1 ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ASSESSMENT REPORT: POTENTIAL IMPACTS ON MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

1.1 INTRODUCTION

Volume 13 provides a standalone Environment Protection and Biodiversity Conservation (EPBC) Assessment Report, which addresses the requirements of *Section 1.9* of the Environmental Impact Statement (EIS) joint Terms of Reference (TOR) prepared by the Queensland Coordinator-General and Commonwealth Government. It also addresses 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.

The purpose of the EPBC Assessment Report is to facilitate the Commonwealth Government's assessment of impacts on Matters of National Environmental Significance (MNES) under Part 8 of the *Environment Protection and Biodiversity Conservation Act (EPBC Act) 1999*.

The joint TOR (i.e. also guidelines under the *EPBC Act*) required this EPBC Assessment Report to have sub-sections for each of the referrals submitted to DEWHA. To avoid duplication, the descriptions of environmental, impact assessment and mitigation measures are addressed in an integrated manner where applicable.

- *Section 2 details the submission of the nine referrals to DEWHA for the QCLNG Project.*
- *Section 2.1. summarises the "controlled actions" covered by the referrals, as well as the relevant MNES that are likely to be affected.*
- *Section 2.2 provides a brief description of the Project.*
- *Section 2.3 identifies the supporting Annexes in which the MNES are described.*
- *Section 2.4 identifies the Annex in which impacts to MNES and mitigation measures are outlined.*
- *Section 2.5 concludes by providing a summary statement of the significance of impacts to MNES for each of the nine referrals.*

This EPBC Assessment Report should be read in conjunction with the following EIS Volumes and Chapters, and Annexes, which detail the applicable MNES, a summary of impacts to MNES and proposed mitigation measures:

- *Gas Field Component: Volume 1 Chapter 5 sections 5.1, 5.3 and 5.4; Volume 2 Chapter 4 section 4.1; Volume 3 Chapter 7 sections 7.3-7.8, and Chapter 8 sections 8.1-8.5; and Volume 13 Annex 13.1 (Gas Field Component)*

- *Pipeline Component: Volume 1 Chapter 5 section 5.1, 5.3 and 5.4; Volume 2 Chapter 4 section 4.2; Volume 4 Chapter 7 sections 7.2-7.6, and Chapter 8 section 8.1-8.4; and Volume 13 Annex 13.2 (Pipeline Component)*
- *Curtis Island Bridge: Not part of Project*
- *LNG Marine Facilities Component: Volume 1 Chapter 5 sections 5.1, 5.3 and 5.4; Volume 2 Chapter 4 section 4.3; Volume 5 Chapter 7 sections 7.2-7.10, Chapter 8 sections 8.2-8.6, Chapter 11 sections 11.2-11.8, and Chapter 16 sections 16.3-16.8; and Volume 13 Annex 13.3 (LNG Component and Shipping Operations)*
- *LNG Plant and Onshore Facilities: Volume 1 Chapter 5 sections 5.1, 5.3 and 5.4; Volume 2 Chapter 4 section 4.3; Volume 5 Chapter 7 sections 7.2-7.10, Chapter 8 sections 8.2-8.6, Chapter 11 sections 11.2-11.8, and Chapter 16 sections 16.3-16.8; and Volume 13 Annex 13.3 (LNG Component and Shipping Operations)*
- *Mainland Road and Bridge Approach: Not part of Project*
- *Curtis Island Road: Not part of Project*
- *Shipping Activity Associated with Project: Volume 1 Chapter 5 sections 5.1, 5.3 and 5.4; Volume 2 Chapter 4 section 4.3; Volume 5 Chapter 7 sections 7.2-7.10, Chapter 8 sections 8.2-8.6, Chapter 11 sections 11.2-11.8, and Chapter 15 sections 15.2-15.5; and Volume 13 Annex 13.3 (LNG Component and Shipping Operations)*
- *Swing Basin and Channel Dredging: Volume 1 Chapter 5 section 5.8.3; Volume 2 Chapter 4 section 4.3, Chapter 10, and Chapter 14 sections 14.1-14.8; Volume 5 Chapter 7 sections 7.2-7.10, Chapter 8 sections 8.2-8.6, Chapter 11 sections 11.2-11.8; Volume 6; and Volume 13 Annex 13.3 (LNG Component and Shipping Operations).*

2 EPBC ACT REFERRALS

On August 8, 2008, BG International Limited (BGIL) and Queensland Gas Company Limited (QGCL) 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 September 15, 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. These controlled actions therefore require assessment and approval by the Commonwealth Minister for the Environment, Heritage and the Arts.

A single EIS for the QCLNG Project has been prepared to meet Commonwealth and Queensland Government separate assessment requirements, but with combined public documentation.

QGC is the Proponent of the QCLNG Project and is responsible for the nine referred actions. QGC was created when the former Queensland Gas Company Limited (QGCL) was merged with the Australian operations (BG International Limited) of BG Group following a recommended acquisition announced in October 2008. The merger consolidates QGC's extensive CSG expertise and BG Group's international experience in LNG within a single-company structure.

The operation of the QCLNG Project requires other supporting or Ancillary Infrastructure. Other parties solely or possibly with the involvement of QGC will develop these Ancillary Infrastructure Components.

That is, QGC and other LNG project proponents are in discussions with the Queensland Department of Infrastructure and Planning (DIP) to determine who will be responsible for developing the Curtis Island Bridge, Mainland Road and Bridge Approach and Curtis Island Road (collectively referred to in this EIS as the Bridge/Road Access to Curtis Island).

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

Discussions are underway with the Gladstone Ports Corporation (GPC) to determine responsibilities for the dredging of the Swing Basin and Shipping Channel required for the QCLNG Project. Shipping channels, swing basins and shipping infrastructure in the Port of Gladstone are administered by the GPC. It is currently proposed that the GPC would develop this Ancillary Infrastructure and own and operate it. Other LNG proponents may share the new channel.

The following ancillary infrastructure and activities associated with the QCLNG Project have been referred as separate actions so that it would be possible to transfer them to a different proponent in the future:

- *EPBC 2008/4400 – Curtis Island Bridge*
- *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*

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. Reasons for this alternative 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.

QGC is in the process of withdrawing the following referrals:

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

However, this infrastructure is still being investigated by the DIP together with other LNG project proponents, and this EPBC Assessment Report addresses potential impacts on MNES for these three referrals.

2.1 EPBC REFERRAL AND SUMMARY OF CONTROLLED ACTIONS

Table 13.2-1 sets out the nine referrals for the Project that were submitted to the DEWHA, along with a brief description of the action and the MNES that may be significantly impacted, and QCLNG EIS cross-references to MNES.

Table 13.2-1 Summary of EPBC Act Referrals and Identified Matters of National Environmental Significance

Referral No.	Project Component/ Referral Name	Summary Description and Action Referred	Comments / Inclusions and Exclusions	Identified Matters of National Environmental Significance (MNES)	QCLNG EIS cross-reference to MNES[2]
EPBC 2008/4398	**Gas Field Component** **BG International Ltd & QGC Ltd/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*)	*Vol 1 Ch 5 s.5.1, 5.3 & 5.4; Vol 2 Ch 4 s4.1;* *Vol 3 Ch 7 s.7.3-7.8, and Ch 8 s.8.1-8.5;* *Vol 13 and Annex 13.1.*
EPBC 2008/4399	**Pipeline Component** **BG International Ltd and QGC Ltd/Energy generation and supply (non-renewable)/Miles to Gladstone, 380km (extending to Tara and Fairview) /QLD/ Queensland Curtis LNG Project - Pipeline Network**	Development, construction, operation and decommissioning of a pipeline network of approximately 800 kilometres 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*)	*Vol 1 Ch 5 s.5.1, 5.3 & 5.4; Vol 2 Ch 4 s.4.2;* *Vol 4 Ch 7 s.7.2-7.6, and Ch 8 s.8.1-8.4;* *Vol 13 and Annex 13.2.*
EPBC 2008/4400	**Curtis Island Bridge** **BG International Ltd & QGC Ltd/Energy generation and**	Construction, operation, maintenance and decommissioning of a road	Bridge to cross The Narrows from around Friend Point on the mainland to Laird Point on the western side of	World Heritage (*Sections 12 & 15A*)	Not part of Project.

2 Includes Annexes and Appendices referenced in these Volumes and Chapters

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	Identified Matters of National Environmental Significance (MNES)	QCLNG EIS cross-reference to MNES[2]
	supply (non-renewable)/Friend Point & Laird Point Near Gladstone & Curtis Island/ QLD/Bridge Construction Connecting Mainland & Curtis Island	bridge connecting the mainland and Curtis Island.	Curtis Island (south of Graham Creek). This bridge is ancillary infrastructure for the development of the QC LNG Project and other LNG projects proposed on Curtis Island. The bridge may be developed by parties other than the Proponent.	National Heritage Places (*Sections 15B & 15C*) Listed Threatened species and communities (*Sections 18 & 18A*) Listed Migratory species (*Sections 20 & 20A*)	
EPBC 2008/4401	**LNG Component** **BG International Ltd & QGC Ltd/Energy generation and supply (non-renewable)/Curtis Island and mainland, adjacent to Gladstone/QLD/Queensland Curtis LNG Project - LNG Marine Facilities**	Development, construction, operation and decommissioning of LNG Marine Facilities for: • receiving and loading of LNG tankers (Curtis Island) • receiving butane to be incorporated in the LNG exports (Curtis Island) • receiving equipment barges and personnel ferry services to and from the LNG Facility and Gladstone (Gladstone and Curtis Island).	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*)	*Vol 1 Ch 5 s.5.1, 5.3 & 5.4; Vol 2 Ch 4 s4.3;* *Vol 5 Ch 7 s.7.2-7.10, Ch 8 s.8.2-8.6, Ch 11 s.11.2-11.8, and Ch 16 s.16.3-16.8;* *Vol 13 and Annex 13.3.*
EPBC 2008/4402	**LNG Component** **BG International Ltd and QGC Ltd/Energy generation and supply (non-renewable)/Curtis Island adjacent to Gladstone /QLD Curtis LNG 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 300 hectares onshore footprint (above high water mark). Onshore footprint may include temporary construction camp(s). The LNG Plant and associated onshore facilities will have an ultimate capacity of up to 12 million	World Heritage (*Sections 12 & 15A*) National Heritage Places (*Sections 15B & 15C*) Listed Threatened species and communities (*Sections 18*	*Vol 1 Ch 5 s.5.1, 5.3 & 5.4; Vol 2 Ch 4 s4.3;* *Vol 5 Ch 7 s.7.2-7.10, Ch 8 s.8.2-8.6, Ch 11 s.11.2-11.8, and Ch 16 s.16.3-16.8;*

Referral No.	Project Component/ Referral Name	Summary Description and Action Referred	Comments / Inclusions and Exclusions	Identified Matters of National Environmental Significance (MNES)	QCLNG EIS cross-reference to MNES[2]
			tonnes per annum (mtpa), nominally comprising three LNG trains, each of 3 to 4 mtpa production capacity.	*& 18A*) Listed Migratory species (*Sections 20 & 20A*)	*Vol 13 and Annex 13.3.*
EPBC 2008/4403	**Mainland Road and Bridge Approach** **BG International Ltd and QGC Ltd/Energy generation and supply (non-renewable)/Extending 6km near Friend point, north of Gladstone/QLD/Queensland Curtis LNG Project - Mainland Road and Bridge Approach**	Construction, operation, maintenance and decommissioning of up to six kilometres of road, connecting existing gazetted roads on the mainland side of the Port of Gladstone with the western end of the Curtis Island Bridge.	The development of the Mainland Road and Bridge Approach may involve construction of a causeway along part of its length, crossing intertidal zones on the mainland. The Mainland Road and Bridge Approach are required for the development of the Curtis Island Bridge. The Mainland Road and Bridge Approach may be developed by parties other than the Proponent.	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*)	Not part of Project.
EPBC 2008/4404	**Curtis Island Road** **BG International Ltd & QGC Ltd/Energy generation and supply (non-renewable)/Curtis Island adjacent to Gladstone/QLD/Queensland Curtis LNG Project - Curtis Island Road**	Construction, operation maintenance and decommissioning of up to 8.5 km of road/s from the Curtis Island Bridge to the QCLNG Facility on Curtis Island.	The development of the Curtis Island Road may involve construction of a causeway along part of its length, crossing intertidal zones on Curtis Island. The Curtis Island Road is required for the development of the Curtis Island Bridge. The Curtis Island Road may be developed by parties other than the Proponent.	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*)	Not part of Project.
EPBC 2008/4405	**Shipping Operations** **BG International Ltd & QGC Ltd/Energy generation and**	Shipping activities associated with the QCLNG Project, including:	Shipping conducted within the Australian Exclusive Economic Zone comprising Australian waters (including the Great Barrier Reef	World Heritage (*Sections 12 & 15A*) National Heritage Places	*Vol 1 Ch 5 s.5.1, 5.3 & 5.4; Vol 2 Ch 4 s4.3;* *Vol 5 Ch 7 s.7.2-7.10, Ch 8*

Referral No.	Project Component/ Referral Name	Summary Description and Action Referred	Comments / Inclusions and Exclusions	Identified Matters of National Environmental Significance (MNES)	QCLNG EIS cross-reference to MNES[2]
	supply (non- renewable)/Port of Gladstone Ship route Capricorn Channel/QLD/Shipping Activity Assoc with QLD Curtis LNG Project	• regular transit of LNG tankers • infrequent transit of ships carrying butane • transit of construction equipment barges and personnel ferries between Gladstone and Curtis Island • associated shipping activities.	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 and LPG shipping 3. Ship refuelling operations 4. LNG ship operation, including disposal of ballast 5. Butane ship operation, including disposal of ballast 6. Any other associated shipping and navigational aids and activities.	(*Sections 15B & 15C*) Listed Threatened species and communities (*Sections 18 & 18A*) Listed Migratory species (*Sections 20 & 20A*)	*s.8.2-8.6, Ch 11 s.11.2-11.8, and Ch 15 s.15.2-15.5;* *Vol 13 and Annex 13.3.*
EPBC 2008/4406	**Swing Basin and Channel Dredging** **BG International Ltd & QGC Ltd/Energy generation and supply (non-renewable)/Port of Gladstone/QLD/Queensland Curtis LNG 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.	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 any dredging associated with bridge or Pipeline development. Does not include dredging undertaken by GPC as part of ongoing maintenance or development of the Port of	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*)	*Vol 1 Ch 5 s.5.8.3;* *Vol 2 Ch 4 s4.3, Ch 10 & 14 s.14.1-14.8;* *Vol 5 Ch 7 s.7.2-7.10, Ch 8 s.8.2-8.6, Ch 11 s.11.2-11.8; Vol 6;* *Vol 13 and Annex 13.3.*

Referral No.	Project Component/ Referral Name	Summary Description and Action Referred	Comments / Inclusions and Exclusions	Identified Matters of National Environmental Significance (MNES)	QCLNG EIS cross-reference to MNES[2]
			Gladstone. The swing basin and channel dredging works may be developed by parties other than the Proponent.	Commonwealth Marine (*Sections 23 & 24A*)	

2.2 DESCRIPTION OF THE PROJECT

An overview of the QCLNG Project is provided in *Volume 1, Chapter 2* of the EIS. A comprehensive description of the Project, encompassing each of the controlled actions, is provided in *Volume 2*.

2.3 DESCRIPTION OF THE AFFECTED ENVIRONMENT RELEVANT TO THE CONTROLLING PROVISIONS

The description of MNES that could be affected by different components of the QCLNG Project, and which are protected under the *EPBC Act,* is based on the findings of the following specialist studies commissioned for the QCLNG EIS:

- *Flora and Fauna Assessment, undertaken by Unidel for the Gas Field (Volume 3, Chapter 7 and Appendix 3.2)*
- *Flora and Fauna Assessment, undertaken by Unidel for the Pipeline Component (Volume 4, Chapter 7 and Appendix 4.2).*
- *Landscape and Visual Impact Assessment, undertaken by Environmental Resources Management (ERM) Australia for the LNG Facility and Curtis Island Bridge (Volume 5, Chapter 16 and Appendix 5.18).*
- *Terrestrial Ecology Study, undertaken by ERM for the LNG Facility, Pipeline Crossing and Ancillary Infrastructure (Volume 5, Chapter 7 and Appendices 5.5, 5.6, 5.7 and 5.8).*
- *Marine Ecology Study, undertaken by ERM for the LNG Facility, Pipeline Crossing of The Narrows, Ancillary Infrastructure and Shipping Operations (Volume 5, Chapter 8).*

2.3.1 Gas Field

Annex 13.1 identifies and describes MNES that are present within, or could be affected by, the development of the Gas Field and are relevant to referral *EPBC 2008/4398*.

2.3.2 Pipeline

Annex 13.2 identifies and describes the MNES Threatened species and communities listed under the *EPBC Act,* as well as listed Migratory species that are present within, or could be affected by, the development of the Pipeline Component and are relevant to referral *EPBC 2008/4399.*

The pipeline crossing of The Narrows within the Port of Gladstone will fall within the Great Barrier Reef World Heritage Area (GBRWHA), which is also listed as a National Heritage Place. Relevant features of the GBRWHA, as well as listed Threatened species and communities and listed Migratory species that may be affected by the construction of the pipeline across The Narrows are discussed in *Annex 13.3*.

2.3.3 LNG Facility and Pipeline Crossing, Ancillary Infrastructure and Shipping Operations

Annex 13.3 identifies and describes MNES that are present within, or could be affected by, the development of the LNG Facility and the pipeline crossing of The Narrows, ancillary infrastructure and associated Shipping Activities. This description of the affected environment is relevant to the following referrals:

- *EPBC 2008/4399 – Pipeline Component from The Narrows crossing to the LNG Facility)*
- *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*

2.4 ASSESSMENT OF IMPACTS ON MNES AND MITIGATION MEASURES

2.4.1 Coal Seam Gas Field

Annex 13.1 identifies and assesses impacts to MNES and proposed mitigation measures for EPBC 2008/4398 – Gas Field.

2.4.2 Pipeline Network

Annex 13.2 identifies and assesses impacts to MNES and proposed mitigation measures for EPBC 2008/4399 – Pipeline up to the crossing of The Narrows.

2.4.3 LNG Facility and Pipeline Crossing, Ancillary Infrastructure and Shipping Activities

Annex 13.3 identifies and assesses impacts to MNES and proposed mitigation measures for the following referrals:

- *EPBC 2008/4399 – Pipeline Network (from The Narrows crossing to the LNG Facility)*
- *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*

2.5 CONCLUSIONS

2.5.1 EPBC 2008/4398 – CSG Field

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

Flora

The total known area of *EPBC Act* Listed Ecological Communities in the CSG Field is estimated to be 4,039 ha, including approximately 3,418 ha Brigalow Communities and 621 ha of Semi-evergreen Vine Thicket (SEVT). These are represented by eight Regional Ecosystems, namely: Brigalow woodland / open forest communities – REs 11.3.1, 11.4.3, 11.4.7, 11.4.10, 11.9.5, and 11.9.6, and SEVT communities – RE 11.8.3 and RE 11.9.4.

The Brigalow remnants are almost always small and narrow fragments which have been left along fencelines, creeks and roadsides. The small patches were generally found to be degraded due to edge effects including weed invasion and fire damage. Small patches of Brigalow, of relatively high quality were observed in Braemar and Condamine State Forests.

The SEVT communities occur on deep red soils with clay subsoil and are confined to the northern part of the CSG Field. The SEVT remnants are typically small fragmented patches, although two larger ones occur in the far north of the CSG Field. The small patches are degraded by edge effects including weed invasion and fire damage.

In summary, the proportion of each of the Brigalow and SEVT REs which occur within the CSG Field is less than 13% of that found in a 200 km x 200 km area centred on the CSG Field and less than 2.4% of that found in the Bioregion. An exception to this is RE 11.4.10 for which the area contained in the CSG Field represents approximately 20% of that which occurs in the broader 200 km x 200 km buffer.

Note that due to the nature of the Project it is not possible to state the exact location and area of Threatened Ecological Communities to be removed. However, it is expected that all non-linear infrastructure will not be sited within any Threatened Ecological Communities. Total avoidance will not be practicable, as linear infrastructure, namely pipelines (and potentially access tracks) will occasionally need to transect narrow linear remnants which follow creeklines, fences and roads.

It is estimated that the worst case (unmitigated) clearing scenario will amount to the removal of approximately 117 ha, which equates to approximately 0.009% of the Threatened Ecological Communities found within the Bioregion. Avoidance of these areas by excluding non-linear infrastructure will reduce the clearing scenario to an estimated maximum of 36 ha (30 ha Brigalow and 6 ha SEVT). Implementation of the mitigation measures proposed in Section 7 of Annex 13.1 (including offsets of at least 1:1.5) would minimise and compensate for adverse impacts to all Threatened Ecological Communities.

In summary, due to the small area to be cleared relative to that to be contained in the local area and the fragmented and degraded nature of these remnants, it is considered that the proposed clearing will not have a significant impact on any Threatened Ecological Communities.

As detailed in *Section 6.3* of *Annex 13.1*, the unmitigated potential for the CSG Field to impact on *EPBC Act* listed Threatened flora is very high for three species, and high for eight species. These species include:

- *Acacia curranii* (Curly Bark Wattle) – Very High for Landzone 7 within Gurulmundi area due to it being a geographically restricted species, low elsewhere
- *Calytrix gurulmundis* – Very High for Landzone 7 within Gurulmundi area due to it being a geographically restricted species, low elsewhere
- *Philotheca sporadica* – Very High for Landzone 7 within the central parts of the CSG Field (e.g. in the vicinity of Graham's Road, Mary's Roads, Kogan and Braemar State Forest) due to it being a geographically restricted species
- *Acacia chinchillensis* – High – Present within field but easily avoided with appropriate survey
- *Acacia lauta* – High – Present within field but easily avoided with appropriate survey
- *Acacia wardellii* – High – Present within field but easily avoided with appropriate survey
- *Cadellia pentastylis* – High – Present within field but easily avoided with appropriate survey
- *Denhamia parvifolia* – High – Present within field but easily avoided with appropriate survey
- *Eucalyptus virens* (Shiny-leaved Ironbark) – High – Present within field but easily avoided with appropriate survey
- *Homopholis belsonii* – High – Present within field but easily avoided with appropriate survey
- *Rhaphidospora bonneyana* – High – Present within field but easily avoided with appropriate survey.

Potential impacts on all EPBC listed species is expected to be significantly reduced with the implementation of proposed mitigation measures as described in *Table 7* of *Annex 13.1*. This is based on the premise that Gas Field infrastructure will, wherever practicable, be excluded from these species potential habitat areas. For instance it is proposed that all non-linear Gas Field infrastructure and associated construction activities will not be conducted within Gurulmundi State Forest and the Environmentally Sensitive area immediately north west of the State Forest. If development is to occur within these areas all non-linear infrastructure should follow existing tracks and previously disturbed areas where possible and avoid or minimise disturbance of highest value areas (e.g. EVR plant populations, high quality fauna habitats, steep terrain). QGC will not undertake drilling or development of non-linear infrastructure in this area prior to government endorsement of detailed development plans showing proposed production techniques and

infrastructure locations. Such a plan would be based on detailed ecological investigations within this area and would aim at ensuring that any such development would be undertaken in an ecologically sustainable and acceptable manner. If CSG non-linear activities are undertaken within the forest they will be contingent upon government endorsement. Endorsement will be based on detailed ecological evidence that such activities will not have a significant impact on MNES.

The potential impacts on *EPBC Act* listed Threatened fauna as a result of the CSG Field development are projected to be low. The conservation zoning model excludes non-linear infrastructure development in Threatened ecological communities and other high conservation value areas. Consequently very small areas of vegetation providing habitat for Threatened fauna are likely to be affected by the CSG Field development.

Migratory birds

Twelve migratory and/or marine bird species were identified by desktop studies as potentially occurring within the CSG Field. Of these species:

- Five are listed as both migratory and marine species (White-Bellied Sea Eagle, Great Egret, Cattle Egret, Lathams Snipe and the Fork-tailed Swift)
- Six are listed as migratory species only (Regent Honeyeater, White-throated Needletail, Rainbow Bee-Eater, Roufous Fantail, Cotton Pygmy Goose and the Painted Snipe) and
- One species is listed as a marine species only (Magpie Goose).

A list of these species and their potential to be impacted upon is presented in Section *6.5.10* of *Annex 13.1*.

Of these species, during the field surveys the White-throated Needletail (Hirundapus caudacutus) and the Fork-tailed Swift (Apus pacificus) were observed within the CSG Field and the Magpie Goose (Anseranus semipalmata) was observed just outside the CSG at Lake Broadwater. These bird species occur fleetingly in the CSG Field or utilise the airspace above (swifts). For these species, an assessment was made as to whether the project was likely to:

- lead to loss or modification of habitat important for migratory species (including fragmentation, altered land use, fire regimes, altered nutrient cycle, altered hydrological cycles etc),
- introduce or establish invasive species, and
- disrupt species lifecycle (breeding, feeding, migration, roosting etc).

As the level of disturbance proposed to native vegetation and other resources used by migratory and marine fauna in the CSG Field is projected to be negligible, thus impacts on the migratory species that utilise this type is form of habitat is not considered to be significant . Many of the migratory/marine species are water birds and as outlined in Section 7, Annex 13.1, riparian and wetland habitats are afforded special protection in this project with these

habitats precluded from development, with the exception that linear riparian habitats will sometimes not be able to be avoided by linear infrastructure (with worse case clearing estimated to affect less than 1% of the riparian habitat area contained within the CSG Field). Clearing locations will be preferentially sited within the lowest quality riparian habitats in the vicinity of each unavoidable crossing point.

Based on the unlikely and/or limited presence of these species within the CSG Fields coupled with the fact that the habitat of these species (i.e. riparian vegetation and wetlands) is largely precluded from development, it is considered unlikely that proposed developments will significantly impact any migratory and/or marine species.

Mitigation and rehabilitation measures are detailed in *Section 7* of *Annex 13.1*. They include use of a constraints based approach to managing impacts in which an Ecological Constraints zoning system places more stringent environmental conditions on areas of higher conservation value. All non-linear infrastructure is excluded from EPBC listed Ecological Communities. Other mitigation and rehabilitation measures identified include (but are not limited to): crossing vegetated creeklines, fencelines and road reserves at approximately 90 degrees; use of "Best Available Technology" to minimise clearing requirements and risk of erosion and sedimentation; individual site pre-clearance surveys which include identification of potential microhabitat for fauna and fauna habitat which may require the presence of fauna handlers during clearing; presence of fauna handlers; a clearing database; and development of an offset strategy which will compensate for all unavoidable clearing.

The principal mitigation and rehabilitation measures proposed for Threatened Ecological Communities include:

- All non-linear infrastructure to be sited outside of Threatened Ecological Communities
- Linear infrastructure to be sited outside of Threatened Ecological Communities wherever possible
- Where linear infrastructure cannot avoid Threatened Ecological Communities (i.e. where there is no alternative route which would allow long linear remnants (associated with watercourses, fence lines and road reserves) to be avoided), such infrastructure will transect these remnants at existing disturbed areas or the most degraded and narrowest suitable location. Such transects will occur at ninety degrees to these remnants so as to minimise the length of impact
- Provision of offsets, in accordance with the Commonwealth Government's *Draft Policy: Use of Environmental Offsets under the Environment Protection and Biodiversity Conservation Act (EPBC Act)* for all unavoidable impacts.

Mitigation and rehabilitation measures proposed for *EPBC Act* listed flora and fauna include (among others):

- Planning and clearance surveys
- If species are recorded during planning and clearance surveys the proposed infrastructure location will be revised and further ecological assessment will be undertaken to help determine the extent of the species and potential for any local populations to be impacted by the CSG activities
- Exclusion of non-linear infrastructure from waterways and wetlands
- Exclusion of non-linear infrastructure from the Gurulmundi area, unless further studies show otherwise and proposals to conduct CSG activities within this area are endorsed by DEWHA and DERM
- Siting of linear infrastructure will avoid areas if high value to *EPBC Act* listed species conservation (e.g waterways, wetlands and Gurulmundi) wherever possible
- Where linear infrastructure cannot avoid high value areas (e.g. where there is no alternative route), such infrastructure will utilise existing tracts, disturbed and degraded areas to the greatest practicable extent
- Minimising clearing to the greatest possible extent in all areas
- Fire Management
- Provision of offsets, in accordance with the Commonwealth Government's *Draft Policy: Use of Environmental Offsets under the Environment Protection and Biodiversity Conservation Act (EPBC Act)* for all unavoidable impacts.

The complete list of species specific mitigation and rehabilitation measures is detailed in *Section 7* of *Annex 13.1.*

As detailed in Section 7 of Annex 13.1, the proposed mitigation and rehab measures will reduce the predicted adverse impacts for all EPBC listed flora and fauna species to low with the exception of three flora species.

The three exceptions are:

1. *Acacia curranii* – Potentially High in Landzone 7 within Gurulmundi State Forest, low elsewhere

2. *Calytrix gurulmundensis* – Potentially High in Landzone 7 within Gurulmundi State Forest, low elsewhere

3. *Philotheca sporadica* – Potentially High in Landzone 7 within the central parts of the CSG Field (e.g. in the vicinity of Graham's Road, Mary's Roads, Kogan and Braemar State Forest).

To reduce the potential to impact these species to low levels, the following specific mitigation measures are proposed:

- Exclusion of non-linear infrastructure from the Gurulmundi area, unless further studies show otherwise and proposals to conduct CSG activities within this area are endorsed by DEWHA and DERM

- Where disturbance of individual EVR listed flora species is unavoidable (i.e. where there is no suitable alternative route for linear infrastructure to avoid such species) the following actions will be undertaken:
  - Detailed survey of the extent and numbers of unavoidable plants
  - Develop a Threatened Species Management Plan which would include justification of why the disturbance is unavoidable and proposed offsetting activities where appropriate
  - Seek DERM permits to disturb EVR listed species (NC Act) and authorisation from DEWHA prior to undertaking any disturbance or offset activities in relation to EPBC listed species.

As detailed in Section 7 of Annex 13.1, the potential impacts on *EPBC Act* listed Threatened fauna as a result of the Gas Field development are projected to be low. The conservation zoning model excludes non-linear infrastructure development in Threatened ecological communities and other high conservation value areas. Consequently very small areas of vegetation providing habitat for Threatened fauna are likely to be affected by the CSG Field development.

Implementation of the mitigation and rehabilitation measures detailed above will protect *EPBC Act* MNES matters from being significantly impacted by the proposed CSG extraction activities.

2.5.2 EPBC 2008/4399 – Gas Pipeline Network

2.5.2.1 Pipeline Network from the CSG Field to The Narrows

MNES for this section of the pipe relate only to Listed Threatened species and communities and Listed Migratory species.

Flora

The estimated worse case clearing footprints within each *EPBC Act* Listed Vegetation Community are: Brigalow (14.5 ha); SEVT (2.5 ha) Grassland (0 ha) and Weeping Myall (0 ha). The estimated total clearing of *EPBC Act* Listed Vegetation Communities is 17 ha. This represents 0.15% of that which occurs within a 5 km buffer of the pipelines and is less than 0.01% of that which occurs in the Bioregion. The extent and condition of the *EPBC Act* Listed Ecological Communities along the pipeline alignments is described in *Section 4.1.2* of *Annex 13.2*. The remnants transected by the alignments are all small, narrow fragments which are affected by edge effects and degraded by grazing and weed invasion. Nonetheless, these communities will be avoided where possible. Where unavoidable, offsets will be undertaken to compensate for the unavoidable clearing of any *EPBC Act* Listed Community. No significant impact on these communities is predicted.

The pipeline alignments contain potential habitat for 32 *EPBC Act* Listed flora species. These species and their preferred habitats were targeted during initial field survey work and will be targeted during ongoing detailed alignment

surveys. Detailed surveys are required to confirm the presence or absence of all EPBC listed flora species prior to finalisation of the pipeline alignments and the commencement of construction activities. The field surveys observed two *EPBC Act* Listed species within or in the close proximity of the Export Pipeline alignments. These were *Cadellia pentastylis* (Ooline) (EPBC Vulnerable) at approximate KP 227 (Site M36) along the Option 1 Export Pipeline and a small population of *Cycas megacarpa* (Large-fruited Zamia) (EPBC Endangered) between KPs 296.5-298.5 (Sites M56 and M57) and two additional plants at approximate KPs 301 and 305 along the Option 1 and Option 2 Export Pipeline corridors (refer Figure 4.7.7, Figure 4.7.8 and Figure 4.7.9 within Volume 4, Chapter 7). The initial field surveys also recorded four *EPBC Act* Listed species within the general vicinity of the UIC. These were *Acacia curranii* (EPBC Vulnerable), *Acacia wardellii* (EPBC Vulnerable), *Calytrix gurulmundensis* (EPBC Vulnerable) and *Philotheca sporadica* (EPBC Vulnerable). In the absence of mitigation measures detailed in *Section 6* of *Annex 13.2* there would be a moderate to high potential to impact on these species. With the application of the proposed mitigation measures there is considered low potential to impact on these listed species (excepting two species as detailed below).

The two exceptional species are the EPBC listed Endangered Large-fruited Zamia *(Cycas* megacarpa) and Vulnerable EPBC listed *Philotheca sporadica.* As detailed in *Section 5.3* of *Annex 13.2*, these species have restricted habitat niches (rocky ridgelines and residual lateritic rises respectively) from which a pipeline may not be able to deviate or avoid totally. The potential to impact these two *EPBC Act* Listed flora species is moderate due to potential inability reroute the pipeline away from where they occur. Additional mitigation measures will be required for these species. If any such circumstances are identified, a threatened species conservation plan would be developed and approval sought from DEWHA, prior to finalisation and development of the alignment.

Fauna

Table 8 of *Annex 13.2* provides details of the *EPBC Act* listed fauna species which the desktop studies indicated may occur in the wider vicinity of the study corridor. The Table also identifies the preferred habitat for each and an indication as to whether this habitat is present within the 10 km wide study corridor.

Field surveys conducted as part of the CSG Field study identified two *EPBC Act* listed Threatened fauna species (for a description of the methodology see *Section 3.3.3, Annex 13.2* and for the results of surveys refer to *Section 4.2.2, Annex 13.2*). These records were obtained within the area where the UIC is proposed:

- Eastern Long-eared Bat (*Nyctophilus timoriensis*)- Vulnerable under the *EPBC Act*, and

- Large-eared Pied Bat (*Chalinolobus dwyeri*) - Vulnerable under the *EPBC Act* (Tentative Record at Gurulmundi SF).

The potential impacts on *EPBC Act* listed Threatened fauna as a result of the pipeline construction and operation are projected to be low, taking into consideration the very small areas of vegetation that are considered likely to be affected relative to that which will be retained in adjoining areas.

Fish

EPBC Listed species identified by the EPBC MNES database as potentially occurring within the region include the Murray Cod (*Maccullochella peelii peelii*), the Australian Lung Fish (*Neoceratodus forsteri)* and the Fitzroy River Turtle (*Rheodytes leukops*). The southern portion of the Export Pipeline and UIC are located in the Condamine River catchment which is part of the Murray-Darling system, a known habitat of the Murray Cod. The Australian Lungfish is only known from the Burnett and Mary River Systems. The Option 2 Export Pipeline falls within the Burnett River catchment between KPs 180-230. The Fitzroy River Turtle is found in the Fitzroy River catchment which is predominantly to the north of the pipeline corridors, however the Dawson River and its tributaries are part of this system and their catchments are transected by the Export Pipeline.

Migratory Birds

Three migratory and/or marine bird species were identified by desktop studies as potentially occurring within the CSG Field, these include:

- The Cotton Pygmy Goose (*Nettapus coromandelianus*) listed as both migratory and marine species,
- The White-throated Needle-tail (*Hirundapus caudacutus*) listed as a migratory species only, and
- The Swift Parrot (*Lathamus discolour*) listed as a marine species only.

Of these species, the field surveys identified the migratory White-throated Needletail in the airspace in vicinity of the UIC (See *Table 11, Section 5.4* of *Annex 13.2*). The field surveys also recorded the presence of two additional migratory and/or marine fauna species, these include:

- The Fork-tailed Swift (*Apus pacificus*)- Migratory and Marine species observed in the airspace in the vicinity of the UIC, and the
- Magpie Goose (*Anseranus semipalmata*)- Marine species recorded at Lake Broadwater to the south east of the UIC

For a description of the field assessment methodology see *Section 3.3.3* of *Annex 13.2* and for the results of surveys refer to *Section 4.2.2* of *Annex 13.2*.

For these migratory/marine species that could potentially occur or were observed within the vicinity of the pipeline corridors, an assessment was made as to whether the project was likely to:

- Lead to loss or modification of habitat important for migratory species (including fragmentation, altered land use, fire regimes, altered nutrient cycle, altered hydrological cycles etc)

- Introduce or establish invasive species, and
- Disrupt species lifecycle (breeding, feeding, migration, roosting etc).

This assessment concluded that the construction of the pipeline corridors is unlikely to lead to significant impacts on any potentially occurring migratory/marine species. This is based on the fact that:

- The Cotton Pygmy-Goose and the Magpie Goose are water bird that occur in large water bodies, and as the pipelines have been aligned to avoid such areas impacts on these species are projected to be negligible,
- The Swift Parrot breeds in Tasmania and fleetingly visits and feeds in the southern Queensland during the non-breeding period. Once again, the proportion of feeding habitat affected by the project is minimal and therefore impacts are projected to be negligible, and
- The White-throated Needletail and the Fork Tailed Swift are aerial foragers and are not known to land or breed in Australia. The range of these species extends over vast areas of the eastern Australia and is not confined to a particular bioregion.

Provided that the mitigation and rehabilitation measures detailed in *Section 6* of *Annex 13.2* are adopted and successfully implemented, the Pipeline Component from the CSG Field to The Narrows is considered unlikely to have a significant impact on any *EPBC Act* MNES.

2.5.2.2 Pipeline Crossing of The Narrows

World Heritage and National Heritage Values

The Pipeline is considered unlikely to have a significant impact on any of the World Heritage and National Heritage values, namely 'aesthetics and natural beauty', 'geological phenomenon', 'ecological and biological processes' and 'biodiversity and Threatened species'.

The four criteria developed as the basis for the listing as a World Heritage Area, together with a summary assessment of potential impact from the Project (i.e. Pipeline Network (from The Narrows crossing to the LNG Facility); LNG Marine Facilities; LNG Plant and Associated Onshore Facilities; Shipping Activities; and Swing Basin and Channel Dredging) is contained in *Table 13.2-2*.

Table 13.2-2 does not consider the impact of the Curtis Island Bridge; Mainland Road and Bridge Approach; or Curtis Island Road, as QGC is in the process of withdrawing these referrals. These EPBC referral activities are not part of the QCLNG Project as the Marine Transportation Operations option is the preferred strategy for access to and from the LNG Facility on Curtis Island.

Table 13.2-2 World Heritage Criteria

Criterion	Project impact and Conclusions
Outstanding example representing a major stage of the earth's evolutionary history	*Examples given of the values of the Great Barrier Reef which relate to this criterion include: its coral reefs; coral cays; geological processes linking reefs, cays, islands, sand barriers and dunes; and its record of sea level changes and climatic history.* The following sections of the EIS assess the interaction of the Project with the evolutionary history of the WHA: Volume 1 Chapter 5 sections 5.1, 5.3, 5.4 *and* 5.8; Volume 2 Chapter 4 section 4.3, Chapter 10, *and* Chapter 14 sections 14.1-14.8; Volume 5 Chapter 7 sections 7.2-7.10, Chapter 8 sections 8.2-8.6, Chapter 11 sections 11.2-11.8, *and* Chapter 16 sections 16.3-16.8; Volume 6; *and* Volume 13 Annex 13.3 *(LNG Component and Shipping Operations).* Parts of Port Curtis may exhibit geological processes linking the various elements of the coastal environment (e.g. estuaries, intertidal flats, coral reefs, mangroves and embayments). However, the hydrodynamic and coastal process investigations have demonstrated that the construction and operation of marine facilities (i.e. loading jetty and MOF) within the WHA will not have a detrimental impact on the coastal environment. The placement of dredged material generated from the development of the QCLNG swing basin and shipping channel (if the QCLNG Project proceeds ahead of any other mooted project) will result in permanent disturbance to a limited area of intertidal flats in the vicinity of Fishermans Landing within the Port Curtis area. In the event that GPC's FL153 or Western Basin Strategic Dredging Disposal Project proceed, reclamation associated with the QCLNG Project will have no incremental effect on coastal geomorphological values. There will be no other Project components which will interfere with the listed examples of the earth's evolutionary history.
An outstanding example representing significant ongoing geological processes, biological evolution and man's interaction with his natural environment.	*Examples given of the values of the Great Barrier Reef which relate to this criterion include: its size and morphological diversity; the process of accretion and erosion of coral reefs; extensive Halimeda beds; dispersion and evolution of hard corals; diversity of flora and fauna; coral colonies and communities; floristic regions; and morphological and genetic changes in mangroves and seagrass.* The Project is to be located within the designated industrial precinct of the GSDA associated with the Port of Gladstone (Port Curtis). The Port handles over 30 products, which are transported to more than 30 countries. Major products include coal, alumina, aluminium and cement. In addition, the Port also caters to all forms of containerised and general cargoes. The Queensland government has identified the Port of Gladstone and adjacent lands as one of Australia's major ports and industrial centres. The following sections of the EIS assess the interaction of the Project with the geological processes and

Criterion	Project impact and Conclusions
	biological environment: Volume 1 Chapter 5 sections 5.1, 5.3, 5.4 and 5.8; Volume 2 Chapter 4 section 4.3, Chapter 10, and Chapter 14 sections 14.1-14.8; Volume 5 Chapter 7 sections 7.2-7.10, Chapter 8 sections 8.2-8.6, Chapter 11 sections 11.2-11.8, and Chapter 16 sections 16.3-16.8; Volume 6; and Volume 13 Annex 13.3 (LNG Component and Shipping Operations). The QCLNG Project is entirely consistent with the future plans for the Port of Gladstone. The swing basin and channel development associated with the Project is also consistent with the Gladstone Port Corporation's 50 year Strategic Plan. As discussed above, the hydrodynamic and coastal process investigations have demonstrated that the construction and operation of marine facilities associated with the Project (i.e. loading jetty and MOF) within the WHA will not have a detrimental impact on the geomorphological environment. In addition, the predicted increased turbidity associated with the dredging for construction of the pipeline crossing of The Narrows and the QCLNG swing basin and channel development will have potential short term effects on elements of the WHA such as sea grass meadows and coral reefs within the Port Curtis area. The placement of dredged material generated from the development of the QCLNG swing basin and shipping channel will result in permanent disturbance to a limited area of intertidal flats in the vicinity of Fishermans Landing within the Port Curtis area.
Contains unique, rare and superlative natural phenomena, formations and features and areas of exceptional natural beauty.	*Examples given of the values of the Great Barrier Reef which relate to this criterion include: its vast extent and variety of reefs and islands; coastal mangrove systems of exceptional beauty; rich variety of landscapes and seascapes; spectacular breeding colonies of seabirds and butterflies; and migrating mammals.* The Project location within the Port of Gladstone means the "aesthetics and natural beauty" of the GBRWHA in this area is already attenuated by the presence of Port of Gladstone industrial elements in the viewshed. The Project does not interfere with the natural beauty of any reefs or coral islands. The proposed LNG Facilities will result in a local impact of major adverse significance within approximately 4.2 km of the site. The landscape values within the affected viewshed are not representative of the WHA criterion of 'areas of exceptional natural beauty'. The limited extent of visual impact of the Project and the existing degradation of landscape values within the Port of Gladstone results in the Project not significantly altering or modifying the WHA values.
Provides habitats where populations of rare and endangered plants and animals still survive	*Examples given of the values of the Great Barrier Reef which relate to this criterion include: structurally and ecologically complex coral reefs; large number of islands providing extensive habitats; mangroves and seagrass beds; inter-reefal and lagoonal benthos; and plants and animals of conservation significance.* Potential impacts to MNES from the marine facilities,

Criterion	Project impact and Conclusions
	dredging and increase in shipping activities associated with the development include the following (refer to Volume 5, Chapter 8 and Volume 6 for full impact assessment): • Short term effects on seagrass, coral reefs and other benthic communities due to increased turbidity • injury and fatality of a small number of marine fauna through vessel strikes • disturbance from vessel & dredge noise • disturbance from vessel lighting • potential injury of fauna and contamination of habitats from accidental spills of hydrocarbons or chemicals Impacts to "biodiversity and threatened species" may be possible but these are likely to be insignificant, temporary and/or highly localised when considered in a regional context (refer Volume 5, Chapters 8, 11 and 15; Volume 6; Appendix 5.18 and Annex 13.3). If the QCLNG Project were the first project to utilise the GPC's FL153 and Western Basin Strategic Dredging and Disposal reclamation area the impacts would include the loss of a significant area of intertidal flat habitat due to the placement of dredge material in the vicinity of Fishermans Landing

Field Studies

Prior to field investigations, desktop assessments and literature reviews were undertaken to ensure that field surveys were appropriate to the proposed developments and the study area. Two field surveys were carried out (spring and summer) from 28th September 2008 to 15th October 2008 and 12th to 24th February 2009 (a total of five weeks). An earlier site inspection to identify key issues was also carried out in June 2008. The methods used during the desktop and field ecology assessments carried out for the ecological impact assessment are summarised in *Volume 5 Chapter 7, section 7.5*.

Detailed assessment studies and reports for birds, reptiles and amphibians and vegetation were undertaken by specialist consultants. Specialist technical reports are summarised within *Volume 5 Chapter 7*, with the full technical reports provided as *Appendix 5.5*[5], *Appendix 5.6*[6], *Appendix 5.7*[7] *and Appendix 5.8*[8].

5 Unidel (2009) QCLNG – Curtis Island Components: Flora Report.

6 Unidel (2009) QCLNG – Curtis Island Components: Reptiles and Amphibians Report.

7 Rohweder, Dr D, and Charley D (2008) QGC Queensland Curtis LNG Project, Curtis Island: Targeted Bird Survey.

8 Rohweder, Dr D, and Charley D (2009) QGC Queensland Curtis LNG Project, Curtis Island: Supplementary Targeted Bird Survey.

Flora

No Threatened vegetation communities listed under the *EPBC Act* occur within, or within the vicinity of, the Pipeline crossing of The Narrows. This section of the Pipeline will not have a significant impact on listed Threatened vegetation communities.

Eight *EPBC Act* listed Threatened flora species were predicted to occur within the terrestrial areas in close proximity to the Pipeline crossing of The Narrows, however, no *EPBC Act* listed Threatened flora species were identified within the vicinity of the proposed Pipeline Crossing. The flora of the study area is not considered to be of conservation significance from a national perspective. The Pipeline Crossing of The Narrows is considered unlikely to have a significant impact on listed Threatened flora species.

Terrestrial Birds

Eight *EPBC Act* listed Threatened terrestrial bird species were predicted to occur within the study area. During the field surveys one *EPBC Act* listed Threatened bird species was recorded (Squatter Pigeon (*Geophaps scripta scripta*)) which is listed as Vulnerable. The Squatter Pigeon was recorded on the mainland but did not occur in the vicinity of the proposed Pipeline crossing of The Narrows. Therefore the Pipeline crossing of The Narrows is considered unlikely to have a significant impact on listed Threatened terrestrial bird species.

Migratory Birds

Twenty-five terrestrial *EPBC Act* listed Migratory birds were recorded during the field surveys. Areas within the tidal mudflats on the mainland were identified as representing important habitat to only one Migratory species, the Eastern Curlew (*Numenius madagascariensis*). The Pipeline crossing of The Narrows does not directly affect this habitat and it is considered unlikely that the Pipeline will have a significant impact on any listed terrestrial Migratory birds.

Terrestrial Mammals

Three listed Threatened terrestrial mammals were predicted to occur within the vicinity of the Pipeline crossing of The Narrows. None of these species were detected during the field surveys. Therefore the Pipeline crossing of The Narrows is considered unlikely to have a significant impact on listed Threatened terrestrial mammal species.

Reptiles

Three listed Threatened terrestrial reptiles and amphibians were predicted to occur within vicinity of the Pipeline crossing of The Narrows. None of these species were detected during the field surveys. Therefore the Pipeline crossing of The Narrows is considered unlikely to have a significant impact on listed Threatened terrestrial reptiles and amphibian species.

Butterfly Species

No *EPBC Act* listed Threatened butterfly species were identified in the EPBC protected matters or EPA Wildlife Online search and none were recorded during the terrestrial ecology field surveys. The 'controlled actions' will therefore not impact on listed Threatened terrestrial butterfly species.

Fish

Two listed Threatened fish species- Whale Shark *(Rhincodon typus)* and the Green Sawfish *(Pristis zijsron)* have the potential to occur or migrate within the area of the proposed Curtis Island Bridge. Green Sawfish are predominantly found north of Cairns in the Gulf of Carpentaria, and Whale Shark is a predominantly an offshore species. It is unlikely that these species will utilise the Port of Gladstone. It is considered unlikely that the controlled actions will have a significant impact listed Threatened fish species.

Marine Mammals

One *EPBC Act* listed Threatened Marine mammal and six listed Migratory Marine mammals were predicted to occur within the area of proposed Pipeline crossing of The Narrows. Of these, two dolphin species (Snubfin Dolphin (*Orcaella heinsohni)* and Indo-Pacific Humpback Dolphin (*Sousa chinensis*) and dugongs are considered likely to be found within the Port of Gladstone, however there is no published literature documenting their occurrence within the study area. Previous studies have shown that the Indo-Pacific Humpback Dolphin co-exist with coastal development such as in Cleveland Bay, Townsville[9] and therefore not likely to be significantly impacted by the pipeline crossing of The Narrows.

Marine Reptiles

Six *EPBC Act* listed Threatened Marine reptiles and seven listed Migratory Marine reptiles were predicted to occur within the area of proposed Pipeline crossing of The Narrows. Only the Green Turtle, Loggerhead Turtle and the Flatback Turtle are considered likely to be present within the Port of Gladstone. There are no known turtle nesting beaches within the vicinity of the Pipeline crossing of The Narrows (refer *Volume 5, Chapter 8* and *Annex 13.3*) and therefore turtle nesting and hatchling activities will not be significantly impacted by associated impacts from the pipeline crossing. However, turtles may transit and their behaviour may be altered during construction of the pipeline across The Narrows.

Intertidal Habitats

Intertidal mudflats with saltmarsh and mangrove vegetation in the Port of Gladstone support a high biodiversity and biomass of benthic invertebrates and provide important feeding habitat for listed Migratory waders, protected under JAMBA, CAMBA and ROKAMBA Migratory bird agreements. Eleven

9 Parra, G.J. (2006) Resource Partitioning in sympatric delphinids: Space Use and Habitat Preferences of Australian Snubfin and Indo-Pacific Humpback Dolphins. Journal of Animal Ecology 75:862-874

Marine and wetland Migratory bird species listed under the *EPBC Act* may potentially also occur within this area. Of these one species is listed as Endangered; the Southern Giant Petrel *(Macronectes giganteus)* and one species is listed as Vulnerable; the Kermadec Petrel *(Pterodroma neglecta).* There are no significant petrel breeding grounds or feeding areas in the Port of Gladstone and these species were not recorded during the bird surveys. It is considered unlikely that the controlled actions will have a significant impact on listed Threatened and Migratory Marine and wetland bird species.

The Pipeline crossing of The Narrows is considered unlikely to have a significant impact on *EPBC Act* listed Threatened and Migratory Marine species, due to:

- the small number of individuals that utilise the area
- the likelihood that Marine fauna would continue to utilise parts of the area despite the short-term and highly localised activities associated with the construction of the Pipeline across The Narrows
- the mobile nature of the marine fauna discussed, enabling them to avoid direct impact.

2.5.3 EPBC 2008/4400 – Curtis Island Bridge

QGC is in the process of withdrawing this referral.

This EPBC referral activity is not part of the QCLNG Project as the Marine Transportation Operations option is the preferred strategy for access to and from the LNG Facility on Curtis Island.

World Heritage and National Heritage Values

The Curtis Island Bridge is considered likely to have a significant impact on the landscape character and visual quality within 2 km of the development (refer *Volume 5, Chapter 16, Appendix 5.18 and Annex 13.3).* This area is within the Port of Gladstone and the Great Barrier Reef World Heritage Area (GBRWHA). However, 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 the Restricted Development Precinct on Kangaroo Island indicates a planning intention to develop the area for Local Infrastructure, Materials Transport Infrastructure and Special Use, with the potential for development of an Infrastructure Facility. In these circumstances, the landscape and visual impact of the Curtis Island Bridge would be consistent with the proposed development of an infrastructure corridor to link the mainland with the Curtis Island Industry Precinct of the GSDA (refer *Volume 5, Chapter 16, Appendix 5.18 and Annex 13.3)*.

The Curtis Island Bridge is unlikely to have a significant impact on other World Heritage and National Heritage values, namely "geological phenomenon", "ecological and biological processes" and "biodiversity and threatened species" (refer *Volume 5, Chapter 16, Appendix 5.18 and Annex 13.3)*.

Field Studies

Prior to field investigations, desktop assessments and literature reviews were undertaken to ensure that field surveys were appropriate to the proposed developments and the study area. Two field surveys were carried out (spring and summer) from 28th September 2008 to 15th October 2008 and 12th to 24th February 2009 (a total of five weeks). An earlier site inspection to identify key issues was also carried out in June 2008. The methods used during the desktop and field ecology assessments carried out for the ecological impact assessment are summarised in *Volume 5 Chapter 7, section 7.5*.

Detailed assessment studies and reports for birds, reptiles and amphibians and vegetation were undertaken by specialist consultants. Specialist technical reports are summarised within *Volume 5 Chapter 7*, with the full technical reports provided as *Appendix 5.5*[10], *Appendix 5.6*[11], *Appendix 5.7*[12] *and Appendix 5.8*[13].

Terrestrial Birds

Eight listed Threatened terrestrial bird species were predicted to occur within the study area. During field surveys, the only listed Threatened bird species recorded was the Squatter Pigeon (*Geophaps scripta scripta*), which is listed as Vulnerable (refer *Volume 5, Chapter 7, and Annex 13.3*). The Squatter Pigeon was recorded on the mainland but did not occur in the vicinity of the proposed Curtis Island Bridge. The Curtis Island Bridge is considered unlikely to have a significant impact on listed Threatened terrestrial bird species.

Migratory Birds

Twenty-five terrestrial listed Migratory birds were recorded during the field surveys (refer *Volume 5, Chapter 7, Appendix 5.7 and 5.8, and Annex 13.3*). Areas within the tidal mudflats on the mainland were identified as representing important habitat to one Migratory species, the Eastern Curlew (*Numenius madagascariensis*). The Curtis Island Bridge does not directly affect this habitat and it is therefore considered unlikely that the bridge will have a significant impact on any listed terrestrial Migratory birds (refer *Volume 5, Chapter 7, Appendix 5.7 and 5.8, and Annex 13.3*). However, the Mainland Road and Bridge Approach currently bisect this habitat and is likely to have a significant impact on the Eastern Curlew. This is discussed under the conclusions for the Mainland Road and Bridge Approach in *Section 2.5.6*.

10 Unidel (2009) QCLNG – Curtis Island Components: Flora Report.

11 Unidel (2009) QCLNG – Curtis Island Components: Reptiles and Amphibians Report.

12 Rohweder, Dr D, and Charley D (2008) QGC Queensland Curtis LNG Project, Curtis Island: Targeted Bird Survey.

13 Rohweder, Dr D, and Charley D (2009) QGC Queensland Curtis LNG Project, Curtis Island: Supplementary Targeted Bird Survey.

Fish

Two listed Threatened fish species - Whale Shark *(Rhincodon typus)* and the Green Sawfish *(Pristis zijsron)* were identified by a search of the EPBC Protected Matters database as having the potential to occur or migrate within the area of the proposed pipeline crossing of The Narrows (refer *Volume 5, Chapter 8 and Annex 13.3*). However, Green Sawfish are predominantly found north of Cairns in the Gulf of Carpentaria, and the Whale Shark is predominantly an offshore species. It is therefore unlikely that these species will utilise the Port of Gladstone. Therefore, it is unlikely that the controlled actions will have a significant impact on listed Threatened fish species.

Marine Mammals

One listed Threatened and Migratory Marine mammal (Humpback whale *(Megaptera novaeangliae)* and five listed Migratory Marine mammals (Bryde's whale (*Balaenoptera edeni*), Dugong *(Dugong dugon),* Snubfin dolphin (*Orcaella heinsohni*), Killer whale *(Orcinus orca) and* Indo-Pacific Humpback dolphin *(Sousa chinensis)* have the potential to occur within the area of the proposed Curtis Island Bridge from a search of the EPBC Protected Matters database (refer *Volume 5, Chapter 8 and Annex 13.3*). Of these, two dolphin species Snubfin Dolphin and Indo-Pacific Humpback Dolphin may occur within the Port of Gladstone, however there is no published literature documenting their occurrence within the study area. Previous studies have shown that the Indo–Pacific Humpback dolphin co-exist with coastal development such as in Cleveland Bay, Townsville[14] and therefore not likely to be significantly impacted by the Curtis Island Bridge.

The incremental increase in noise and light emissions from the bridge and associated activities will be small in comparison to the current level of activity in the Port of Gladstone. Noise and light impacts are therefore expected to be low (refer *Volume 5, Chapter 8)*.

Given the offshore nature of the three listed whale species and the known distances from the Port of Gladstone area, whales are not expected to be a key sensitive receptor for this Project.

Dugongs are known to inhabit the study area, and may suffer short term disturbance to their feeding patterns due to increased vessel activity and turbidity within the Port associated primarily with bridge construction vessels (refer *Volume 5, Chapter 8 and Annex 13.3*). Shipping activities and related impacts are described in *Section 2.5.8* of this current volume. Dugongs feed predominately on seagrass, but supplement their diet with invertebrates such as polychaete worms, seasquirts and shellfish. The value of the large seagrass meadows identified in the coastal areas within the Port of Gladstone[15] to the dugong population has resulted in declaration of the Rodds Bay DPA (refer *Volume 5, Chapter 8*). The seagrass meadows around

14 Parra G J (2006) Resource partitioning in sympatric delphinids: Space use and habitat preferences of Australian snubfin and Indo-Pacific humpback dolphins. Journal of Animal Ecology 75:862-874.

15 Coles R G, Lee Long W J, Squire B A, Squire L C and Bibby J M (1987) Distribution of seagrasses and associated juvenile commercial penaeid prawns in north-eastern Queensland waters. Aust J Mar Freshwater Res, 38: 103–119.

Wiggins Island in particular appear to be heavily utilised by dugongs, as feeding trails were found at a majority of sites sampled in 2007, and have been recorded in all previous surveys[16]. Given the extensive areas of seagrass (approximately 13,500 ha) within the Port of Gladstone, it is considered unlikely the Curtis Island Bridge will result in such a loss of seagrass that would adversely impact dugong populations[17]. The prominent areas of seagrass are located in the Pelican Banks/Quoin Island, Fisherman's Landing area, Facing Island, Seal Rocks and the West and East Banks and due to the distance from the proposed bridge, not likely to be affected.

Impacts from accidental spills of hydrocarbons or chemicals from bridge activities, primarily during construction have the potential to be high, but there is a low probability of occurrence. Marine mammals surface to breathe air and are therefore vulnerable to exposure to oil spill impacts caused by surfacing through an oil slick on the sea surface. Cetaceans have mostly smooth skins with limited areas of pelage (hair covered skin) or rough surfaces such as barnacled skin. Oil tends to adhere to rough surfaces, hair or calluses of animals, so contact with oil by whales may cause only minor oil adherence[18]. Chemical spills volumes from bridge activities are likely to be small and therefore any impact will be highly localised and short term. Chemicals are expected to be dissipated quickly upon entering the marine environment and not likely to cause any impact on feeding habitats. *Volume 5, Chapter 8* describes mitigation measures that will be applied to minimise the risk of spills.

Mitigation measures to be applied as detailed in *Volume 5, Chapter 8* combined with the descriptions for marine mammals described above and in *Volume 5, Chapter* 8, it is considered unlikely that the Curtis Island Bridge will have a significant impact on listed Threatened and Migratory Marine mammal species.

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 Curtis Island Bridge (refer *Volume 5, Chapter 8 and Annex 13.3*). Only the Green Turtle, Loggerhead Turtle and the Flatback Turtle are likely to be present within the Port of Gladstone[19,20,21] as they have known nesting beaches in the area. However, there are no known turtle nesting beaches in the vicinity of the Curtis Island bridge (refer *Volume 5, Chapter 8 and Annex 13.3*) and therefore turtle nesting

16 Alquezar R, Small K,, Hendry R (2007) **P*ort Curtis Biomonitoring programme: macroinvertebrate, mangrove and seagrass surveys November 2006.*** A report to Queensland Energy Resource Limited (QERL). Centre for Environmental Management, Central Queensland University, Gladstone Queensland

17 British Gas and Queensland Gas Company (2008). Queensland Curtis LNG Project Initial Advice Statement.

18 Haebler, R. (1994) Biological Effects: Marine Mammals and Sea Turtles. In 'Before and After an Oil Spill: The Arthur Kill' (Ed. J. Burger) Rutgers University Press, New Jersey. 305pp.

19 Limpus C J, McLaren M, McLaren G and Knuckey B. (2006) Queensland Turtle Conservation Project: Curtis Island and Woongarra Coast Flatback Turtle Studies, 2005-2006.

20 Queensland Environmental Protection Agency (QEPA) (2003) ***Curtis Coast Regional Coastal Management Plan***

21 Taylor H, Rasheed M, Dew K. and Sankey T. (2007) **L*ong Term Seagrass Monitoring in Port Curtis and Rodds Bay, Gladstone, November 2006.*** *Queensland*:

and hatchling activities will not be significantly impacted by associated impacts from the bridge (i.e. light spill, construction, noise).

However, turtles may be in transit and their behaviour or movement may be altered during the construction or operation of the bridge. Unknown numbers of turtles may use the area for foraging adjacent to the proposed bridge location and Green turtles have been regularly observed within the seagrass meadows particularly on Pelican Banks (eastern side of Curtis Island)[22]. Turtles foraging in shallow water and the extensive seagrass beds close by are more likely to suffer disturbance or strikes from vessels. Shipping activities and related impacts are described in *Section 2.5.8* of this Volume.

The incremental increase in noise and light emissions from bridge associated activities will be small in comparison to the current level of activity in the Port of Gladstone. Noise and light impacts are therefore expected to be low.

Impacts from accidental spills of hydrocarbons or chemicals from bridge activities, primarily during construction have the potential to be high, but there is a low probability of occurrence. Turtles surface to breathe air and are therefore vulnerable to exposure to oil spill impacts caused by surfacing through an oil slick on the sea surface. In addition, there is the potential for contamination of breeding and nesting sites in the area. *Volume 5, Chapter 8* describes mitigation measures that will be applied to minimise the risk of spills.

Mitigation measures such as lighting design, vessel speed restrictions and exclusion zones will reduce the extent of impacts and are further detailed in *Volume 5, Chapter 8*. It is considered unlikely that the Curtis Island Bridge will have a significant impact on listed Threatened and Migratory Marine reptile species.

Migratory Birds

Intertidal mudflats with saltmarsh and mangrove vegetation in the Port of Gladstone support a high biodiversity and biomass of benthic invertebrates and provide important feeding habitat for listed Migratory waders, protected under JAMBA, CAMBA and ROKAMBA Migratory bird agreements. Eleven Marine and wetland Migratory bird species listed under the *EPBC Act* may potentially also occur within this area (refer *Volume 5, Chapters 7 and 8, and Annex 13.3*). Of these, one species is listed as Endangered; the Southern Giant Petrel *(Macronectes giganteus)* and one species is listed as Vulnerable; the Kermadec Petrel *(Pterodroma neglecta).* There are no significant petrel breeding grounds or feeding areas in the Port of Gladstone area and these species were not recorded during the bird surveys (refer *Volume 5, Chapter 7, Appendix 5.7 and 5.8, and Annex 13.3*).

The incremental increase in noise and light emissions from Project associated vessels will be small in comparison to the current level of activity in the Port of Gladstone. Noise and light impacts on are therefore expected to be low.

22 Taylor H, Rasheed M, Dew K. and Sankey T. (2007) ***Long Term Seagrass Monitoring in Port Curtis and Rodds Bay, Gladstone, November 2006.*** *Queensland*:

Impacts from accidental spills of hydrocarbons or chemicals from bridge activities, primarily during construction have the potential to be high, but there is a low probability of occurrence. Seabirds and shorebirds are very sensitive to both internal and external effects of hydrocarbons. In addition, there is the potential for contamination of feeding and roosting sites. *Volume 5, Chapter 8* describes mitigation measures that will be applied to minimise the risk of spills.

It is considered unlikely that the controlled actions will have a significant impact on listed Threatened and Migratory Marine and wetland bird species.

The Curtis Island Bridge is considered unlikely to have a significant impact on listed Threatened and Migratory Marine species, due to:

- the small numbers of individuals that utilise the area (refer to *Volume 5, Chapter 8*);
- the mobile nature of the marine fauna discussed, enabling them to avoid direct impact;
- the management and mitigation measures that will be in place (refer to *Volume 5, Chapter 8*); and
- the likelihood that Marine fauna will continue to utilise parts of the area despite the activities associated with the construction of the Curtis Island Bridge.

2.5.4 EPBC 2008/4401 – LNG Marine Facilities

World Heritage and National Heritage Values

The proposed LNG Plant Marine Facilities are likely to have a significant impact on the landscape character and visual quality within 4.2 km of the development (refer *Volume 5, Chapter 16, Appendix 5.18 and Annex 13.3)*. This area is within the Port of Gladstone and the GBRWHA designation. However, 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 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 Marine Facilities would be consistent with the proposed expansion of industry around the Port of Gladstone.

The LNG Marine Facilities are unlikely to have a significant impact on other World Heritage and National Heritage values, namely "geological phenomenon", "ecological and biological processes" and "biodiversity and threatened species" (refer *Table 13.2-2 of Volume 13; and Volume 5, Chapter 16, Appendix 5.18 and Annex 13.3)*.

Flora

No Threatened vegetation communities listed under the *EPBC Act* occur within, or within the vicinity of, the proposed LNG Marine Facilities *(refer Volume 5, Chapters 7 and 8, Appendix 5.5 and Annex 13.3)*. The controlled actions will not have a significant impact on listed Threatened vegetation communities.

Eight listed Threatened flora species were predicted to occur within the area; however, none were identified within, or within the vicinity of, the proposed LNG Marine Facilities (refer *Volume 5, Chapters 7 and 8, Appendix 5.5 and Annex 13.3)*. The flora of the study area is therefore not considered to be of conservation significance from a national perspective. The controlled action is considered unlikely to have a significant impact on listed Threatened flora species.

Terrestrial Birds

Eight listed Threatened terrestrial bird species were predicted to occur within the study area. During field surveys, one listed Threatened bird species was recorded (Squatter Pigeon (*Geophaps scripta scripta*)), which is listed as Vulnerable (refer *Volume 5, Chapter 7, Appendix 5.7 and 5.8, and Annex 13.3*). The Squatter Pigeon was recorded only on the mainland and not on Curtis Island. The proposed LNG Marine Facilities are considered unlikely to have a significant impact on listed Threatened terrestrial bird species.

Migratory Birds

Twenty-five terrestrial listed Migratory birds were recorded during field surveys (refer *Volume 5, Chapter 7, Appendix 5.7 and 5.8, and Annex 13.3*). No important habitats for these species were identified on Curtis Island. It is considered unlikely that the proposed LNG Marine Facilities will have a significant impact on any listed terrestrial Migratory birds.

Terrestrial Mammals

Three listed Threatened terrestrial mammals were predicted to occur within the vicinity of the proposed LNG Marine Facilities (refer *Volume 5, Chapter 7, Appendix 5.6 and Annex 13.3*). None of these species were detected during field surveys. The proposed LNG Marine Facilities are considered unlikely to have a significant impact on listed Threatened terrestrial mammal species.

Reptiles

Three listed Threatened terrestrial reptiles and amphibians were predicted to occur within vicinity of the proposed LNG Marine Facilities (refer *Volume 5, Chapter 7, and Annex 13.3*). None of these species were detected during field surveys. The proposed LNG Marine Facilities are considered unlikely to have a significant impact on listed Threatened terrestrial reptiles and amphibian species.

Butterfly Species

No listed Threatened butterfly species were identified in the EPBC protected matters or EPA Wildlife Online search. Additionally, no listed Threatened species were recorded during terrestrial ecology field surveys (refer *Volume 5, Chapter 7 and Annex 13.3*). The controlled actions are considered unlikely to impact on listed Threatened terrestrial butterfly species.

Fish

From a search of the EPBC Protected Matters database two listed Threatened fish species - Whale Shark *(Rhincodon typus)* and the Green Sawfish *(Pristis zijsron)* have the potential to occur or migrate within the area of the proposed LNG Marine Facilities (refer *Volume 5, Chapter 8 and Annex 13.3*). However, Green Sawfish are predominantly found north of Cairns in the Gulf of Carpentaria, and the Whale Shark is predominantly an offshore species. It is unlikely that these species will utilise the Port of Gladstone. Therefore, it is unlikely that the LNG Marine Facilities will have a significant impact listed Threatened fish species.

Marine Mammals

One listed Threatened and Migratory Marine mammal (Humpback whale (Megaptera novaeangliae) and five listed Migratory Marine mammals (Bryde's whale (Balaenoptera edeni), Dugong (*Dugong dugon*), Snubfin dolphin (Orcaella heinsohni), Orca (Orcinus orca) and Indo-Pacific Humpback dolphin (Sousa chinensis) have the potential to occur within the area of the proposed LNG Marine Facilities (refer Volume 5, Chapter 8 and Annex 13.3). Of these, two dolphin species Snubfin Dolphin and Indo-Pacific Humpback Dolphin may occur within the Port of Gladstone, however there is no published literature documenting their occurrence within the study area. Previous studies have shown that the Indo–Pacific Humpback dolphin co-exist with coastal development such as in Cleveland Bay, Townsville[23] and therefore not likely to be significantly impacted by the LNG Marine Facilities.

Given the offshore nature of the three listed whale species and the known distances from the Port of Gladstone area, these species are not expected to be a key sensitive receptor for this Project.

Dugongs (*dugong dugon*) are known to inhabit the study area, and may suffer short term disturbance to their feeding patterns due to increased vessel activity and turbidity within the Port primarily from vessels associated with LNG Marine Facilities (refer Volume 5, Chapter 8 and Annex 13.3). Shipping activities and related impacts are described in Section 2.5.8 of this current volume. The physical presence of the marine infrastructure may alter the movement of the dugongs, but primarily they will be influenced by feeding areas rather than avoidance of infrastructure.

23 Parra G J (2006) Resource partitioning in sympatric delphinids: Space use and habitat preferences of Australian snubfin and Indo-Pacific humpback dolphins. Journal of Animal Ecology 75:862-874.

The incremental increase in noise and light emissions from the LNG Marine Facilities and associated activities will be small in comparison to the current level of activity in the Port of Gladstone. Noise and light impacts are therefore expected to be low.

Impacts from accidental spills of hydrocarbons or chemicals from the LNG Marine Facilities have the potential to be high, but there is a low probability of occurrence. Marine mammals surface to breathe air and are therefore vulnerable to exposure to oil spill impacts caused by surfacing through an oil slick on the sea surface. These marine mammals are smooth-skinned and hairless so contact with oil may cause only minor oil adherence. *Volume 5, Chapter 8* describes mitigation measures that will be applied to minimise the risk of spills.

Mitigation measures to be applied as detailed in *Volume 5, Chapter 8* combined with the descriptions for marine mammals described above and in *Volume 5, Chapter 8*, it is considered unlikely that the LNG Marine Facilities will have a significant impact on listed Threatened and Migratory Marine mammal species.

It is considered unlikely that the LNG Marine Facilities will have a significant impact on listed Threatened and Migratory Marine and wetland bird species.

The proposed LNG Marine Facilities are considered unlikely to have a significant impact on listed Threatened and Migratory Marine species, due to:

- the small numbers of individuals that utilise the area (refer to *Volume 5, Chapter 8*);
- the mobile nature of the marine fauna discussed, enabling them to avoid direct impact;
- the management and mitigation measures that will be in place (refer to *Volume 5, Chapter 8*); and
- the likelihood that Marine fauna will continue to utilise parts of the area despite the activities associated with the proposed LNG Marine Facilities.

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 (refer *Volume 5, Chapter 8* and *Annex 13.3*). Only the Green Turtle, Loggerhead Turtle and the Flatback Turtle are likely to be present within the Port of Gladstone[24,25,26] as they have known nesting beaches in the area. However, there are no known turtle nesting beaches within 5 km of the proposed LNG Marine Facilities (refer *Volume 5, Chapter 8* and *Annex 13.3*) and therefore

24 Limpus C J, McLaren M, McLaren G and Knuckey B. (2006) Queensland Turtle Conservation Project: Curtis Island and Woongarra Coast Flatback Turtle Studies, 2005-2006.

25 Queensland Environmental Protection Agency (QEPA) (2003) ***Curtis Coast Regional Coastal Management Plan***

26 Taylor H, Rasheed M, Dew K. and Sankey T. (2007) ***Long Term Seagrass Monitoring in Port Curtis and Rodds Bay, Gladstone, November 2006.*** *Queensland*:

turtle nesting and hatchling activities will not be significantly impacted by associated impacts from the LNG Marine Facilities (i.e. light spill, construction, noise).

However, turtles may be in transit and their behaviour or movement may be altered during the construction or operation of the LNG Marine Facilities. Unknown numbers of turtles may use the area for foraging adjacent to the proposed LNG Marine Facilities location and Green turtles have been regularly observed within the seagrass meadows particularly on Pelican Banks (eastern side of Curtis Island)[27]. Turtles foraging in shallow water and the extensive seagrass beds close by are more likely to suffer disturbance or strikes from vessels. Shipping activities and related impacts are described in *Section 2.5.8* of this current volume.

The incremental increase in noise and light emissions from Project associated vessels will be small in comparison to the current level of activity in the Port of Gladstone. Noise and light impacts are therefore expected to be low.

Impacts from accidental spills of hydrocarbons or chemicals from the LNG Marine Facilities have the potential to be high, but there is a low probability of occurrence. Turtles surface to breathe air and are therefore vulnerable to exposure to oil spill impacts caused by surfacing through an oil slick on the sea surface. In addition, there is the potential for contamination of breeding and nesting sites in the area. *Volume 5, Chapter 8* describes mitigation measures that will be applied to minimise the risk of spills.

Mitigation measures such as lighting design, vessel speed restrictions and exclusion zones will reduce the extent of impacts and are further detailed in *Volume 5, Chapter 8*. It is therefore unlikely that the LNG Marine Facilities will have a significant impact on listed Threatened and Migratory Marine reptile species.

Migratory Birds

Intertidal mudflats with saltmarsh and mangrove vegetation in the Port of Gladstone support a high biodiversity and biomass of benthic invertebrates and provide important feeding habitat for listed Migratory waders, protected under JAMBA, CAMBA and ROKAMBA. Eleven Marine and wetland Migratory bird species listed under the *EPBC Act* may potentially also occur within this area (refer *Volume 5, Chapters 7 and 8*, and *Annex 13.3*). Of these, one species is listed as Endangered; the Southern Giant Petrel (*Macronectes giganteus*) and one species is listed as Vulnerable; the Kermadec Petrel (*Pterodroma neglecta*). There are no significant petrel breeding grounds or feeding areas in the Port of Gladstone area and these species were not recorded during the bird surveys (refer *Volume 5, Chapter 7*, *Appendix 5.7 and 5.8*, and *Annex 13.3*).

27 Taylor H, Rasheed M, Dew K. and Sankey T. (2007) ***Long Term Seagrass Monitoring in Port Curtis and Rodds Bay, Gladstone, November 2006.*** *Queensland*:

The incremental increase in noise and light emissions from LNG Marine Facilities will be small in comparison to the current level of activity in the Port of Gladstone. Noise and light impacts are therefore expected to be low.

Impacts from accidental spills of hydrocarbons or chemicals from LNG Marine Facilities have the potential to be high, but there is a low probability of occurrence. Seabirds and shorebirds are very sensitive to both internal and external effects of hydrocarbons. In addition, there is the potential for contamination of feeding and roosting sites. *Volume 5, Chapter 8* describes mitigation measures that will be applied to minimise the risk of spills.

2.5.5 EPBC 2008/4402 – LNG Plant and Associated Onshore Facilities

World Heritage and National Heritage Values

The proposed LNG Plant and Associated Onshore Facilities are likely to have a significant impact on the landscape character and visual quality within 4.2 km of the development (refer *Volume 5*, *Chapter 16*, *Appendix 5.18* and *Annex 13.3*). This area is within the Port of Gladstone and the GBRWHA designation. However, 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 (refer to *Table 13.2-2*). 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 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.

The proposed LNG Plant and Associated Onshore Facilities are unlikely to have a significant impact on other World Heritage and National Heritage values, namely "geological phenomenon", "ecological and biological processes" and "biodiversity and Threatened species" (refer to *Table 13.2-2* of *Volume 13*; and *Volume 5*, *Chapter 16*, *Appendix 5.18* and *Annex 13.3*).

Field Studies

Prior to field investigations, desktop assessments and literature reviews were undertaken to ensure that field surveys were appropriate to the proposed developments and the study area. Two field surveys were carried out (spring and summer) from 28th September 2008 to 15th October 2008 and 12th to 24th February 2009 (a total of five weeks). An earlier site inspection to identify key issues was also carried out in June 2008. The methods used during the desktop and field ecology assessments carried out for the ecological impact assessment are summarised in *Volume 5 Chapter 7, section 7.5*.

Detailed assessment studies and reports for birds, reptiles and amphibians and vegetation were undertaken by specialist consultants. Specialist technical reports are summarised within *Volume 5 Chapter 7*, with the full technical reports provided as *Appendix 5.5*[28], *Appendix 5.6*[29], *Appendix 5.7*[30] *and Appendix 5.8*[31].

Terrestrial Flora

No Threatened vegetation communities listed under the *EPBC Act* occur within, or within the vicinity of, the proposed LNG Plant and Associated Onshore Facilities site (refer *Volume 5*, *Chapter 7*, *Appendix 5.5* and *Annex 13.3*). The controlled actions will not have a significant impact on listed Threatened vegetation communities.

Eight listed Threatened flora species were predicted to occur within the area, however, no listed Threatened flora species were identified within, or within the vicinity of, the proposed LNG Plant and Associated Onshore Facilities site (refer *Volume 5*, *Chapter 7*, *Appendix 5.5* and *Annex 13.3*). The flora of the study area is therefore not considered to be of conservation significance from a national perspective (refer *Volume 5, Chapter 7, Appendix 5.5* and *Annex 13.3*). The controlled actions are considered unlikely to have a significant impact on listed Threatened flora species.

Terrestrial Birds

Eight listed Threatened terrestrial bird species were predicted to occur within the study area. During field surveys, one listed Threatened bird species was recorded (the Squatter Pigeon *(Geophaps scripta scripta)*), which is listed as Vulnerable (refer *Volume 5*, *Chapter 7*, *Appendix 5.7 and 5.8*, and *Annex 13.3*). The Squatter Pigeon was recorded only on the mainland and not on Curtis Island. The proposed LNG Plant and Associated Onshore Facilities are considered unlikely to have a significant impact on listed Threatened terrestrial bird species.

Intertidal Habitats

Intertidal mudflats with saltmarsh and mangrove vegetation in the Port of Gladstone support a high biodiversity and biomass of benthic invertebrates and provide important feeding habitat for listed Migratory waders, protected under JAMBA, CAMBA and ROKAMBA. Eleven Marine and wetland Migratory bird species listed under the *EPBC Act* may potentially also occur within this area (refer *Volume 5, Chapters 7 and 8*, and *Annex 13.3*). Of these, one species is listed as Endangered; the Southern Giant Petrel (*Macronectes giganteus*) and one species is listed as Vulnerable; the Kermadec Petrel (*Pterodroma neglecta*). There are no significant petrel

28 Unidel (2009) QCLNG – Curtis Island Components: Flora Report.

29 Unidel (2009) QCLNG – Curtis Island Components: Reptiles and Amphibians Report.

30 Rohweder, Dr D, and Charley D (2008) QGC Queensland Curtis LNG Project, Curtis Island: Targeted Bird Survey..

31 Rohweder, Dr D, and Charley D (2009) QGC Queensland Curtis LNG Project, Curtis Island: Supplementary Targeted Bird Survey.

breeding grounds or feeding areas in the Port of Gladstone area and these species were not recorded during the bird surveys (refer *Volume 5, Chapter 7* and *Annex 13.3*).

Migratory Birds

Twenty-five terrestrial listed Migratory birds were recorded during field surveys (refer *Volume 5, Chapter 7, Appendix 5.7 and 5.8* and *Annex 13.3*). No important habitats for these species were identified on Curtis Island. It is considered unlikely that the proposed LNG Plant and Associated Onshore Facilities will have a significant impact on any listed terrestrial Migratory birds.

Terrestrial Mammals

Three listed Threatened terrestrial mammals were predicted to occur within the vicinity of the proposed LNG Plant and Onshore Facilities. None of these species were detected during the field surveys (refer *Volume 5, Chapter 7* and *Annex 13.3*). The proposed LNG Plant and Onshore Facilities are considered unlikely to have a significant impact on listed Threatened terrestrial mammal species.

Reptiles

Three listed Threatened terrestrial reptiles and amphibians were predicted to occur within vicinity of the proposed LNG Plant and Onshore Facilities. None of these species were detected during the field surveys (refer *Volume 5, Chapter 7, Appendix 5.6* and *Annex 13.3*). The proposed LNG Plant and Onshore Facilities are considered unlikely to have a significant impact on listed Threatened terrestrial reptiles and amphibian species.

Butterfly Species

No listed Threatened butterfly species were identified in the EPBC protected matters or EPA Wildlife Online search and none were recorded during the terrestrial ecology field surveys (refer *Volume 5, Chapter 7* and *Annex 13.3*). The controlled actions are considered unlikely to impact on listed Threatened terrestrial butterfly species.

Marine Environment

Liquid discharges for operations are described in *Volume 2 Chapter 9* (*Section 9.11*) and for construction in *Volume 2 Chapter 13* (*Section 13.9, 13.10 and 13.11*). In summary, liquid discharges to the marine environment will include:

- Stormwater runoff from the LNG Facility site, consisting of stormwater run-off from uncontaminated parts of the site which will be routed to sedimentation ponds prior to overflow into Gladstone Harbour; and during operations, process wastewater and stormwater run-off from the Facility process, which will be routed to a corrugated plate interceptor (CPI) separator for treatment. CPI effluent will be further treated in a dissolved air flotation unit and a tertiary filter before being routed to

- Desalination brine resulting from operation of the LNG Facility Reverse Osmosis (RO) plant (used for water supply for both construction and operations)
- Treated sewage effluent, with sewage treated via an extended aeration-activated sewage treatment plant prior to discharge.

Desalination brine and treated sewage effluent will be discharged via a diffuser on the MOF nominally assumed to be located on the end of the MOF, although detailed design of this system is still ongoing. Indicative discharge volumes and characteristics are summarised in *Table 13.2-3* below, with impacts on receiving water quality described in *Volume 5 Chapter 8* (*Section 8.4.3*).

Table 13.2-3 Indicative Discharge Volumes and Characteristics

Stream Description	Flow, m^3/hr						Estimated Characteristics
	Average			Maximum			
No. of Trains	**1**	**2**	**3**	**1**	**2**	**3**	
Treated Process/ contaminated stormwater (Note 1)	2.5	3.5	5	44	70	100	pH: 6 to 7 BOD_5: 10 to 20 mg/l TSS: 5 to 10 mg/l Oil: 5 to 15 mg/l
Desalination (RO) System Blowdown (Note 2)	10	15	20	26	40	50	pH: 6.5 to 7.5 units TDS: 55,500-60,000 mg/l $N+^{-}$: 17,000 mg/l Alkalinity: 170 mg/l Cl: 30,650 mg/l Mg++ : 2000 mg/l TSS: 0 mg/l SiO_2: 16 mg/l
Treated sewage (Note 3)	1	2	2.5	1.5	2.5	3.5	pH: 6.5 to 7.5 BOD_5: 10 to 20 mg/l Oil & Grease: 5 to 10 mg/l Total Nitrogen: 30 to 40 mg/l as N Total Kjeldahl Nitrogen: 1 to 5 mg/l Ammonia nitrogen: 1 to 5 mg/l Total Phosphorus: 5 to 10 mg/l TDS: 250 mg/l

Volume 5, Chapter 7 section 7.9 identifies general measures applicable across all proposed works; and specific measures to reduce impacts to key flora and fauna of the study area. The specific measures aim to avoid impacts where possible and mitigate the impact of unavoidable actions. *Section 7.9.3* also sets out that an environmental offsets strategy will be developed prior to the commencement of the Project. The strategy will identify the environmental offset activities which will be established to compensate for the unavoidable clearing of ecologically significant areas.

2.5.6 EPBC 2008/4403 – Mainland Road and Bridge Approach

QGC is in the process of withdrawing this referral.

This EPBC referral activity is not part of the QCLNG Project as the Marine Transportation Operations option is the preferred strategy for access to and from the LNG Facility on Curtis Island.

World Heritage and National Heritage Values

The Mainland Road and Bridge Approach is unlikely to have a significant impact on any of the World Heritage and National Heritage values, namely 'aesthetics and natural beauty', 'geological phenomenon', 'ecological and biological processes' and 'biodiversity and Threatened species' (refer *Volume 5, Chapter 16, Appendix 5.18* and *Annex 13.3*).

Terrestrial Flora

No Threatened vegetation communities listed under the *EPBC Act* occur within, or within the vicinity of, the Mainland Road and Bridge Approach (refer *Volume 5, Chapter 7, Appendix 5.5* and *Annex 13.3*). The 'controlled action' will not have a significant impact on listed Threatened vegetation communities.

Eight *EPBC Act* listed Threatened flora species were predicted to occur within the area, however, no *EPBC Act* listed Threatened flora species were identified within, or within the vicinity of, the Mainland Road and Bridge Approach (refer *Volume 5, Chapter 7, Appendix 5.5* and *Annex 13.3*). The flora of the study area is therefore not considered to be of conservation significance from a national perspective. Therefore, the 'controlled action' is considered unlikely to have a significant impact on listed Threatened flora species.

Terrestrial Birds

Detailed assessment studies and reports for birds were undertaken by specialist consultants. Specialist technical reports are summarised within *Volume 5 Chapter 7*, with the full technical reports provided as *Appendix 5.7*[32] *and Appendix 5.8*[33].

Eight *EPBC Act* listed Threatened terrestrial bird species were predicted to occur within the study area. During the field surveys only one *EPBC Act* listed Threatened bird species was recorded was (the Squatter Pigeon (*Geophaps scripta scripta*)) which is listed as Vulnerable (refer *Volume 5, Chapter 7, Appendix 5.7 and 5.8, and Annex 13.3)*. During the summer surveys, Squatter Pigeons were observed at four locations on the mainland but were not observed on Curtis Island. All of the mainland observations were within 150 m of a dam or creekline containing permanent fresh water and were associated

32 Rohweder, Dr D, and Charley D (2008) QGC Queensland Curtis LNG Project, Curtis Island: Targeted Bird Survey..

33 Rohweder, Dr D, and Charley D (2009) QGC Queensland Curtis LNG Project, Curtis Island: Supplementary Targeted Bird Survey.

with existing vehicle tracks or small areas with sparse ground cover. Understorey vegetation through most of the study area is unsuitable for Squatter Pigeons as it consists of dense grass cover. Habitat removed to construct the Mainland Road and Bridge Approach would not have direct impacts on Squatter Pigeons as most of the existing track network would remain unaffected, though the proposed road would pose a risk of vehicle strike to Squatter Pigeons (refer *Volume 5, Chapter 7 and Annex 13.3)*.

Significant impacts to Squatter Pigeon are considered unlikely as:

- the study area is not considered to support an important population as defined under the *EPBC Act*;
- the area of habitat to be affected (mainland) is small; and
- areas of known habitat are available in areas immediately adjacent to the study area.

Intertidal Habitats

Intertidal mudflats with saltmarsh and mangrove vegetation in the Port of Gladstone support a high biodiversity and biomass of benthic invertebrates and provide important feeding habitat for listed Migratory waders, protected under JAMBA, CAMBA and ROKAMBA. Eleven Marine and wetland Migratory bird species listed under the *EPBC Act* may potentially also occur within this area (refer *Volume 5, Chapter 7* and *Annex 13.3*). Of these, one species is listed as Endangered; the Southern Giant Petrel (*Macronectes giganteus*) and one species is listed as Vulnerable; the Kermadec Petrel (*Pterodroma neglecta*). There are no significant petrel breeding grounds or feeding areas in the Port of Gladstone area and these species were not recorded during the bird surveys (refer *Volume 5, Chapter 7* and *Annex 13.3*).

Migratory Birds

Twenty-five terrestrial *EPBC Act* listed Migratory birds were recorded during the field surveys (refer *Volume 5, Chapter 7, Appendix 5.7 and 5.8,* and *Annex 13.3)*. Five migratory bird species of national significance (Red-necked Stint (*Calidris ruficollis*), Bar-tailed Godwit (*Limosa lapponica*), Eastern Curlew (*Numenius madagascariensis*), Whimbrel (*Numenius phaeopus*) and Common Greenshank (*Tringa nebularia*) were recorded within the field survey study area. Areas within the tidal mudflats which would be bisected by the Mainland Road and Bridge Approach were identified as representing important habitat to one Migratory species, the Eastern Curlew (*Numenius madagascariensis*) (refer *Volume 5, Chapter 7, Appendix 5.7 and 5.8*, and *Annex 13.3)*.

Eastern Curlews were widely distributed throughout the study area. Curlews forage on intertidal habitat along the mainland and island coasts and small flocks roost in areas along the Curtis Island coastline to the north and south of the LNG Facility site, as well as at Laird Point. Larger numbers of individuals (often up to 50) use the neap tide roost near Friend Point on the mainland. The proposed mainland road route would render the neap tide roost unsuitable for Eastern Curlews and reduce the suitability of the nearby spring tide roost.

The subject site is situated within the Curtis Coast region that provides important habitat for a large shorebird population[34]. The proposal would directly modify an identified neap tide roost and affect use of a nearby spring tide roost. The proposed access road extends across the western edge of the neap tide roost. In addition to the removal of habitat an elevated roadway would reduce visibility from the roost, provide a source of disturbance to roosting birds, alter the hydrology of the adjoining (Saltpan) spring tide roost and disrupt movement between roosts. The proposal may also increase human visitation to Laird Point.

The subject roosts are known to, at times, support a substantial proportion of the Whimbrel (49%) and Red-necked Stint (25%) populations in the Curtis Coast Region[35]. The maximum count of Whimbrels recorded in late February 2009 was undertaken in the late afternoon and included birds that stopped briefly at the site before being disturbed and flying to an alternative site. Whilst the value of the subject roosts to the local shorebird population is difficult to gauge from a baseline survey the data suggest that the roosts are important. Furthermore, the neap tide roost (at Friend Point) has been identified as a "Major Shorebird Roost Site" by the former Queensland Environment Protection Agency. It is unlikely that shorebirds would continue to utilise the neap tide roost during or after road construction.

An assessment of significance of the important mainland habitat to five migratory species; Bar-tailed Godwit, Eastern Curlew, Red-necked Stint, Whimbrel and Common Greenshank undertaken to assess the impacts of the Mainland Road and Bridge Approach to these species are contained in *Appendix 5.7 and 5.8*.

The assessment of significance concluded that the proposed Mainland Road and Bridge Approach has the potential to have a significant impact on these migratory species due to:

- direct impacts (i.e. habitat removal and disturbance); and
- indirect impacts (hydrology and visual barrier).

Mitigation measures are detailed in *Volume 5 Chapter 7 Section 7.6* to reduce impacts on the migratory and threatened species recorded within the study area.

Impacts on Curtis Island are either minor or can be controlled by managing vehicle access to Laird Point. Impacts on the mainland resulting from the Mainland Road and Bridge Approach would be more severe as they would affect an important roost site for Eastern Curlew and other migratory shorebirds.

The proposed Mainland Road and Bridge Approach has the potential to have a significant impact on the Eastern Curlew, due to:

34 Driscoll, P. (1997), The distribution of waders along the Queensland coastline. Pages 80-122 in Shorebird Conservation in the Asia Pacific Region, Ed P. Straw, Australasian Wader Studies Group

35 Driscoll, P. (1997), The distribution of waders along the Queensland coastline. Pages 80-122 in Shorebird Conservation in the Asia Pacific Region, Ed P. Straw, Australasian Wader Studies Group

- direct impacts (i.e. habitat removal and disturbance) on a neap tide roost that is used by a species whose population is decline; and
- indirect impacts (hydrology and visual barrier) on a nearby spring tide roost for the species.

The following potential impacts of the Mainland Road and Bridge Approach on birds and associated habitat are summarised:

- removal of neap tide roosting habitat used by Eastern Curlew and increased disturbance at three roost sites
- removal or modification of a substantial area of foraging habitat used by Eastern Curlew
- hydrological impacts on a spring tide roost used by Eastern Curlews and possible disruption of movement paths between the neap and spring tide roost
- removal of potential Beach Stone-curlew nesting habitat and disturbance of shelter and foraging habitat near Friend Point
- removal of a small area of known Squatter Pigeon foraging habitat and increased risk of mortality through road strike.

Terrestrial Mammals

Three listed Threatened terrestrial mammals were predicted to occur within the vicinity of the Mainland Road and Bridge Approach. None of these species were detected during the field surveys (refer *Volume 5, Chapter 7* and *Annex 13.3*). The Mainland Road and Bridge Approach is considered unlikely to have a significant impact on listed Threatened terrestrial mammal species.

Reptiles

Three listed Threatened terrestrial reptiles and amphibians were predicted to occur within vicinity of the Mainland Road and Bridge Approach. None of these species were detected during the field surveys (refer *Volume 5, Chapter 7, Appendix 5.6* and *Annex 13.3*). The Mainland Road and Bridge Approach is considered unlikely to have a significant impact on listed Threatened terrestrial reptiles and amphibian species.

Butterfly Species

No *EPBC Act* listed Threatened butterfly species were identified in the EPBC protected matters or EPA Wildlife Online search and none were recorded during the terrestrial ecology field surveys (refer *Volume 5, Chapter 7* and *Annex 13.3*). The 'controlled actions' will therefore not impact on listed Threatened terrestrial butterfly species.

2.5.7 EPBC 2008/4404 – Curtis Island Road

QGC is in the process of withdrawing this referral.

This EPBC referral activity is not part of the QCLNG Project as the Marine Transportation Operations option is the preferred strategy for access to and from the LNG Facility on Curtis Island.

World Heritage and National Heritage Values

The proposed Curtis Island Road is considered unlikely to have a significant impact on any of the World Heritage and National Heritage values, namely "aesthetics and natural beauty", "geological phenomenon", "ecological and biological processes" and "biodiversity and Threatened species" (refer *Volume 5, Chapter 16, Appendix 5.18* and *Annex 13.3).*

Field Studies

Prior to field investigations, desktop assessments and literature reviews were undertaken to ensure that field surveys were appropriate to the proposed developments and the study area. Two field surveys were carried out (spring and summer) from 28th September 2008 to 15th October 2008 and 12th to 24th February 2009 (a total of five weeks). An earlier site inspection to identify key issues was also carried out in June 2008. The methods used during the desktop and field ecology assessments carried out for the ecological impact assessment are summarised in *Volume 5 Chapter 7, section 7.5*.

Detailed assessment studies and reports for birds, reptiles and amphibians and vegetation were undertaken by specialist consultants. Specialist technical reports are summarised within *Volume 5 Chapter 7*, with the full technical reports provided as *Appendix 5.5*[36]*, Appendix 5.6*[37]*, Appendix 5.7*[38] *and Appendix 5.8*[39].

Terrestrial Flora

Studies concluded that no Threatened vegetation communities listed under the *EPBC Act* occur within, or within the vicinity of, the proposed Curtis Island Road (refer *Volume 5, Chapter 7, Appendix 5.5* and *Annex 13.3*). The controlled actions are considered unlikely to have a significant impact on listed Threatened vegetation communities.

Eight listed Threatened flora species were predicted to occur within the area, however, no listed Threatened flora species were identified within, or within the vicinity of, the proposed Curtis Island Road (refer *Volume 5, Chapter 7, Appendix 5.5* and *Annex 13.3*). The flora of the study area is therefore not considered to be of conservation significance from a national perspective. The

36 Unidel (2009) QCLNG – Curtis Island Components: Flora Report.

37 Unidel (2009) QCLNG – Curtis Island Components: Reptiles and Amphibians Report.

38 Rohweder, Dr D, and Charley D (2008) QGC Queensland Curtis LNG Project, Curtis Island: Targeted Bird Survey.

39 Rohweder, Dr D, and Charley D (2009) QGC Queensland Curtis LNG Project, Curtis Island: Supplementary Targeted Bird Survey.

controlled actions are considered unlikely to have a significant impact on listed Threatened flora species.

Terrestrial Birds

Eight listed Threatened terrestrial bird species were predicted to occur within the study area. During the field surveys, one listed Threatened bird species was recorded (the Squatter Pigeon (*Geophaps scripta scripta*)), which is listed as Vulnerable (refer *Volume 5, Chapter 7, Appendix 5.7 and 5.8*, and *Annex 13.3*). The Squatter Pigeon was only recorded on the mainland and not on Curtis Island. The proposed Curtis Island Road is considered unlikely to have a significant impact on listed Threatened terrestrial bird species.

Migratory Birds

Twenty-five terrestrial listed Migratory birds were recorded during the field surveys (refer *Volume 5, Chapter 7, Appendix 5.7 and 5.8*, and *Annex 13.3*). No important habitats for these species were identified on Curtis Island. It is considered unlikely that the proposed Curtis Island Road will have a significant impact on any listed terrestrial Migratory birds.

Terrestrial Mammals

Three listed Threatened terrestrial mammals were predicted to occur within the vicinity of the proposed Curtis Island Road. None of these species were detected during the field surveys (refer *Volume 5, Chapter 7* and *Annex 13.3*). The proposed Curtis Island Road is considered unlikely to have a significant impact on listed Threatened terrestrial mammal species.

Reptiles

Three listed Threatened terrestrial reptiles and amphibians were predicted to occur within vicinity of the proposed Curtis Island Road. None of these species were detected during the field surveys (refer *Volume 5, Chapter 7, Appendix 5.6* and *Annex 13.3*). The proposed Curtis Island Road is considered unlikely to have a significant impact on listed Threatened terrestrial reptiles and amphibian species.

Butterfly Species

No listed Threatened butterfly species were identified in the EPBC protected matters or EPA Wildlife Online search and none were recorded during the terrestrial ecology field surveys (refer *Volume 5, Chapter 7* and *Annex 13.3*). The controlled actions are considered unlikely to impact on listed Threatened terrestrial butterfly species.

2.5.8 EPBC 2008/4405 – Shipping Activities

Potential impacts to MNES from the increase in shipping activities associated with the development include the following (refer to *Volume 5, Chapter 8* for full impact assessment):

- injury and fatality of marine fauna through vessel strikes
- disturbance from vessel noise
- disturbance from vessel lighting
- injury of fauna and contamination of habitats from accidental spills of hydrocarbons or chemicals

World Heritage and National Heritage Values

Proposed Shipping Activities are considered unlikely to have a significant impact on any of the World Heritage and National Heritage values, namely "aesthetics and natural beauty", "geological phenomenon", "ecological and biological processes" and "biodiversity and Threatened species" (refer *Table 13.2-2 of Volume 13 and Annex 13; and Volume 5, Chapter 16, Appendix 5.18).*

Fish

Two listed Threatened fish species, the Whale Shark *(Rhincodon typus)* and the Green Sawfish *(Pristis zijsron)* were identified by a search of the EPBC Protected Matters database as having the potential to occur or migrate within the area of the proposed Shipping Activities (refer *Volume 5, Chapter 8 and Annex 13.3*). However, Green Sawfish are predominantly found north of Cairns in the Gulf of Carpentaria, and the Whale Shark is predominantly an offshore species. It is therefore unlikely that these species will utilise the Port of Gladstone (refer *Volume 5, Chapter 8 and Annex 13.3*). Therefore, it is considered unlikely that Project associated shipping activities will have a significant impact to listed Threatened fish species.

Marine Mammals

One listed Threatened and Migratory Marine mammal (Humpback whale) and five listed Migratory Marine mammals (Bryde's whale, Dugong, Snubfin dolphin, Indo-Pacific Humpback dolphin, and Killer whale) were predicted to occur within the area of the proposed shipping activities from a search of the EPBC Protected Matters database (refer *Volume 5, Chapter 8* and *Annex 13.3*):

- Humpback whale (migratory, vulnerable)
- Bryde's whale (migratory)
- Dugong (migratory)
- Snubfin dolphin (migratory)
- Indo-Pacific Humpback dolphin (migratory)
- Killer whale (migratory)

The two dolphin species (Snubfin dolphin (*Orcaella heinsohni*) and Indo-Pacific Humpback dolphin (*Sousa chinensis*)) and the Dugong are the only species that are likely to occur within the Port of Gladstone (refer *Volume 5, Chapter 8* and *Annex 13.3*). There is no published literature documenting the occurrence of the two dolphin species within the area of the proposed shipping activities. However, dolphins are highly mobile and are likely to avoid the path of vessels, particularly those that are slow moving with in the Port of Gladstone. Dugongs (*dugong dugon*) are slower moving and may be more vulnerable to strikes. They may also suffer short-term disturbance to their feeding patterns due to the increased shipping activities within the Port. Propwash from vessel activity may also increase disturbance to seagrass meadows. However, given the extensive area of seagrass meadows especially around Wiggins Island, it is unlikely that vessel activity will result in such a loss of seagrass that would adversely impact dugong populations. *Volume 5, Chapter 8* describes mitigation measures that will be applied, including reduced vessel speeds and marine mammal watches, which will reduce and avoid impacts of vessel presence on dugongs.

The incremental increase in noise and light emissions from Project associated vessels will be small in comparison to the current level of activity in the Port of Gladstone. Noise and light impacts are therefore expected to be low.

Impacts from accidental spills of hydrocarbons or chemicals from vessels have the potential to be high, but there is a low probability of occurrence. Marine mammals surface to breathe air and are therefore vulnerable to exposure to oil spill impacts caused by surfacing through an oil slick on the sea surface. These marine mammals are smooth-skinned and hairless so contact with oil may cause only minor oil adherence. *Volume 5, Chapter 8* describes mitigation measures that will be applied to minimise the risk of spills.

It is considered unlikely that shipping activities will have a significant impact on listed Threatened and Migratory Marine mammal species.

Reptiles

Six listed Threatened and Migratory Marine reptiles and one listed Migratory Marine reptiles were predicted to occur within the area of the proposed shipping activities from a search of the EPBC Protected Matters database (refer *Volume 5, Chapter 8* and *Annex 13.3*):

- Green turtle (migratory vulnerable)
- Loggerhead turtle (migratory, endangered)
- Flatback turtle (migratory, vulnerable)
- Pacific Ridley turtle (migratory, endangered)
- Hawksbill turtle (migratory, vulnerable)
- Leatherback turtle (migratory, vulnerable)
- Saltwater crocodile (migratory)

Only the Green turtle, Loggerhead turtle and the Flatback turtle are likely to be present within the Port of Gladstone as they have known nesting beaches in the area. However, there are no known turtle nesting beaches within 5 km of

the proposed LNG Marine Facilities (refer *Volume 5, Chapter 16* and *Annex 13.3*). Vessel activities may disturb foraging turtles and could result in vessel strikes. *Volume 5, Chapter 8* describes mitigation measures that will be applied, including reduced vessel speeds and marine fauna watches, which will reduce and avoid impacts of vessel presence on turtles.

The incremental increase in noise and light emissions from Project associated vessels will be small in comparison to the current level of activity in the Port of Gladstone. Noise and light impacts are therefore expected to be low.

Impacts from accidental spills of hydrocarbons or chemicals from vessels have the potential to be high, but there is a low probability of occurrence. Turtles surface to breathe air and are therefore vulnerable to exposure to oil spill impacts caused by surfacing through an oil slick on the sea surface. In addition, there is the potential for contamination of breeding and nesting sites in the area. *Volume 5, Chapter 8* describes mitigation measures that will be applied to minimise the risk of spills.

It is considered unlikely that shipping activities will have a significant impact on listed Threatened and Migratory Marine reptile species.

Migratory Birds

Intertidal mudflats with saltmarsh and mangrove vegetation in the Port of Gladstone support a high biodiversity and biomass of benthic invertebrates and provide important feeding habitat for listed Migratory waders, protected under JAMBA, CAMBA and ROKAMBA. Eleven Marine and wetland Migratory bird species listed under the *EPBC Act* may potentially also occur within this area (refer *Volume 5, Chapters 7 and 8*, and *Annex 13.3*). Of these, one species is listed as Endangered, the Southern Giant Petrel (*Macronectes giganteus*); and one species is listed as Vulnerable, the Kermadec Petrel (*Pterodroma neglecta*). There are no significant petrel breeding grounds or feeding areas in the Port of Gladstone area and these species were not recorded during the bird surveys (refer *Volume 5, Chapter 7* and *Annex 13.3*).

The incremental increase in noise and light emissions from Project associated vessels will be small in comparison to the current level of activity in the Port of Gladstone. Noise and light impacts are therefore expected to be low.

Impacts from accidental spills of hydrocarbons or chemicals from vessels have the potential to be high, but there is a low probability of occurrence. Seabirds and shorebirds are very sensitive to both internal and external effects of hydrocarbons. In addition, there is the potential for contamination of feeding and roosting sites. *Volume 5, Chapter 8* describes mitigation measures that will be applied to minimise the risk of spills.

It is considered unlikely that Shipping Activities will have a significant impact on listed Threatened and Migratory Marine and wetland bird species. Impacts are likely to be higher, but short-term, during construction activities.

The proposed shipping activities are considered unlikely to have a significant impact on listed Threatened and Migratory Marine species, due to:

- the small numbers of individuals that utilise the area (refer to *Volume 5, Chapter 8*);
- the mobile nature of the marine fauna discussed, enabling them to avoid direct impact;
- the management and mitigation measures that will be in place such as vessel speed restrictions, minimisation of unnecessary movements (for example, thrusters) and using specified navigation channels (refer to *Volume 5, Chapter 8* for further details); and
- the likelihood that marine fauna will continue to utilise parts of the area despite the short-term and localised shipping activities.

2.5.9 *EPBC 2008/4406 – Swing Basin and Channel and Pipeline Dredging*

Potential impacts to MNES from dredging activities associated with the development include the following (refer to *Volume 5, Chapter 8* for full impact assessment):

- Short term effects on seagrass, coral reefs and other benthic communities due to increased turbidity
- Loss of a significant area of intertidal flat habitat due to the placement of dredge material in the vicinity of Fishermans Landing
- injury and fatality of a small number of marine fauna through vessel strikes
- disturbance from vessel & dredge noise
- disturbance from vessel lighting
- injury of fauna and contamination of habitats from accidental spills of hydrocarbons or chemicals

If the QCLNG Project were the first project to utilise the GPC's FL153 and Western Basin Strategic Dredging and Disposal reclamation area the impacts would include the loss of a significant area of intertidal flat habitat due to the placement of dredge material in the vicinity of Fishermans Landing

World Heritage and National Heritage Values

The proposed Swing Basin and Channel Dredging is unlikely to have a significant impact on any of the World Heritage and National Heritage values, namely "aesthetics and natural beauty", and "geological phenomenon". Impacts to "ecological and biological processes" and "biodiversity and threatened species" may be possible but these are likely to be insignificant, temporary and highly localised when considered in a regional context (refer *Table 13.2-2 Volume 13; Annex 13.3; Volume 5, Chapter 16*; and *Volume 6; Appendix 5.18*).

Fish

Two listed Threatened fish species - Whale Shark *(Rhincodon typus)* and the Green Sawfish *(Pristis zijsron)* have the potential to occur or migrate within the area of the proposed swing basin and channel dredging (refer *Volume 5, Chapter 8 and Annex 13.3*). Green Sawfish are predominantly found north of Cairns in the Gulf of Carpentaria, and the Whale Shark is predominantly an offshore species. It is highly unlikely that either species utilises the Port of Gladstone (refer *Volume 5, Chapter 8 and Annex 13.3*). Therefore, it is unlikely that the controlled actions will have a significant impact on any listed Threatened fish species.

Marine Mammals

One listed Threatened Marine mammal (Humpback whale) and five listed Migratory Marine mammals (Bryde's whale, Dugong, Snubfin dolphin, Indo-Pacific Humpback dolphin, and Killer whale) were predicted to occur within the area of the proposed dredging activities from a search of the EPBC Protected Matters database (refer *Volume 5, Chapter 8* and *Annex 13.3*):

- Humpback whale (vulnerable)
- Bryde's whale (migratory)
- Dugong (migratory)
- Snubfin dolphin (migratory)
- Indo-Pacific Humpback dolphin (migratory)
- Killer whale (migratory)

The only species that are likely to occur within the Port of Gladstone are the Snubfin dolphin (*Orcaella heinsohni*); Indo-Pacific Humpback dolphin (*Sousa chinensis*); and the Dugong (*Dugong dugon*) (refer *Volume 5, Chapter 8* and *Annex 13.3*). There is no published literature documenting the occurrence of the two dolphin species within the area of the proposed dredging activities. However, dolphins are highly mobile and are likely to avoid the path of slow moving dredges as well as faster moving support vessels. Dugongs (*D. dugon*) are slower moving and may be more vulnerable to vessel strikes and interactions with dredge heads and equipment. They may also suffer disturbance to their feeding patterns due to impacts associated with dredging activities such as increased noise, turbidity and sedimentation. *Volume 5, Chapter 8* and *Volume 6, Chapter 4* describe mitigation measures that will be applied, including reduced vessel speeds and marine mammal watches, which will reduce and avoid impacts of vessel movements on dugongs and other marine fauna.

The incremental increase in noise and light emissions from Project associated vessels will be small in comparison to the current level of activity in the Port of Gladstone, however noise generated from active dredge heads is considered to be relatively greater than existing background conditions. Noise and light impacts are expected to be low due to the temporal extent and ability of sensitive receptors to avoid areas where noise levels are higher than baseline levels.

Accidental hydrocarbon or chemical spills from dredge vessels have the potential to impact on marine mammals. Cetaceans and dugongs are smooth-skinned and relatively hairless and therefore only minor oil adherence is expected if contact occurs with oil or other chemicals. However, these species breathe air and are therefore vulnerable to exposure to slicks when they surface to breathe. This scenario holds the potential to cause serious injury or even fatalities to marine mammals, however the likelihood of such an occurrence is considered rare to virtually impossible and therefore the risk to these species is considered to be low. *Volume 5, Chapter 8* and *Volume 6, Chapter 4* describe mitigation measures that will be applied to minimise the risk of vessel collisions and hydrocarbon and chemical spills.

It is considered unlikely that dredging activities will have a significant impact on listed Threatened and Migratory Marine mammal species.

Reptiles

Six listed Threatened Marine reptiles and one listed Migratory Marine reptile were predicted to occur within the area of the proposed dredging activities from a search of the EPBC Protected Matters database (refer *Volume 5, Chapter 8* and *Annex 13.3*):

- Green turtle (*Cheolonia mydas*, vulnerable)
- Loggerhead turtle (*Caretta caretta*, endangered)
- Flatback turtle (*Natator depressus*, vulnerable)
- Pacific Ridley turtle (*Lepidochelys olivacea*, endangered)
- Hawksbill turtle (*Eretmochelys imbricate*, vulnerable)
- Leatherback turtle (*Dermochelys coriacea*, vulnerable)
- Saltwater crocodile (*Crocodylus porosus*, migratory)

Only the Green turtle, Loggerhead turtle and the Flatback turtle are likely to be present within the Port of Gladstone as they have known nesting beaches in the area. However, there are no known turtle nesting beaches within 5 km of the proposed LNG Marine Facilities (refer *Volume 5, Chapter 16* and *Annex 13.3*). Dredge activities may disturb foraging turtles and could result in dredge head interactions and vessel strikes. *Volume 5, Chapter 8* and *Volume 6, Chapter 4* describe mitigation measures that will be applied, including reduced vessel speeds and marine fauna watches, which will reduce and avoid impacts of vessel presence on turtles.

Physical injury and death of marine fauna resulting from entrainment via suction drag heads is expected to be rare. While turtle fatalities caused by dredging in shipping channels have been recorded in other parts of the world, the capture and mortality of sea turtles has primarily been documented from hopper dredge operations that use trailing suction drag heads. Incidental takes of sea turtles from cutter suction or other types of dredges are less likely. The extent of the potential risk of injury or fatality of turtles will therefore depend on the type of dredge being used, but is expected to be small. In the event that Trailer Suction Hopper Dredges are required for portions of the

proposed development, turtle excluding devices (TEDs) fitted to drag heads can be used to limit accidental interactions. There is also the slight possibility of injury or death of marine turtles from the dredge cutter as turtles occasionally sleep on the submerged surface offshore from Port of Gladstone. However, the noise and vibration from the dredge head (see *Volume 6, Chapter 3*) would suggest this is unlikely to occur.

The potential for collisions between fauna and vessels is regarded as slight, due to these species being likely to display behavioural and avoidance responses. The greatest risk of collision would be in relation to vessels moving between dredge operation and reclamation areas, however, a high level of traffic management and presents of vessel crew who are trained and assigned to observe for marine fauna means that the expected risk of vessel collision is low.

Entrainment into the active suction drag head of operating dredges is expected to be low due to a combination of fauna mobility and avoidance behaviour and operational controls such as TEDs on dredge heads and slow start-ups to dredging operations which will allow any marine fauna in the proximity of the dredge vessel to move away before the dredge is operating at full capacity. The anticipated risk of entrainment of marine reptiles is therefore low.

Entanglement of marine reptiles in mooring systems and temporary structures is possible though not common. Entanglement typically occurs in areas where there is a large tidal range but slow currents which can result in mooring lines becoming slack and thus creating loops and snags for passing fauna. Due to the shallow water depths, high currents and constant maintenance routines expected for temporary structures, fauna entanglements are not expected to be common and the subsequent risk is deemed to be low.

Impacts from accidental spills of hydrocarbons or chemicals from vessels have the potential to be high, but there is a low probability of occurrence. Turtles surface to breathe air and are therefore vulnerable to exposure to oil spill impacts caused by surfacing through an oil slick on the sea surface. In addition, there is the potential for contamination of breeding and nesting sites in the area. *Volume 5, Chapter 8* and *Volume 6, Chapter 4* describe mitigation measures that will be applied to minimise the risk of spills.

While not identified in the EPBC Protected Matters database report, seasnakes also occur in the region and therefore may occur in the areas to be dredged. Given the highly mobile nature of sea snakes and the fact that the dredging area has not been identified as important sea snake habitat, impacts to sea snakes are unlikely.

It is considered unlikely that dredging activities will have a significant impact on listed Threatened and Migratory Marine reptile species.

Migratory Birds

Intertidal mudflats with saltmarsh and mangrove vegetation in the Port of Gladstone support a high biodiversity and biomass of benthic invertebrates and provide important feeding habitat for listed Migratory waders, protected under JAMBA, CAMBA and ROKAMBA. Eleven Marine and wetland Migratory bird species listed under the *EPBC Act* may potentially also occur within this area (refer *Volume 5, Chapters 7 and 8*, and *Annex 13.3*). Of these, one species is listed as Endangered, the Southern Giant Petrel (*Macronectes giganteus*); and one species is listed as Vulnerable, the Kermadec Petrel (*Pterodroma neglecta*). There are no significant petrel breeding grounds or feeding areas in the Port of Gladstone area and these species were not recorded during the bird surveys (refer *Volume 5, Chapter 7* and *Annex 13.3*).

The incremental increase in noise and light emissions from Project associated vessels will be small in comparison to the current level of activity in the Port of Gladstone. Noise and light impacts are therefore expected to be low.

Impacts from accidental spills of hydrocarbons or chemicals from vessels have the potential to be high, but there is a low probability of occurrence. Seabirds and shorebirds are very sensitive to both internal and external effects of hydrocarbons. In addition, there is the potential for contamination of feeding and roosting sites. *Volume 5, Chapter 8* describes mitigation measures that will be applied to minimise the risk of spills.

It is considered unlikely that Dredging Activities will have a significant impact on listed Threatened and Migratory Marine and wetland bird species. The proposed dredging activities are considered unlikely to have a significant impact on listed Threatened and Migratory Marine species, due to:

- the small numbers of individuals that utilise the area (refer to *Volume 5, Chapter 8*);
- the mobile nature of the marine fauna discussed, enabling them to avoid direct impact;
- the management and mitigation measures that will be in place (refer to *Volume 5, Chapter 8*); and
- the likelihood that marine fauna will continue to utilise parts of the area despite the dredging activities.

Intertidal Habitats

Intertidal habitats including mudflats, saltmarsh, seagrass and mangrove vegetation occur throughout the Port of Gladstone and support a high biodiversity and biomass of benthic invertebrate and vertebrate fauna including turtles, dugong and bird species.

Fringing mangroves dominate the intertidal zones around Curtis Island and the mainland, and potential impacts from a hydrocarbon or chemical spill are considered high in this area due to the sensitivity of mangroves to oiling and the difficulties with clean-up attempts. Mangroves are also likely to be

impacted directly through clearing and indirectly through changes to hydrodynamics regimes and sediment erosion and deposition patterns as a result of the physical changes to seabed and shoreline profiles and subsequent tidal flows.

Elevated suspended sediment levels are likely to be a major stressor to water quality during dredging and reclamation operations. Benthic primary producers, such as seagrass and macroalgae can be highly susceptible to adverse changes to turbidity levels, through decreased light penetration; increased sedimentation rates, higher ambient water temperatures and increased biological oxygen demand (refer to *Volume 5 Chapter 8*). Adverse changes to these environmental conditions can have significant effects on the health, distribution and abundance of these habitat types.

Seagrass is a key benthic primary producer, and a number of marine fauna species are dependent on the seagrass distribution and health in the Port of Gladstone area. Secondary receptors of impacts associated with sediment mobilisation and settlement therefore include all marine species with lifecycles and trophic pathways associated with seagrass meadows and macroalgal distribution. Such species include adult green turtles and most turtle hatchlings, fish, invertebrates and dugong (*Dugong dugon*). Dugong might be particularly susceptible on a local scale to secondary impacts associated with sediment mobilisation and settling due to their reliance on seagrass meadows in the Western Basin for feeding and other activities.

While accurate quantification is not possible at this stage, it is highly likely that significant local impacts will be experienced by mangroves and seagrasses as a result of dredging activities. As a result dependent fauna such as dugong, fish and invertebrate populations may also be impacted. While these changes might be significant in terms of local species composition, and local distribution parameters the impact to benthic productivity and species abundance cannot be determined. When considered at the scale of the entire Western Basin, the impact of these changes on benthic populations is unlikely to be significant, however when considered in the regional context, the proposed dredging activity is unlikely to cause a significant or lasting impact to seagrass and mangrove habitats.

The proposed Swing Basin and Channel Dredging is considered unlikely to have a significant impact on listed Threatened and Migratory Marine species, due to:

- the small numbers of identified species that utilise the area
- the likelihood that identified species will be able to utilise unaffected habitats adjacent to the areas impacted by dredging activities
- The temporary nature of many of the impacts associated with dredging e.g. noise
- And the relatively local distribution of impacts when considered in a regional context.