrasses from the QCLNG Project is considered negligible and the subsequent indirect effect on dugong in the area is negligible.

Dredged sediment dispersion modelling indicates that the indirect effects of dredging (increased levels of suspended solids in the water column) on seagrass habitat will potentially extend over an area of between 360 ha and 430 ha, depending upon the dredging methodology, but the loss of habitat within these areas is predicted to be temporary, and it is expected that seagrasses will recover in these areas within one to three years of the cessation of dredging. The indirect effects on seagrasses from the QCLNG Project is considered minor and the subsequent indirect effect on dugong in the area is minor.

Population size

As discussed in the draft EIS (*Volume 5, Chapter 8 section 8.3.2.7*) a survey conducted in November 2005 estimated there were 183 (± 66) dugongs in the Port of Gladstone area[33]; dugong feeding activity was observed on the majority of intertidal seagrass meadows surveyed during a study of benthic habitats in the port[34].

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33 Marsh H and Lawler I R (206) ***Dugong distribution and abundance on the urban coast of Queensland: a basis for management.*** Marine and Tropical Science Research Facility Interim Projects 2005-06 FINAL Report Project 2.

34 Rasheed M A, McKenna S A, Taylor H A and Sankey T L (2008) ***Long term seagrass monitoring in Port Curtis and Rodds Bay, Gladstone – October 2007***. DPI&F Publication PRO7-3271 (DPI&F, Cairns), 32 pp.

Underwater Noise

There have been very few studies into the hearing ability of dugongs. Initial research results into their auditory physiology have highlighted some significant anatomical differences between manatees and dugongs[35], but because of the absence of studies on the dugong it is often assumed that hearing range and sensitivities are approximately equal to the manatee. The manatee has peak frequency sensitivity at 16 and 18 kHz with a lower limit of 400 Hz and an upper limit of functional hearing at about 46 kHz[36]. From this it can be inferred that dugongs are unlikely to be disturbed by noise from dredging or shipping activities. Interestingly the limited low-frequency hearing sensitivity may be responsible for the observed low level of response to boating traffic[37] discussed below.

Vessel Interactions

At present, few dugongs are killed by boats, however, increasing vessel traffic in dugong habitat increases their risk[38]. A recent study of the short-term behavioural responses of dugongs to boats[39] found that the majority of observed dugongs did not visibly react to experimental boat passes unless the boat was within approximately 50 m. Most observations of responses to boats were limited to shallow water (<2 m). This result is consistent with the results of a Florida trial[40] carried out using a powerboat to make multiple runs through a group of manatees, which found that the manatees began reacting to the approaching boat at about the same distance (50 m to 60 m) irrespective of boat speed.

Shipping and ferry activity will be conducted in deeper waters that do not support seagrass meadows, therefore the likelihood of both disturbance to dugongs and vessel collision with dugongs is reduced to encounters with transitory animals. The discussion in *Chapter 8.15.4* regarding patterns of vessel movements within Port Curtis is also relevant for assessing potential impacts to dugong populations. As such, given Project vessel numbers and their low speeds compared to the existing traffic, the likelihood of Project vessel interactions with the Port Curtis dugong population is considered to be low. Although the likelihood of collision is low, the protocols illustrated in

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35 Patton GW, Gerstein ER, Domming DP, Sutherland M and Perinetti R (1992) An Annotated Bibliography of Sirenian Hearing, Mote Marine Laboratory Report No. 272. https://dspace.mote.org:8443/dspace/bitstream/2075/51/1/272.pdf, accessed December 2009

36 Gerstein ER, Gerstein L, Forsythe SE and Blue JE (1999). The underwater audiogram of the manatee (Trichechus manatus), Journal of the Acoustical Society of America 150(6): 3575-3583.

37 Hodgeon AJ and Marsh H (2007). Response of dugongs to boat traffic: The risk of disturbance and displacement, Journal of Experimental Marine Biology and Ecology 340 (1): 50–61.

38 DEWHA (2009) Dugong Fact Sheet http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?showprofile=Y&taxon_id=28 accessed December 2009.

39 Hodgson AJ and Marsh H (2007). Response of dugongs to boat traffic: The risk of disturbance and displacement, Journal of Experimental Marine Biology and Ecology 340 (1): 50–61.

40 Weigle, B.L., Wright, I.E. & Huff, J.A. 1994, 'Responses of manatees to an approaching boat: a pilot study', in Proceedings of the First International Manatee and Dugong Research Conference, held at Gainesville Florida, 11–13 Marsh 1994 cited in Preen T. Dugongs, Boats, Dolphins and Turtles in the Townsville-Cardwell Region and Recommendations for a Boat Traffic Management Plan for the Hinchinbrook Dugong Protection Area, Report to the Great Barrier Reef Marine Park Authority, http://www.gbrmpa.gov.au/__data/assets/pdf_file/0004/2938/preen.pdf accessed December 2009.

Figure 13.2.5 will be implemented to further reduce the potential for collisions with dugongs.

Conclusions

It is considered unlikely that the QCLNG Project would lead to a significant impact on dugong populations found in Port Curtis. This is because of the low level of disturbance caused by the Project and because the population size is considered to be large enough, and wide ranging enough, that they will be buffered from the localised impacts.

2.6.3.3 Marine Reptiles

From a search of the EPBC Protected Matters database, six listed Threatened and Migratory Marine reptiles and one listed Migratory Marine reptile were predicted to occur within the area of the proposed LNG Marine Facilities.

Potential Impacts on Turtles

Habitat

The Green turtle (*Chelonia mydas*); Loggerhead turtle (*Caretta caretta*); and Flatback turtle (*Natator depressus*) are known to occur in Port Curtis, nesting occasionally on the beaches of Curtis Island and Facing Island. However, there are no known turtle-nesting beaches within close proximity (within 5 km) to the proposed QCLNG Project and therefore there are no direct impacts predicted to nesting habitat.

Green turtles have been regularly observed within local seagrass meadows, particularly those on Pelican Banks (eastern side of Curtis Island) (Taylor *et al.* 2007).

Leatherback turtles (*Dermochelys coriacea*), Hawksbill turtles (*Eretmochelys imbricata*) and Olive Ridley turtles (*Lepidochelys olivacea*) are not known to nest in the Port Curtis area. Individuals may migrate through the area, but significant numbers of them are unlikely in the Project area.

Underwater Noise

The sea turtle's auditory canal consists of cutaneous plates underlain by fatty material at the side of the head which serves the same function as the tympanic membrane in the human ear. From previous research it is evident that sea turtles can detect sound, and that their hearing is confined to lower frequencies, mainly below 1,000 Hz[41]. Studies using auditory brainstem responses of juvenile Green and Ridley's turtles and sub-adult Green turtles showed that juvenile turtles have a 100 to 800 Hz bandwidth, with best sensitivity between 600 and 700 Hz, while adults have a bandwidth of 100 to

41 Bartol, S.M., Musick, J.A. and Lenhardt, M.L. 1999. Auditory evoked potentials of the Loggerhead sea turtle (Caretta caretta). Copeia 3: 836–840.

500 Hz, with the greatest sensitivity between 200 and 400 Hz[42]. This band of hearing sensitivity approximately coincides with the frequencies emanating from pile-driving operations and overlaps the lower frequencies emanating from vessel activities.

Little is known about the source levels and associated frequencies that will cause physical injury to turtles. Studies by Keevin and Hempen (1997)[43] on the effects of explosions on turtles recommend that an empirically based safety range developed by Young (1991)[44] be used for guidance. Using Young's safety range formula and converting back to sound pressure levels, a conservative value of 222 dB re 1µPa @1 m is obtained for adult turtles and 198 dB re 1µPa^{2}s for hatchlings. Based on these assumed thresholds adult turtles are likely to be unaffected, however, it is possible that hatchlings within about 55 m of the piling operations may suffer physiological harm. The locations of piling operations are some 5 to 10 km distant from turtle-nesting beaches and in opposite direction from the likely pathway of hatchlings as they move to sea from the nesting beaches. Therefore although hatchlings may be theoretically susceptible, the probability of them being in the zone of potential impact is low.

The only known data addressing threshold shift in turtles is from a study conducted by Eckert et al. (2006)[45] on Leatherback turtles. This study demonstrated that when exposed to repetitive high-level acoustic energy impulses greater than 185 dB re 1 µPa the tested turtles suffered temporary threshold shift and eventually permanent threshold shift[46]. The likelihood of turtles approaching to within such a close range of piling operations and remaining there for several hours is considered to be very low and consequently the potential for threshold shift is also considered to be low.

Sea turtles have been recorded as demonstrating a startle response to sudden noises[47]. However, no information is available regarding the threshold level necessary for behavioural effects. In the case of pulsed low frequency sound effects on turtle-nesting behaviour, nest numbers were monitored on beaches near the Port of Hay Point (Queensland) before, during and after a pile-driving program lasting several months in 1996-97. Results showed no significant trend in nest numbers, indicating that the female turtles had not

42 Bartol, S.M. 2006. Turtle and Tuna Hearing, Woods Hole Oceanographic Institute, NOAA Technical Memorandum NMFS PIFSC 7, MA, USA; Ketten, D.R. and Bartol, S.M. 2005. Functional Measures of Sea Turtle Hearing. Woods Hole Oceanographic Institute, MA, USA

43 Keevin, T.M. and Hempen, G.L. 1997. The environmental effects of underwater explosions with methods to mitigate impacts. US Army Corps of Engineers, St. Louis District.

44 Young, G.A. 1991. Concise methods for predicting the effects of underwater explosions on marine life. NAVSWC No. 91-22. Naval Surface Warfare Centre, Silverspring, Maryland, USA. Cited in Keevin and Hempen (1997).

45 Eckert S., Levenson D.H. and Crognale M.A. 2006. The sensory biology of sea turtles:what can they see, and how can this help them avoid fishing gear?.pp in Swimmer Y. and Brill R. (eds) Sea Turtle and Pelagic Fish Sensory Biology: Developing Techniques to Reduce Sea Turtle Bycatch in Longline Fisheries

46 It should be noted that the study was based on a small sample of Leatherback turtles, the results are based on airborne noise (not underwater noise), and it is unlikely that a turtle would (in an uncontrolled situation) be exposed to multiple high intensity noise impulses from piling operations

47 Lenhardt, M.L., Bellmund, S., Byles, R.A., Harkins, S.W. and Musick, J.A. 1983. Marine Turtle reception of bone conducted sound. Journal of Auditory Research 23: 119–1125.

been particularly sensitive to this pulsed source[48], but nest numbers were too few to provide a conclusive result. McCauley *et al*. (2000)[49] conducted controlled exposure experiments on a Loggerhead turtle and a Green turtle to monitor behavioural response to approach by an airgun, which generates similar sound characteristics to that of piling. They found two types of response:

- Above a received noise intensity of approximately 155 dB re 1 μPa^2-s the turtles began to noticeably increase their swimming speed
- Above a received noise intensity of approximately 164 dB re 1 μPa^2-s the turtles began to show more erratic swimming pattern, possibly indicative of them being in a distressed state.

Based on these assumed thresholds for avoidance, turtles within 160 m to 1500 m of the piling operations may be expected to demonstrate a level of behavioural avoidance during piling. During shipping operations the area within which behavioural avoidance may occur is predicted to be in the order of 160 m and during dredging about 55 m from the dredge. The area affected is not considered to represent important habitat for turtles and the significance of potential avoidance over a relatively short period of construction is considered to be minor.

Loss of Habitat

The total area of seagrass that would be directly affected is approximately 2 ha. Relative to the approximately 6200 ha of seagrass meadows present within the Port Curtis area, the direct loss of seagrasses and the subsequent indirect effects on turtles from the QCLNG Project is considered negligible.

Conservative dredged sediment dispersion modelling indicates that the indirect effects of dredging (increased levels of suspended solids in the water column) on seagrass habitat may potentially extend over an area of between 360 ha to 430 ha, depending upon the dredging methodology, but the loss of habitat within these areas will be temporary, and it is expected that seagrasses will regrow in these areas within one to three years of the cessation of dredging. The effect on any turtles in the area is therefore considered minor.

Light

Potential light impacts to turtles from construction activities are mainly associated with the operation of support and construction vessels in the near-shore areas of Curtis Island. The consequences of potential light impacts to turtles associated with the operation of support and construction vessels in the

48 URS LeProvost Dames and Moore, in association with WBM Oceanics Australia 2001, Port of Weipa, Long Term Dredge Material Management Plan, Report on Phase Three (Stage 2) Monitoring Program, URS, Brisbane.

49 McCauley, R.D., Fewtrell, J., Duncan, A.J., Jenner, C., Jenner, M-N., Penrose, J.D., Prince, R.I.T., Adhitya, A., Murdoch, J. and McCabe, K. 2000. Marine Seismic Surveys – A Study of Environmental Implications. Australian Petroleum Production and Exploration Association Journal 2000: 692–708

near-shore areas is predicted to be negligible given the low levels of light, the transitory nature of the disturbance and the distance from nesting beaches.

Lighting associated with the operation of the onshore facilities and marine facilities represents a source for potential impacts to turtles. There is no line of sight between the QCLNG Project and nesting beaches, therefore the impact would only accrue to feeding or transitory animals. Potential light impacts to the local turtle population are considered to be negligible, given the disruption to a small portion of the population.

Vessel Interactions

The interaction between turtles and the Project vessels has the potential to cause injury or mortality to individual animals via direct striking or entrapment/entrainment. The discussion in *Section 2.7.4* above regarding patterns of vessel movements within Port Curtis is also relevant for assessing potential impacts to turtle populations. Given the Project vessel numbers and their low speeds compared to existing traffic, the likelihood of vessel-turtle interactions is considered to be low. However, in line with good practice a range of mitigation measures are proposed to further reduce the risk of impact to turtles. These include the collision avoidance protocol presented in *Figure 13.2.4* and measures described in the Draft Dredge Management Plan (*Appendix 6.1*) which include:

- Vessel speed limits will be applied to vessels operating within the construction area to reduce the risk of vessel strikes on marine mammals.
- During barge transport of dredged material, a lookout for marine turtles will be maintained by dredge crew. In the event that a marine turtle is sighted, the vessel speed and direction will be altered as necessary to avoid impact with the marine turtle (within safety constraints).
- Where practicable, barges will use consistent routes during offshore disposal.
- Adopt ‘‘slow start’’ procedure for dredges to alert turtles and potentially deter them before the cutter head is started.
- At times where the cutter head of the CSD is raised while the dredge pumps are still running (for example, during the pipeline flushing as part of normal operations), the cutter head will remain operational (that is, this continue to rotate) to act as a deterrent to any marine turtles in the vicinity of the dredge and reduce the risk of entrainment within the dredging equipment.
- In the event that the dredging or spoil disposal activities result in injury or mortality to two or more marine turtles, a review of the current management measures will be undertaken in consultation with a marine turtle specialist to identify potential additional management measures.

Conclusions

It is considered unlikely that the QCLNG Project would lead to a significant impact on EPBC-listed turtle species found in Port Curtis. This is because of the low level of disturbance likely to be caused by the Project and the distance to sensitive nesting beaches.

2.6.3.4 *Ray-Finned Fish*

A total of 33 species of syngnathid (seahorse and pipefish) were identified in the *EPBC Act* Protected Matters Report (see *Annex 5.3* of the draft EIS) and have the potential to inhabit the inshore environment of the Port of Gladstone. Syngnathids are occasionally associated with marine structures and potentially inhabit the seagrass communities within the Port of Gladstone.

Potential Impacts on Syngnathids

Underwater Noise

The capacity for hearing in syngnathids, is not well understood and there are no known audiograms of syngnathids. Many syngnathids have been documented to produce sound (loud clicks), suggesting that sound is important for communication in the aquatic environment[50] (. The function of clicks may be associated with mating, to co-ordinate spawning or to advertise prey availability. Among these contexts, feeding clicks are the most widely noted. For two species of seahorse studied, peak frequency measurements were highest between 2,650 to 3,430 Hz for Dwarf seahorse (*Hippocampus zosterae*), and 1,960 to 2,370 Hz for Lined seahorse (*Hippocampus erectus*)[51]. The frequency of noise-making suggests that hearing sensitivity is the greatest in the higher frequency ranges and, by extension that the least sensitivity is in the lower frequency range.

Syngnathids possess a swim bladder that is used for both communication and buoyancy. It is the swim bladder of the fish, which is a gas-containing organ, that will expand and contract with a rapidly changing acoustic field and as a result may cause physical injury. The important metric when determining syngnathid susceptibility to physical injury is its body mass, and hence the juveniles are most susceptible to physical injury from a pressure wave.

Using Young's[52] safety range formula and converting back to sound pressure levels, and a conservative value for a nominal body mass of 7 g, it can be expected that an SEL of between 198 and 203 dB re 1μPa^2.s will result in a 50 per cent risk of physical injury to seahorses and pipefish. By comparing this theoretical sensitivity to the results of the underwater noise modelling undertaken for the QCLNG Project, it can be inferred that dredging and marine operations will not cause physical harm to syngnathids. Seahorse and pipefish within about 50 m of the piling operations may be at risk of physical injury.

50 Bergert, B. and. Wainwright WC. (1997). Morphology and kinematics of prey capture in the syngnathid fishes Hippocampus erectus and Syngnathus floridae. Mar. Biol. 127: 563–570; Colson, D., Sheila P., Brainerd E. and Lewis S. (1998). Sound production during feeding in Hippocampus seahorses (Syngnathidae). Environmental Biology of Fishes, 51: 221-229; Ripley JL. and Foran CM. (2006). Differential parental nutrient allocation in two congeneric pipefish species (Syngnathidae: Syngnathus spp.) J. Exp. Biol; 209(6): 1112 - 1121.

51 Colson, D., Sheila P., Brainerd E. and Lewis S. (1998). Sound production during feeding in Hippocampus seahorses (Syngnathidae). Environmental Biology of Fishes, 51: 221-229

52 Young, G.A. 1991. Concise methods for predicting the effects of underwater explosions on marine life. NAVSWC No. 91-22. Naval Surface Warfare Centre, Silverspring, Maryland, USA. Cited in Keevin and Hempen (1997).

However the likelihood of syngnathidae species being in such close proximity to the piling operations is very low due to the unsuitable habitat in the areas to be piled.

Loss of Habitat

The distribution of the listed syngnathidae species has been determined based on occurrence within IMCRA Bioregions as an indicator of whether suitable habitat is likely to occur in the Port Curtis area. The majority of listed pipefish are recorded to occur in reef areas, the exceptions being the Tiger pipefish, Short-bodied pipefish and Girdled pipefish, and hence are unlikely to be affected by Project-related impacts. Several of the listed seahorse species inhabit shallow seagrass ecosystems and consequently these species, and those pipefish that also inhabit seagrass areas, may be adversely affected by the direct or temporary loss of seagrass habitat.

The total area of seagrass that would be directly affected is approximately 2 ha. Relative to the approximately 6,200 ha of seagrass meadows present within the Port Curtis area, the direct loss of seagrasses from the QCLNG Project is considered negligible and the subsequent indirect effect on the populations of listed syngnathidae species in the area is negligible.

Dredged sediment dispersion modelling indicates that the indirect effects of dredging (increased levels of suspended solids in the water column) on seagrass habitat will potentially extend over an area of between 360 ha and 430 ha, depending upon the dredging methodology, but the loss of habitat within these areas is predicted to be temporary, and it is expected that seagrasses will regrow in these areas within one to three years of the cessation of dredging. The effect on any of the listed syngnathidae species that may be present within these areas is therefore considered minor.

Conclusions

It is considered unlikely that the QCLNG Project would lead to a significant impact on EPBC-listed syngnathidae species that may be present in Port Curtis. This is because of the limited area of disturbance likely to be caused by the Project and because of the temporary nature of the disturbance.

2.6.3.5 Conclusion

From the above assessment and the findings of the draft EIS and sEIS, it is concluded that actions under EPBC Referral 2008/4401 are not considered to cause significant impacts, as specified in the DEWHA MNES EPBC Policy Statement 1.1, to World Heritage, National Heritage Places, listed Threatened species and communities or listed Migratory species.

2.6.4 *EPBC 2008/4402 – LNG Plant and Associated Onshore Facilities*

2.6.4.1 *Marine environment*

The draft EIS presented results of near- and far-field numerical modelling of the reverse osmosis concentrate (ROC) and wastewater (primarily sewage) discharges from secondary treatment of sewage from the LNG Facility.

Near- and far-field modelling was undertaken for salinity, total nitrogen and total phosphorous concentrations, focusing on discharges at the peak of construction, when rates of discharge would be anticipated to be at a maximum.

The modelling results indicated that maximum far-field salinity increase in the order of 0.28 g/L, which given background levels of more than 35 g/L and also natural variability in levels, will be negligible. For nutrient concentrations, the modelling indicated a very localised increase immediately adjacent to the discharge point of approximately 40 per cent for total nitrogen and 100 per cent for total phosphorous. Dilution and dispersion of the discharge will be enhanced by the design of the outfall. The concentration of total nitrogen reduced to approximately 0.5 per cent above background within 200 m of the discharge point and total phosphorous reduced to approximately 1 to 2 per cent above background concentrations within 200 m of the discharge point. These concentrations are within the range of background variability, will occur for approximately six months during the construction period, and hence are considered unlikely to cause significant effects on water quality.

As a result of the increase in the numbers of construction personnel from that described in the draft EIS, the peak rate of sewage effluent discharge may increase from the 4.0 l/s modelled for the draft EIS to approximately 7.5 l/s. This peak rate of discharge will occur for a limited period of up to six months.

QGC is currently investigating treatment of sewage effluent to a standard meeting the definition of tertiary treated sewage specified by sub-regulation 135(3) of The Great Barrier Reef Marine Park Regulations 1983 (Statutory Rules 1983 No. 262 as amended) prior to discharge from the LNG Facility site. This is subject to ongoing assessment of treatment technologies. On this basis, notwithstanding the increase in discharge rate from that modelled in the draft EIS, the peak nutrient flux (mg/s) is not expected to increase from that described in the draft EIS, and thus the outcomes of the near- and far-field modelling undertaken for the draft EIS and summarised above remain a valid representation of peak (worst case) loads. As such, significant impacts to the marine environment and hence to World Heritage, National Heritage Places, and listed Threatened species and communities are not anticipated.

2.6.4.2 *Migratory Birds*

Targeted surveys for EPBC-listed Migratory shorebirds were conducted at roosting and foraging sites at or near the LNG Facility site in September 2009. The results of these surveys supplement previous information gathered during the October 2008 and February 2009 shorebird surveys for the QCLNG Project.

The survey aimed to confirm the presence and estimated numbers of the following shorebirds, which may utilise the intertidal area adjacent to the LNG Facility for foraging or roosting:

- Eastern Curlew *(Numenius madagascariensis)*
- Bar-tailed Godwit *(Limosa lapponica)*
- Whimbrel *(Numenius phaeopus)*
- Common Greenshank *(Tringa nebularia)*
- Red-necked Stint *(Calidris ruficollis).*

Survey Results

Twelve species of shorebird were recorded during the survey, including four resident and eight migratory species (see *Table A5 of Appendix 5.2*). Two threatened species (Beach Stone-Curlew and Eastern Curlew) listed in the *Nature Conservation (Qld) Act* and eight migratory species listed in the Commonwealth *EPBC Act* were recorded. One species that had not been recorded in the study area during previous surveys, the Curlew Sandpiper, was recorded in September 2009. The Curlew Sandpiper is listed as a migratory species in the *EPBC Act*.

Twelve high-tide roosts were sampled during the survey period. During this time the maximum number of shorebirds roosting at the LNG Facility site was around six.

Seven species of migratory shorebird were recorded at low-tide foraging areas on the mainland and at the LNG Facility site. Thirteen individuals were recorded at the LNG Facility site and immediately adjacent mudflat during both low-tide surveys, with the Eastern Curlew and Whimbrel being the most widespread species.

Impact of the LNG Facility on Shorebirds

Data collected during the field surveys show that the LNG Facility site and immediately adjacent intertidal habitat support a very small proportion of the migratory shorebird population in Port Curtis (0.003 per cent).

Although the section of intertidal foraging habitat immediately adjacent to the LNG Facility site has not been sampled during the early summer period (December) when shorebird numbers may peak, the available counts are representative. Even if it were assumed that during peak times the number of shorebirds foraging adjacent to the site was double that recorded in October 2008 and September 2009 the relative proportions are still insignificant. The counts derived for the subject site in October 2008, February and September 2009 are considered reliable. While the proposed LNG Facility may render the claypan habitat unsuitable for shorebirds, this would affect a very small number (i.e. between three and six) of individuals.

Despite the planned presence of a construction dock and loading wharves, substantial areas of the adjoining intertidal habitat will continue to be available to shorebirds at low tide. Shorebirds are likely to continue to use this habitat, albeit in lower numbers. Lights from the wharves may also benefit some individuals that forage near the site at night.

Recent changes to the Project description, such as shifting the LNG Plant away from the shoreline and removing the road and bridge from the scope, mean that impacts on shorebirds will be less than that discussed in the draft EIS. The cumulative effect of several adjoining LNG plants would include increased disturbance of a substantial area of low-value shorebird foraging and roosting habitat. The retention of a buffer between the LNG plants and intertidal habitat, as proposed at the QGC site, will reduce disturbance impacts on foraging shorebirds. However, several individuals that presently roost and forage in claypan habitat at high tide will be displaced. The small number of birds displaced at high tide and low tide are likely to find alternate sites to roost and forage.

Conclusion

During the surveys for the draft EIS, a substantially greater number of individuals and species were recorded in the vicinity of the proposed access road and bridge (which is not within the scope of the Project) than at the LNG Facility site.

The draft EIS concluded that the proposed LNG Facility would have a negligible impact on migratory shorebirds in Port Curtis. The additional migratory shorebird surveys undertaken for the sEIS confirm this conclusion.

2.6.4.3 Landscape and Visual Impact Assessment

The Landscape and Visual Impacts Assessment was updated to address the changes to the LNG Facility layout, principally removal of the LPG tank and relocation of the LNG tanks further inland.

The visual assessment model and associated photomontages were updated to reflect the abovementioned Project changes.

Update to visual impacts

The removal of the LPG tank and relocation of the LNG tanks has resulted in a slight positive change, The alterations to the LNG facility however, while decreasing the level of impact slightly, did not change the overall impact finding.

Conclusion

The changes to the LNG Facility Project, while resulting positive change to the level of visual impact, do not alter the conclusions reached in the draft EIS with respect to impacts on World Heritage Area values.

The draft EIS concluded that although the LNG Facility falls within the Great Barrier Reef World Heritage Area (GBRWHA), the impact on the "aesthetics and natural beauty" of the GBRWHA area is already attenuated by the presence of Port of Gladstone industrial elements in the viewshed. Therefore, this area is not ''pristine'' or representative of the "exceptional natural beauty" assigned to the World Heritage and National Heritage values. In addition, the Gladstone State Development Area (GSDA) designation of Curtis Island indicates a planning intention to develop the area into an industrial precinct. In these circumstances, the landscape and visual impact of the proposed LNG Plant and associated onshore facilities would be consistent with the proposed expansion of industry around the Port of Gladstone, and therefore does not result in a significant impact to World Heritage Area values.

From the above assessment and the findings of the draft EIS and sEIS, it is concluded that actions under EPBC Referral 2008/4402 are not considered to cause significant impacts, as specified in the DEWHA MNES EPBC Policy Statement 1.1, to World Heritage, National Heritage Places, listed Threatened species and communities or listed Migratory species.

2.6.5 EPBC 2008/4405 – Shipping Activities

As discussed in *Section 2.6.3* above, additional information has been obtained from various studies to inform the assessment of impacts to listed Migratory and Threatened species from underwater noise from shipping and potential vessel interactions. The impacts of shipping activities are therefore as stated in *Section 2.6.3*., and are not considered to give rise to significant impacts to the EPBC- Threatened and Migratory species identified as potentially affected by the Project activities.

From the above assessment and the findings of the draft EIS and sEIS, it is concluded that actions under EPBC Referral 2008/4405 are not considered to cause significant impacts, as specified in the DEWHA MNES EPBC Policy Statement 1.1, to World Heritage, National Heritage Places, listed Threatened species and communities or listed Migratory species.