ANNEX 13.2

PIPELINE COMPONENT - REPORT ON MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

Doc. No. QC LNG-00-N-RP04

2	Final	BT/SM	SF	SF	18 Aug 09
1	Final	BT/SM	SF	SF	11 Jun 09
0	Issued for QGC Review	BT/SM	SF	SF	19 Mar 09
A	Issued for Internal Review	BT/SM	SF	SF	14 Mar 09
Rev	**Description**	**Originator**	**Reviewed**	**Approved**	**Date**

Contents

1 INTRODUCTION

This Annex considers the Pipeline Component of the Project which consists of three pipeline cooridors:

- The Export Pipeline - a gas pipeline that extends approximately 380km from the QGC Coal Seam Gas (CSG) Field near Miles to the QC LNG Plant Facility on Curtis Island near Gladstone
- The Lateral - a gas pipeline that originates from Fairview and/or Sunshine tenements and runs approximately 200km to join the Export Pipeline near Wandowan, and
- The Collection Header - a collection of gas and water pipelines approximately 200km in length extending across the CSG Field from East of Tara to West of Wandoan.

An overview of the QCLNG Project is provided in *Volume 1, Chapter 2* of the EIS (particularly **Section 4.2**, **Chapter 8** and **13**). The predominant land uses are rural grazing and dry land cropping.

The pipeline crossing 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 marine species and communities and listed marine migratory species, that are found within the Port of Gladstone and which may be affected by the construction of the pipeline across The Narrows are discussed in **Annex 13.3**.

Besides the GBRMPA, the other MNES relate to Listed threatened species and communities (sections 18 & 18A) and Listed migratory species (sections 20 & 20A).

This assessment considered publically available databases and published information on the project area as well as detailed field surveys undertaken for the CSG Field and rapid flora field surveys of available sections of the Option 1 Export Pipeline and UIC.

This report details the existing nature conservation values of the pipeline corridors in terms of:

- Integrity of ecological processes, including habitats of species and communities listed under the EPBC Act
- Biological diversity, including habitats of rare and threatened species
- Integrity of landscapes and places including any natural places, and
- Aquatic and terrestrial ecosystems.

This report examines the potential and known occurrences of protected plants, animals and communities as identified under the EPBC Act.

The report discusses the nature conservation values of the areas likely to be affected by the Project and identifies mitigation measures to assist in avoiding or minimising impacts on Environmentally Sensitive Areas, areas of remnant vegetation and other areas of conservation value. Where avoidance is not possible, recommendations are made in relation to appropriate offset activities.

2 ASSUMPTIONS AND LIMITATIONS

The assessed pipeline alignments were indicative only and have been modified during the assessment process. Unfortunately this has meant that the assessment is primarily based on a desktop assessment. Field work was limited to a rapid assessment along parts of the Option 1 Export Pipeline and the UIC. Additionally, landholder access constraints prevented field inspection of significant portions of the pipelines at the time of the survey work. At the time of writing this technical report, no comprehensive detailed field surveys had been undertaken along any of the pipelines.

Due to constructability and land access constraints the Option 2 Export Pipeline alignment has been confirmed as the preferred route of the Export Pipeline. As a result of the identification of the preferred route, and developments in landholder access approvals, it will be possible to undertake a final detailed assessment of the entire alignment prior to the commencement of construction activities. This fieldwork will quantify areas and provide details of ecological features and values within the disturbance footprint. In the meantime the Queensland Herbarium RE mapping of these areas is assumed to be correct. Fauna habitat mapping has been derived from the same sources and is subject to similar assumptions and limitations.

Scale-dependant inaccuracies can occur with Queensland Herbarium RE mapping; for example, small remnants along creeks and road reserves may not be detected and small scale variation within larger remnants may not be recognised. Fauna habitat mapping has been derived from the same sources and is subject to similar assumptions and limitations.

The presence of a particular flora or fauna species within the pipeline corridors can only be confirmed by detailed targeted field surveys, so the precautionary approach has been adopted throughout this assessment. A species is assumed to occur in the study area if it was recorded in database searches for the region and the Queensland Herbarium's Regional Ecosystem (RE) mapping and / or the rapid field surveys indicated suitable habitat for the species, based on existing knowledge of the species' ecological requirements.

Whilst a significant proportion of the study area is cleared and is likely to be suitable for locating infrastructure which will be required for the construction and operation of the pipelines, the specific locations for access roads, compressor stations, construction camps and other support infrastructure were not known at the time of the assessment.

Estimated clearing footprints have been calculated using GIS based Queensland Herbarium RE mapping. Areas for individual REs are shown to two decimal points in order to better reflect the extent of the smaller remnant areas (e.g. <1 ha). Total areas are rounded to whole hectares where this rounding has no material affect on comparisons to better reflect the degree of accuracy of the estimations. Where totals have been rounded, they may not equal the sum of the component areas due to rounding errors.

This assessment considers only terrestrial ecological features and values. Marine ecology impacts are the subject of **Annex 13.3**.

3 ASSESSMENT METHODOLOGY

3.1 Assessment of Significance of Impacts

In this report, assessments of potential impacts have been assessed in accordance with the EPBC Significant Impact Guidelines, Policy Statement 1.1 DEWHA (2006).

In this guideline, DEHWA provides a framework to assist in determining whether the impact of an action on any matter of NES is likely to be significant:

'An action has, will have, or is likely to have a significant impact on an endangered ecological community if it does, will, or is likely to:

- *Lead to a long-term adverse affect on an ecological community*
- *Reduce the extent of a community*
- *Fragment an occurrence of the community*
- *Adversely affect habitat critical to the survival of an ecological community*
- *Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for the community's survival*
- *Result in invasive species that are harmful to the critically endangered or endangered community becoming established in an occurrence of the community, or*
- *Interfere with the recovery of an ecological community*.'

3.2 Flora Assessment

3.2.1 Determination of Significance Level

EPBC Act Listed Ecological Communities

EPBC Act Listed Ecological Communities as listed under the EPBC Act can be transposed for the most part, to the descriptions assigned by the Queensland Herbarium's Regional Ecosystem (RE) mapping. Those of relevance to the proposed pipelines are shown in **Table 1**.

Table 1 Translations from EPBC to VM Act Status for communities in the Brigalow Belt Bioregion.

RE Description	Qld VM Act Status	EPBC Act Listed Ecological Community
11.3.1	Endangered	Brigalow (*Acacia harpophylla* dominant and co-dominant)
11.4.3	Endangered	
11.4.7	Endangered	
11.4.8	Endangered	
11.4.9	Endangered	
11.4.10	Endangered	
11.5.16	Endangered	
11.9.1	Endangered	
11.9.5	Endangered	
11.9.6	Endangered	
11.11.14	Endangered	
11.12.21	Endangered	
11.2.3	Of Concern	Semi-evergreen vine thickets of the Brigalow belt (North and South) and Nandewar Bioregions
11.3.11	Endangered	
11.4.1	Endangered	
11.5.15	Not of Concern	
11.8.3	Not of Concern	
11.8.6	Not of Concern	
11.8.13	Endangered	
11.9.4	Endangered	
11.9.8	Not of Concern	
11.11.18	Not of Concern	
11.3.2 (in part)	Of Concern	Weeping Myall Woodlands
11.3.28 (in part)	Of Concern	

EPBC Act Listed Species

EPBC Act Listed species, pursuant to s 179 of the EPBC Act threatened flora species are classified as one of the following status categories:

- Extinct
- Extinct in the wild*
- Critically endangered*
- Endangered*
- Vulnerable*, or
- Conservation dependent.

Note that species classified as Extinct and Conservation dependant are not considered to be matters of National Environmental Significance (NES) (DEWHA 2009).

3.2.2 Flora Desktop Assessment

The flora desktop assessment included:

- Review of Queensland Herbarium HERBRECS data, DEWHA Protected Matters flora data and Queensland Museum data which was sourced 2nd February 2009 (EPA 2007). The data search areas were rectangular polygons and covered an area at least 5 km either side of the pipeline route. The search areas were:
  - Export Pipeline: 23.5333° S to 23.8622° S and 151.35° E to 150.0333° E
  - Lateral: 25.5333° S to 25.9° S and 150.3666° E to 148.85° E
  - Collection Header: 25.8166° S to 27.4333° S and 149.45° E to 151.1666° E
- Review Queensland Herbarium RE mapping (Version 5.0, 2005) for 10 km wide corridor centred on the pipeline route to establish those vegetation communities mapped by the EPA at a scale of 1:100 000
- Examination of satellite imagery to gain an appreciation of the project's proximity to sensitive areas, assess vegetation patterns and identify target areas for the rapid field investigations, and
- Review of the EPA Brigalow Belt South Biodiversity Planning Assessments (EPA 2008a), EPA Biodiversity Planning Assessment Brigalow Belt South Flora Expert Panel Report (EPA 2008b) and the Biodiversity Planning Assessment Brigalow Belt South Fauna Expert Panel Reports (EPA 2008c) to identify species and areas that are recognised as State, Regional or Local Biodiversity Significant or are flagged as important for their integrated biodiversity values within close proximity to the project area.

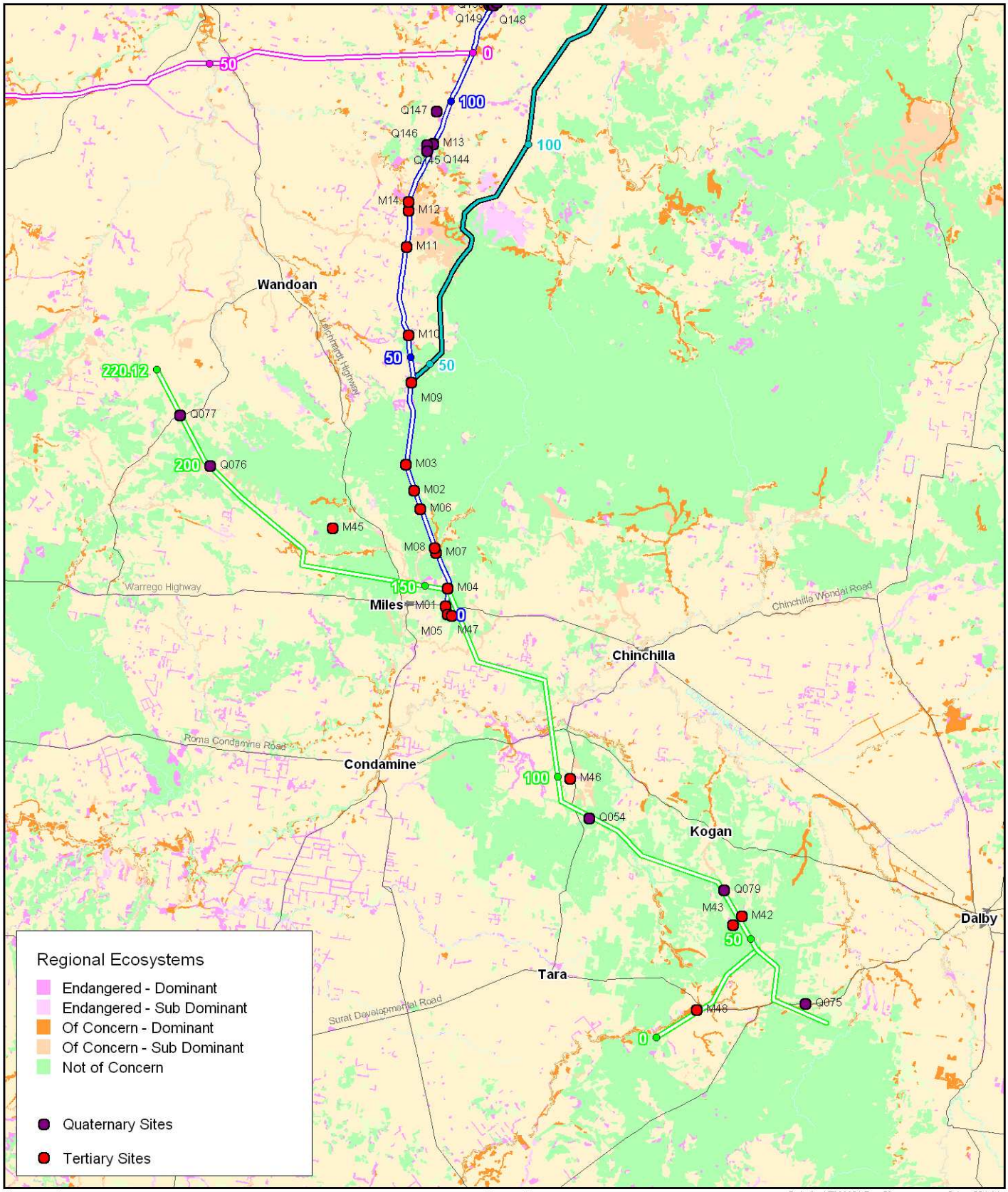
It is recognised that the information gained from these databases has caveats attached to it regarding the robustness or completeness of the information.

HERBRECS data is based almost exclusively on plant specimens actually recorded as present in the given locations. The absence of any specimen records for a particular species from an area does not imply that that species does not occur in that area.

Data from the DEWHA EPBC Act website is based on a combination of actual records, primarily from State Government databases, combined with modelled distributions of species according to their ecological characteristics. The mapping of a particular species in a search area does not guarantee that the species actually occurs in that area.

3.2.3 Flora Field Assessment

Rapid flora field surveys were conducted for the Option 1 Export Pipeline and UIC between the 29th of September and the 3rd of December 2008 by Unidel Botanists, Ann Moran and Martin Bennett (CVs provided in **Attachment 2** of **Appendix 4.2**). Additional assessments of the Export Pipeline alignments were undertaken from the 1-3 April 2009 by Ann Moran. Where land access was available, representative portions of the pipeline corridors were traversed by vehicle and / or foot.. The locations of Tertiary sites are shown in **Figure B.1-B.3 [EO5-P-MA-961036, 37 and 38]**.



Legend:

- Export Pipeline & Kilometre Point
- Export Pipeline Option 2 & Kilometre Point
- Lateral Pipeline & Kilometre Point
- Upstream Infrastructure Corridor & Kilometre Point

Source Note:

1:250,000 Topographic vector copyright Geoscience Australia
Regional Ecosystems v5.0 copyright QLD Herbarium
Quaternary and Tertiary Sites data captured and documented by Ann Moran

Projection UTM MGA Zone 56 Datum GDA 94

0 10 20 30 40

Kilometres

N

QUEENSLAND CURTIS LNG
A BG Group business

Project	Queensland Curtis LNG Project
Client	QGC - A BG Group business

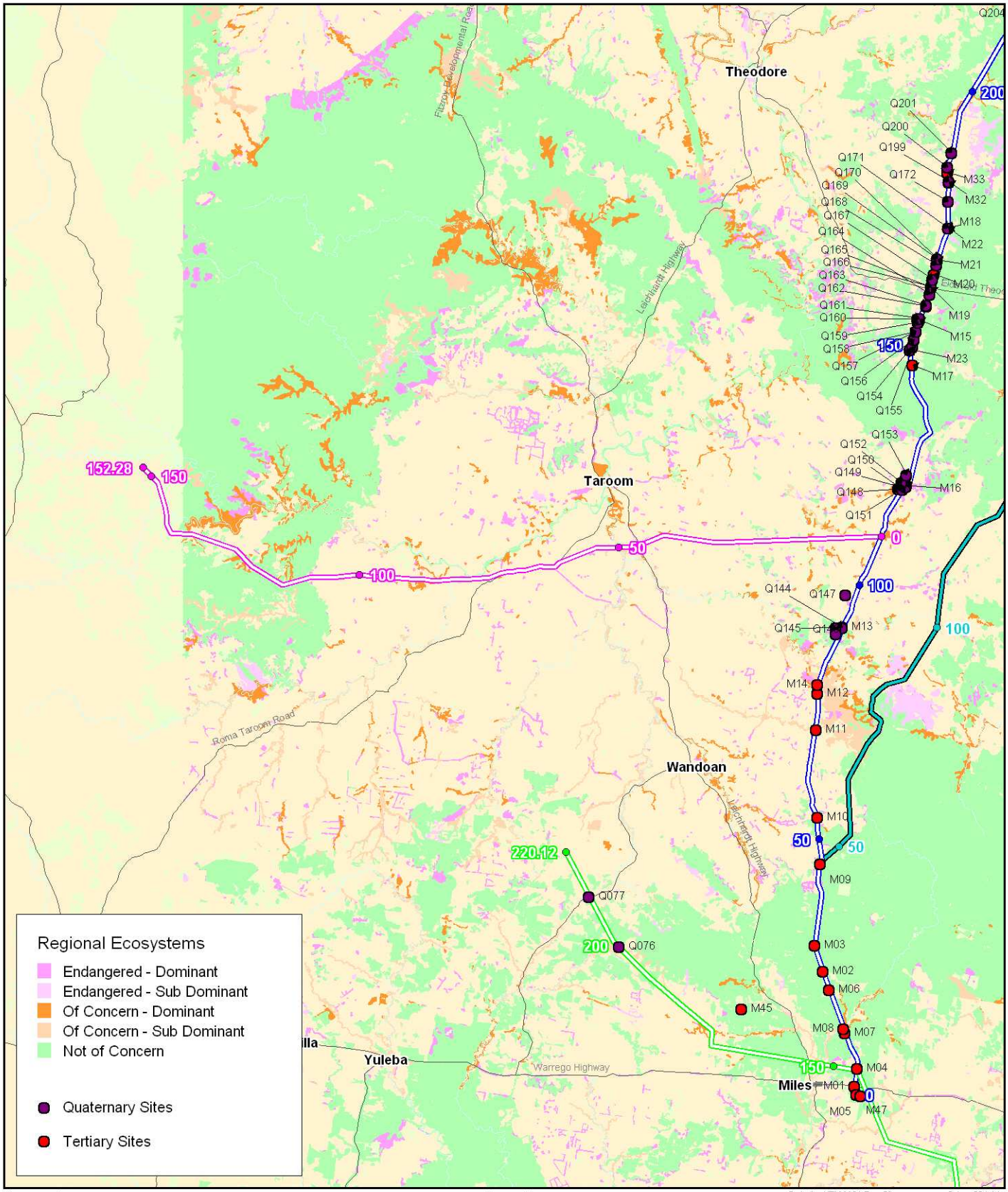
Title **Flora Survey Sites and Mapped Regional Ecosystems**

Map 1 of 3

ERM
Environmental Resources Management Australia Pty Ltd

Drawn	Mipela	Annex 13.2	Figure 13.1
Approved	CD	File No:	EO5-P-MA-96196
Date	17.07.09	Revision	A

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



Legend:

- Export Pipeline & Kilometre Point
- Export Pipeline Option 2 & Kilometre Point
- Lateral Pipeline & Kilometre Point
- Upstream Infrastructure Corridor & Kilometre Point

Source Note:

1:250,000 Topographic vector copyright Geoscience Australia
Regional Ecosystems v5.0 copyright QLD Herbarium
Quaternary and Tertiary Sites data captured and documented by Ann Moran

Projection UTM MGA Zone 56 Datum GDA 94

0 10 20 30 40

Kilometres

N

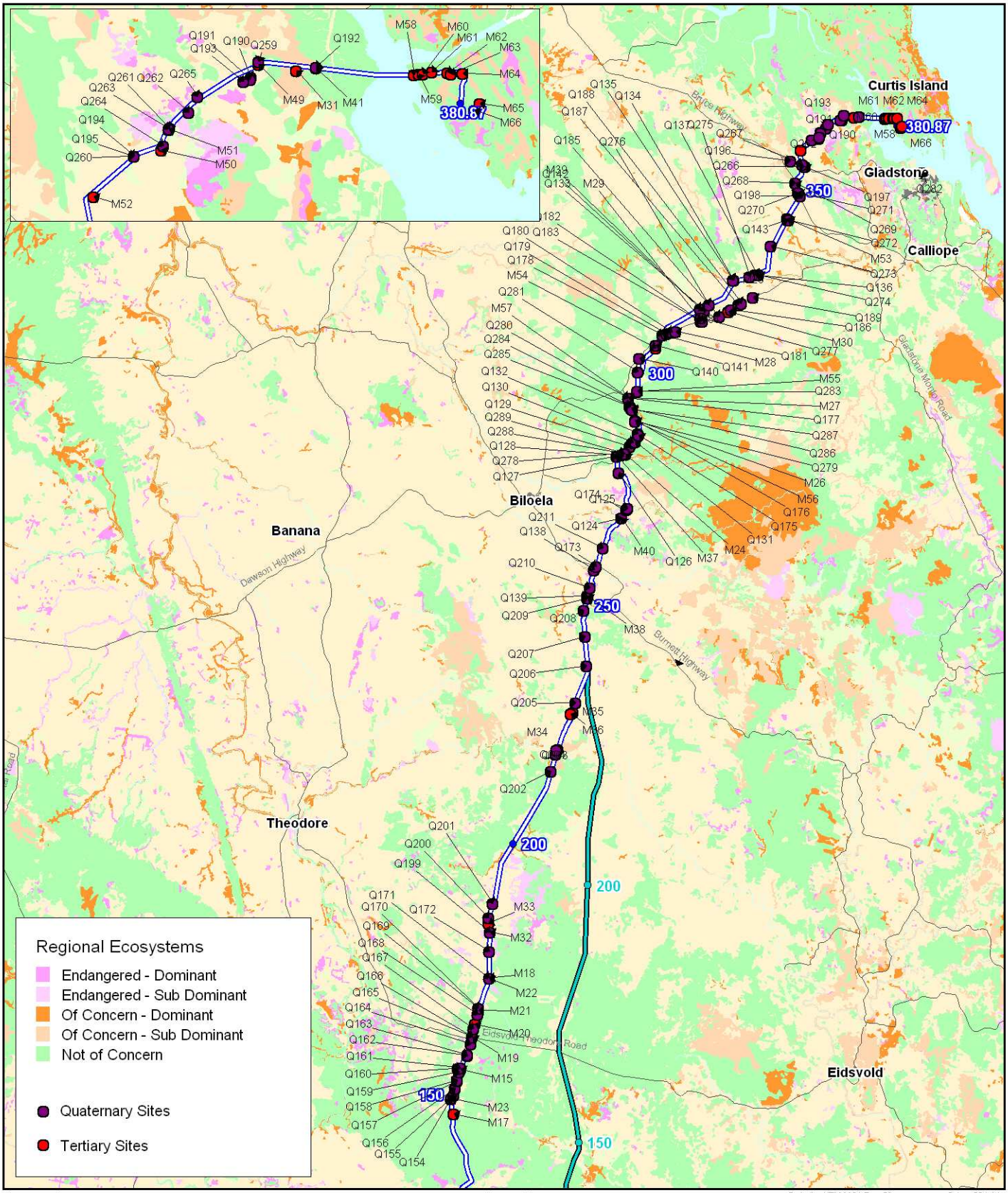
QUEENSLAND CURTIS LNG
A BG Group business

Project	Queensland Curtis LNG Project	Title	Flora Survey Sites and Mapped Regional Ecosystems
Client	QGC - A BG Group business		Map 2 of 3

ERM
Environmental Resources Management Australia Pty Ltd

Drawn	Mipela	Annex 13.2	Figure 13.2
Approved	CDP	File No:	EO5-P-MA-96197
Date	17.07.09	Revision	A

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



Legend:

- Export Pipeline & Kilometre Point
- Export Pipeline Option 2 & Kilometre Point
- Lateral Pipeline & Kilometre Point
- Upstream Infrastructure Corridor & Kilometre Point

Source Note:

1:250,000 Topographic vector copyright Geoscience Australia
Regional Ecosystems v5.0 copyright QLD Herbarium
Quaternary and Tertiary Sites data captured and documented by Ann Moran

Projection UTM MGA Zone 56 Datum GDA 94

0 10 20 30 40

Kilometres

N

QUEENSLAND CURTIS LNG
A BG Group business

Project	Queensland Curtis LNG Project
Client	QGC - A BG Group business

Title **Flora Survey Sites and Mapped Regional Ecosystems**

Map 3 of 3

ERM
Environmental Resources Management Australia Pty Ltd

Drawn	Mipela	Annex 13.2	Figure 13.3
Approved	CD	File No:	E05-P-MA-96198
Date	17.07.09	Revision	A

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

The survey focussed on a 100 m wide corridor, but also assessed surrounding areas where relevant (e.g. to identify options for avoiding ecological constraints on the proposed route

The field surveys included:

- Investigation of the presence / absence or likely presence / absence of EPBC Act Listed flora species and communities identified in Commonwealth and State legislation
- Ground truthing of 184 sites along the Option 1 Export Pipeline and the Collection Header. Of these, 66 sites were detailed Tertiary level assessments and the remainder were assessed to Quaternary level. Quaternary assessments recorded dominant canopy species only while Tertiary assessments recorded an inventory of all woody flora species, their average height and their approximate abundance (including native and exotic flora species). Tertiary assessments also included targeted searches for potential EPBC Act Listed flora species and regionally significant species. As a result of alignment changes, time and access constraints it was not possible to locate a Tertiary site in each type of RE encountered along the pipeline corridors. These areas however, will be groundtruthed prior to alignment finalisation and the commencement of construction activities. Comprehensive flora species lists and detailed abundance data were also not collected nor considered necessary for the purposes of this assessment, and
- Observations on the wider environment of the pipeline alignments so that the potential impacts associated with proposed clearing could be discussed in a local, regional and State context.

The flora site surveys were in accordance with the Queensland Herbarium vegetation survey methods described in Neldner *et.al*. (2005). The following data was collected for the Tertiary sites:

- Confirmation of mapped RE
- General description of vegetation
- Structural characteristics of vegetation (based on life forms, approximate height and relative dominance)
- Groundcover characteristics
- Vegetation condition (integrity) as either pristine, excellent, very good, good, average, degraded or completely degraded
- Occurrence of weed species
- Dominant species in each structural component of the vegetation
- Patch size and shape
- Landscape characteristics
- Soil characteristics, and
- Notes on particular sensitivities to the proposed impacts.

GPS coordinates were taken using hand held GPS (accuracy +/- 10m) to identify survey site locations and to assist in validating the existing Queensland Herbarium RE mapping. The general distributions of declared and other significant pest plants within the corridors were also noted.

3.3 Fauna Assessment

3.3.1 Determination of Significance Level

As was the case for the flora species, pursuant to s 179 of the EPBC Act, threatened fauna species can classified into one of the following categories:

- Extinct
- Extinct in the wild*
- Critically endangered*
- Endangered*
- Vulnerable*, and
- Conservation dependent.

Note that species classified as Extinct and Conservation dependant are not considered to be Matters of National Environmental Significance (MNES).

EPBC Act listed or non-listed Migratory and / or Marine species listed under international conventions or agreements ratified by the Commonwealth of Australia are given additional protection under the EPBC Act. These are:

- Japan - Australia Migratory Bird Agreement (JAMBA)
- China - Australia Migratory Bird Agreement (CAMBA)
- Republic of Korea – Australia Migratory Bird Agreement (ROKAMBA), and
- Convention on the Conservation of the Migratory Species of Wild Animals (Bonn Convention).

3.3.2 Fauna Desktop Assessment

The desktop study involved a review of published material and searches of relevant databases and archives. This assessment was used to document known records for the study area, identify the potential presence of significant fauna species and assist in targeting areas for field assessment. The desktop components undertaken included:

- Collection and review of existing EPA WildNet data, Birds Australia data, Queensland Museum data and EPBC Protected Matters Search. The data search areas were rectangular polygons and covered an area at least 5 km either side of the pipeline route. The search areas were:
  - Export Pipeline: 23.5333° S to 23.8622° S and 151.35° E to 150.0333° E
  - Lateral: 25.5333° S to 25.9° S and 150.3666° E to 148.85° E
  - Collection Header: 25.8166° S to 27.4333° S and 149.45° E to 151.1666° E
- Review of the Brigalow Belt (North and South) Biodiversity Planning Assessment (EPA 2008a) to identify areas that are recognised as State, Regional or Local Biodiversity Significant or flagged as important for their integrated biodiversity values that are within close proximity to the project area
- Review of Queensland Herbarium RE mapping for the corridor to establish those vegetation communities mapped by the EPA at a scale of 1:100 000 as

well as satellite imagery to gain an appreciation of potential fauna habitats and of the project's proximity to sensitive areas, and

- Search of the Directory of Important Wetlands database.

The following texts were also reviewed: Barker et al. (1995), Cogger (2000), Duncan et al. (1999), Ehmann (1992), Garnett and Crowley (2002), Greer (2005), Menkhorst and Knight (2004), Morcombe (2003), Robinson (1998), Strahan (1995), Wilson (2005), Wilson and Swan (2003) and Wilson and Knowles (1988).

3.3.3 Fauna Field Assessment

Rapid field assessment of the UIC was conducted by Bruce Thomson from 27 October to 2 November, the 12-18 November and 3-9 December. The Option 1 Export Pipeline was surveyed by Rebecca Goodwin-Pettit and Rebecca Gibson from the 24 November to the 3 December. KP 250-300 and 350-370 of the Option 2 Export Pipeline was surveyed by Bruce Thomson from 1-3 April 2009. Detailed field assessments of the Curtis Island portion and the mainland shoreline were undertaken from 6 to 16 by Bruce Thomson (reptiles and amphibians), David Rohweder and David Charley (birds) and Will Introna, Melissa Starling, Fiona Donohue and Tim Simpson (mammals) (CVs in **Attachment 2** of **Appendix 4.2**).

The locations of the sites visited during the field surveys are shown in **Figure B.4-B.6 [EO5-P-MA-961043, 44 and 45]**. Accessible portions of the UIC and Option 1 Export Pipeline were traversed by vehicle and / or foot during the assessment. The survey focussed on a 100 m wide corridor, but also assessed surrounding areas where relevant (e.g. to identify options for avoiding ecological constraints on the proposed route).

With the exception of the intensive survey effort on Curtis Island and the mainland shoreline, no fauna trapping methods such as Elliott trapping, pit fall trapping, hair tube sampling or harp trapping were employed during this assessment. Rather, field surveys involved walk-through assessments of representative habitats along the alignments. The selection of these sites was based on the following:

- Occurrence of forested patches and other fauna habitats (such as riparian corridors and wetlands) determined from satellite imagery, combined with review of the Brigalow Belt (South) Biodiversity Planning Assessment (EPA 2008a), and
- Preferred habitat for EPBC Act Listed and regionally significant fauna identified from the database searches, determined from Queensland Herbarium RE mapping combined with satellite imagery

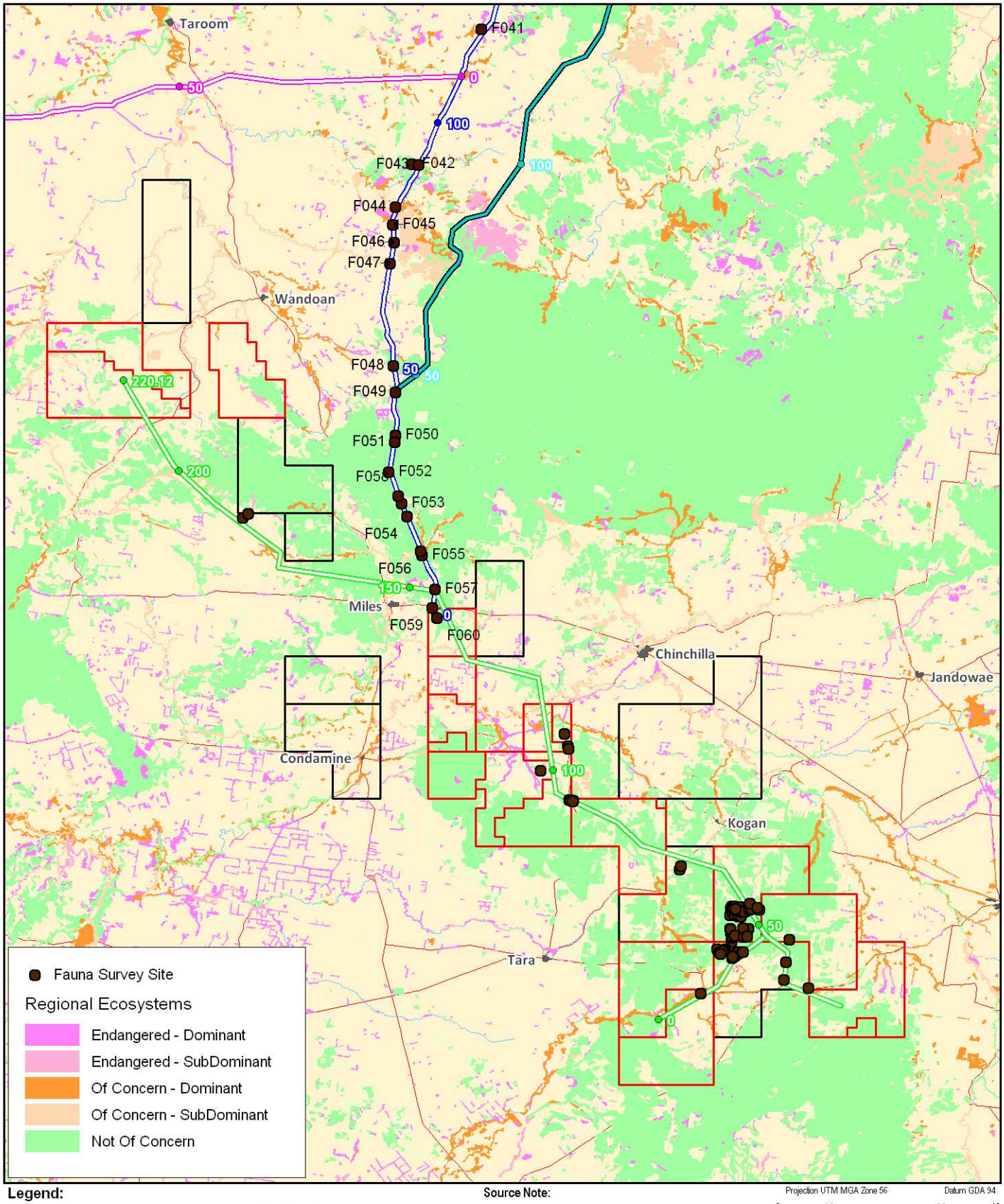
A total of 66 sites were visited and assessed along the UIC and Option 1 Export Pipeline in conjunction with the flora assessment. Tertiary assessments were carried out to evaluate:

- Habitat types / features
- Habitat integrity
- Habitat connectivity, and
- Significance of habitats.

Fauna trapping methods were employed on Curtis Island and the mainland shoreline. Elliott trapping, pit fall trapping, hair tube sampling or harp trapping were all employed.

The methods used in the fauna work on Curtis Island and adjoining mainland areas are those described in ERM (2009).

Assessments of the above attributes were supplemented by opportunistic observations of fauna at each site.



Legend:

- Export Pipeline & Kilometre Point
- Lateral Pipeline & Kilometre Point
- Upstream Infrastructure Corridor & Kilometre Point
- Export Pipeline Option 2 & Kilometre Point
- Gas Fields - PL & PLA
- Gas Fields - ATP

Source Note:

1:250,000 Topographic vector copyright Geoscience Australia
Regional Ecosystems v5.0 copyright QLD Herbarium
Fauna Sites data captured and documented by Ann Moran

Projection UTM MGA Zone 56 Datum GDA 94

0 10 20 30 40

Kilometres

N

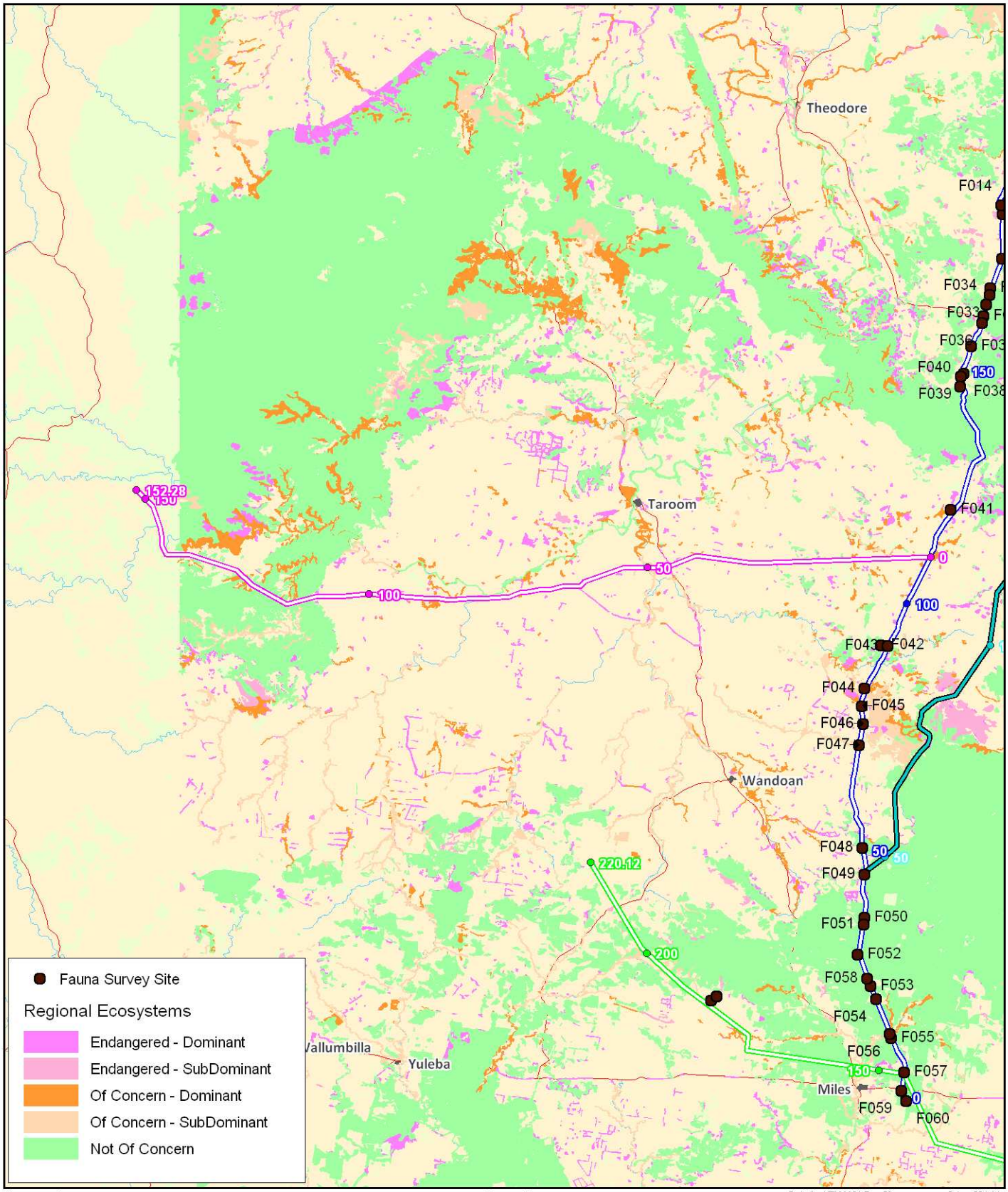
QUEENSLAND CURTIS LNG
A BG Group business

Project	Queensland Curtis LNG Project	Title	Fauna Survey Sites and Mapped Regional Ecosystem
Client	QGC - A BG Group business		Map 1 of 3

ERM
Environmental Resources Management Australia Pty Ltd

Drawn	Mipela	Annex 13.2	Figure 13.4
Approved	CDP	File No:	EO5-P-MA-96143
Date	15.06.09	Revision	A

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



Legend:

- Export Pipeline & Kilometre Point
- Lateral Pipeline & Kilometre Point
- Upstream Infrastructure Corridor & Kilometre Point
- Export Pipeline Option 2 & Kilometre Point

Source Note:

1:250,000 Topographic vector copyright Geoscience Australia
Regional Ecosystems v5.0 copyright QLD Herbarium
Fauna Sites data captured and documented by Ann Moran

Projection UTM MGA Zone 56 Datum GDA 94

0 10 20 30 40

Kilometres

N

QUEENSLAND CURTIS LNG
A BG Group business

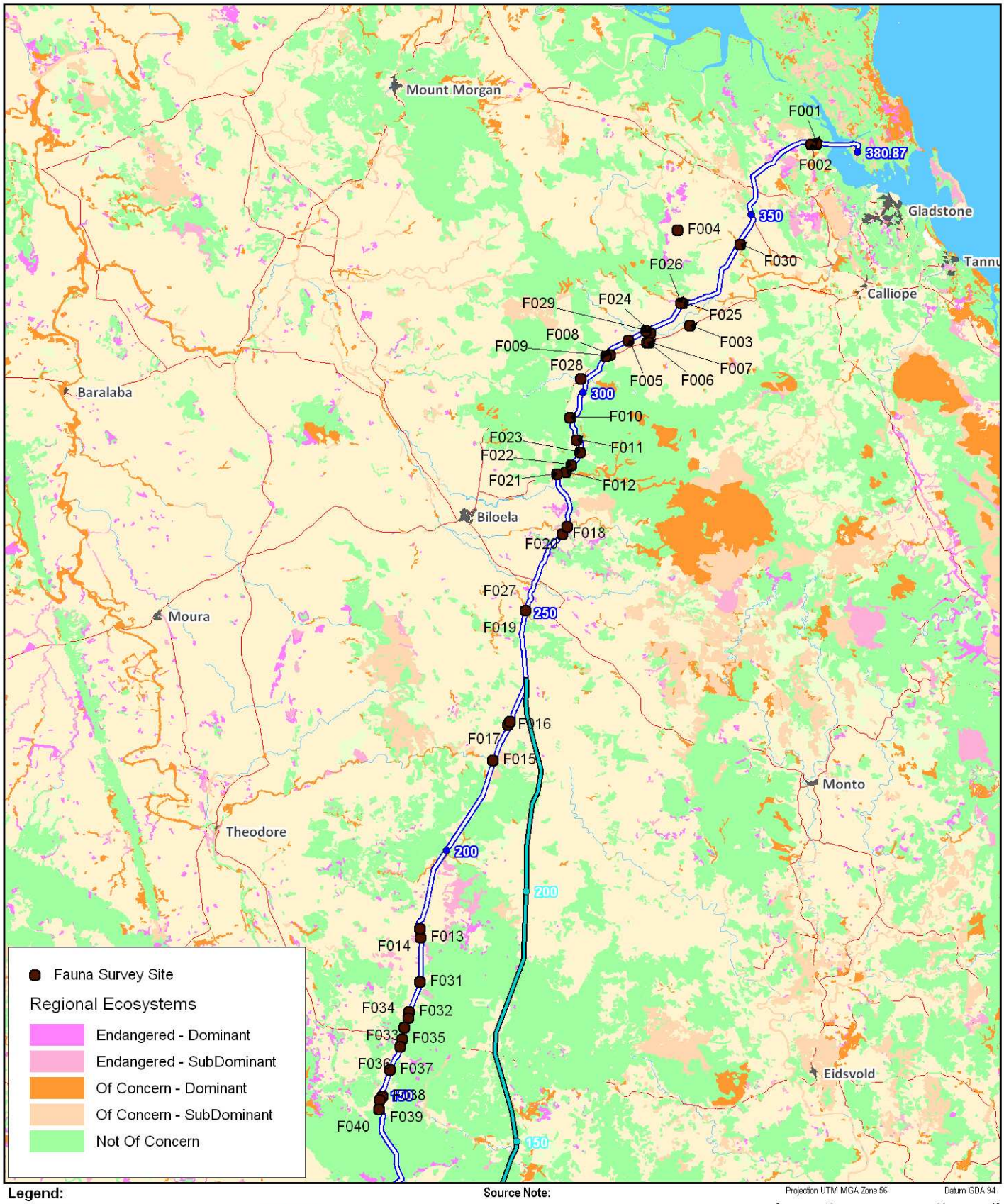
Project	Queensland Curtis LNG Project
Client	QGC - A BG Group business

Title **Fauna Survey Sites and Mapped Regional Ecosystem**

Map 2 of 3

ERM
Environmental Resources Management Australia Pty Ltd

Drawn	Mipela	Annex 13.2	Figure 13.5
Approved	CDP	File No:	EO5-P-MA-96144
Date	17.07.09	Revision	A



Legend:

- Export Pipeline & Kilometre Point
- Lateral Pipeline & Kilometre Point
- Upstream Infrastructure Corridor & Kilometre Point
- Export Pipeline Option 2 & Kilometre Point

Source Note:

1:250,000 Topographic vector copyright Geoscience Australia
Regional Ecosystems v5.0 copyright QLD Herbarium
Fauna Sites data captured and documented by Ann Moran

Projection UTM MGA Zone 56 Datum GDA 94

0 10 20 30 40

Kilometres

N

QUEENSLAND CURTIS LNG
A BG Group business

Project	Queensland Curtis LNG Project
Client	QGC - A BG Group business

Title **Fauna Survey Sites and Mapped Regional Ecosystem**

Map 3 of 3

ERM
Environmental Resources Management Australia Pty Ltd

Drawn	Mipela	Annex 13.2	Figure 13.6
Approved	CDP	File No:	EO5-P-MA-96145
Date	17.07.09	Revision	A

4 EXISTING ENVIRONMENT

The pipeline corridors all occur within the Brigalow Belt Bioregion, with the exception of the north eastern-most 4 km of the Export Pipeline (on Curtis Island), which is within the South East Queensland Bioregion.

4.1 Flora Environment

This description of vegetation communities within the pipeline corridors is based primarily on the existing Queensland Herbarium RE mapping. A rapid flora assessment has been undertaken where access was available based on the Option 1 Export Pipeline.

The Tertiary assessment data sheets are included in **Attachments 3** of **Appendix 4.2**. A complete flora list is provided in **Attachment 4** of **Appendix 4.2**.

It is recommended that detailed field investigations be undertaken of the preferred alignments prior to the commencement of construction activities.

4.1.1 Broad Vegetation Types

The pipeline corridors fall within cleared grazing and cropping lands, roadside and travelling stock reserves, Council lands, State Forests and Resource Reserves.

The proposed pipeline corridors traverse predominantly cleared areas. Based on the Queensland Herbarium RE mapping the approximate area of remnant vegetation within each pipeline corridor is as follows:

- 96 km of the 382 km Option 1 Export Pipeline
- 112 km of the 383 km Option 2 Export Pipeline
- 24 km of the 152 km Lateral, and
- 78 km of the 191 km Collection Lateral.

The area of each broad vegetation type that is identified by the Queensland Herbarium RE mapping as being transected by the proposed pipeline corridors is set out in **Table 2**.

Table 2 Broad Vegetation Communities Transected by the Proposed Pipeline Alignments

Vegetation Type	Area within Option 1 Export Pipeline (ha)	Area within Option 2 Export Pipeline (ha)	Area within Lateral (ha)	Area within UIC (ha)	Total (excluding Option 1) (ha)
Eucalypt woodlands	409.54	494.06	116.44	722.97	1333
Acacia woodlands	14.68	17.07	0.53	3.28	21
Brigalow / Belah woodland	13.77	6.60	0.89	6.92	14
Riparian Eucalypt woodland	13.25	11.03	2.12	33.48	47
Shrubland Community	7.78	12.69	nil	15.46	28
Semi-evergreen Vine Thicket	0.93	0.23	2.24	nil	2.5
Native Bluegrass Grasslands	2.21	nil	nil	nil	nil
Freshwater Wetlands	1.09	1.09	nil	nil	1
Estuarine Wetlands	14.88	14.88	nil	nil	15
Total Remnant Vegetation	478	558	122	782	1462

4.1.2 EPBC Act Listed Vegetation Communities

Based on Queensland Herbarium RE mapping, the pipeline corridors transect three EPBC Act Listed Ecological Communities as listed under the EPBC Act. These are represented on the Queensland Herbarium RE mapping by nine REs. These include:

- Brigalow woodland / open forest communities - REs 11.3.1, 11.4.3, 11.9.1, 11.9.5, 11.9.6, 11.12.21
- Native Bluegrass grassland community – RE 11.9.12, and
- Semi-evergreen Vine Thicket (SEVT) communities– RE 11.9.4 and 11.11.18.

Table 3 sets out each EPBC Act Listed Communities mapped as being present along the pipeline corridors and the corresponding Queensland RE code.

An additional EPBC Act Listed Ecological Community which may also be transected by the pipeline corridors is the Endangered Weeping Myall Open Woodland Community. This community is not mapped by the Queensland Herbarium RE mapping nor was It

detected by the initial field studies. However, it is described as occurring within the Brigalow South Bioregion generally in small patches of alluvial soils within REs 11.3.2 and 11.3.28. As such, it may potentially occur in alluvial areas transected by the pipeline corridors, in particular, the UIC which transects the RE 11.3.2.

Table 3 The EPBC Act Listed Ecological Communities Mapped as Present along the Pipeline Corridors and Corresponding QLD RE Codes

Communities	Option 1 Export Pipeline	Option 2 Export Pipeline	Lateral	UIC
Brigalow	11.4.3 11.9.1 11.9.5 11.9.6 11.12.21	11.4.3 11.9.5 11.12.21	11.9.5	11.3.1 11.4.3 11.9.5
Native Bluegrass Grassland Communities	11.9.12			
Semi-Evergreen Vine Thicket	11.9.4 11.11.18	11.9.4 11.11.18	11.9.4	

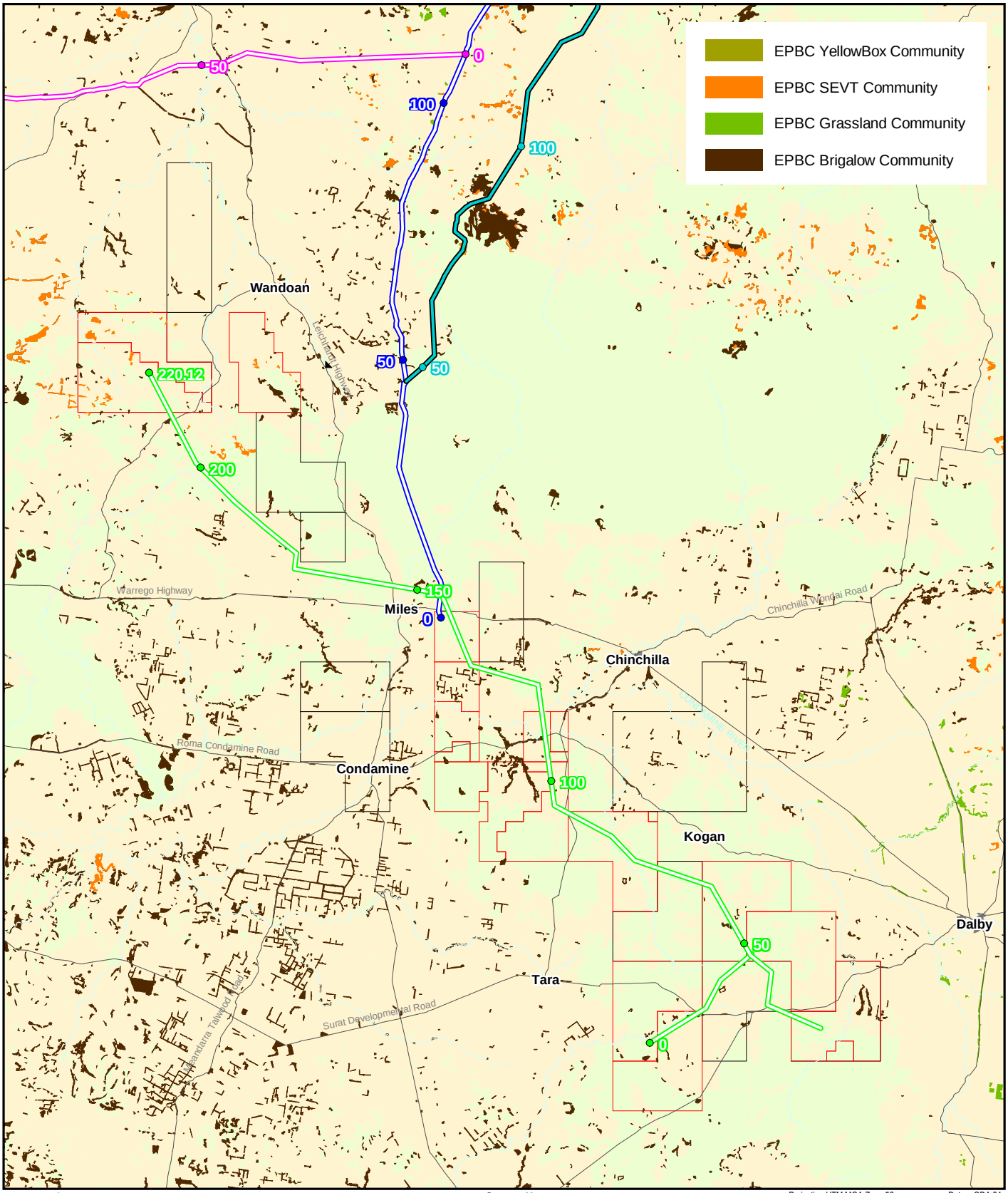
Existing Queensland Herbarium RE mapping indicates that the Endangered Brigalow communities almost always occur in small and narrow fragments which have been left along fencelines, creeks and roadsides (**Figure B.7-B.9 [EO5-P-MA-961039, 40 and 41]**). One exception is the larger patches of the mixed community RE 11.9.5/11.9.6 that is crossed by the Option 1 Export Pipeline corridor at KPs 54.1-55 and 65.1-65.5.

Field surveys of a RE 11.9.5 remnant recorded in the vicinity of the pipeline at approximately KP 50.6 of Option 1 Export Pipeline (Site M10) found this area to be in an average condition due to grazing and weed invasion. The declared Class 2 weed *Opuntia tomentosa* was found present within this site.

Ground truthing of a mapped RE 11.4.3 remnant in the vicinity of Option 1 and Option 2 Export Pipeline (Site M40) found the area to be a degraded non-remnant. This remnant was considered to be degraded due to high weed densities and recent fire damage.

The total area of Endangered Brigalow Community that is located within the pipeline corridors is approximately 14 ha. However, if the Export Pipeline Option 1 corridor was utilised, this area would increase to approximately 22 ha.

RE mapping indicates the presence of one small fragment of Native Bluegrass Grassland community (RE 11.9.12) on the Option 1 Export Pipeline. The RE 11.9.12 occurs in a thin remnant at KP 95.9-96.2. Approximately 2 ha of this RE is transected by the Option 1 Export Pipeline corridor. If Option 1 is selected, detailed field investigations should confirm the precise location and avoidability of this remnant. No Native Bluegrass Grassland communities are mapped as being present along the Option 2 Export Pipeline corridor.



Legend:

- Export Pipeline & Kilometre Point
- Export Pipeline Option 2 & Kilometre Point
- Lateral Pipeline & Kilometre Point
- Upstream Infrastructure Corridor & Kilometre Point
- Gas Fields - PL & PLA
- Gas Fields - ATP

Source Note:

1:250,000 Topographic vector copyright Geoscience Australia
Environment Protection & Biodiversity Conservation data copyright QLD Herbarium

Projection UTM MGA Zone 56 Datum GDA 94

0 10 20 30 40

Kilometres

N

QUEENSLAND CURTIS LNG
A BG Group business

Project: Queensland Curtis LNG Project

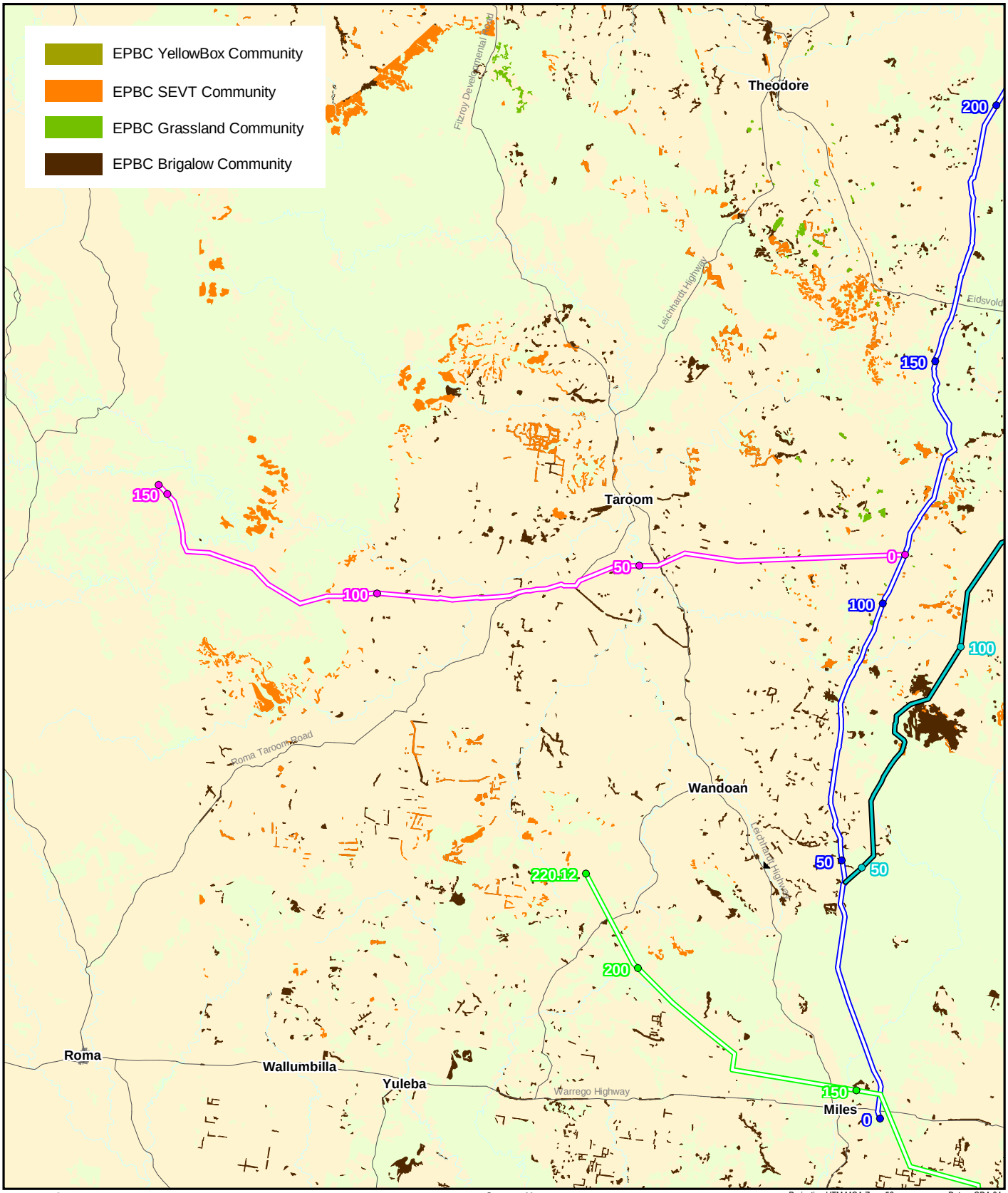
Client: QGC - A BG Group business

Title: **EPBC Communities - Southern Area**

Map 1 of 3

ERM
Environmental Resources Management Australia Pty Ltd

Drawn	Mipela	Annex 13.2	Figure 13.7
Approved	CD	File No:	EO5-P-MA-96199
Date	17.07.09	Revision	A



Legend:

- Export Pipeline & Kilometre Point
- Export Pipeline Option 2 & Kilometre Point
- Lateral Pipeline & Kilometre Point
- Upstream Infrastructure Corridor & Kilometre Point

Source Note:

1:250,000 Topographic vector copyright Geoscience Australia
Environment Protection & Biodiversity Conservation data copyright QLD Herbarium

Projection UTM MGA Zone 56 Datum GDA 94

0 10 20 30 40

Kilometres

N

QUEENSLAND CURTIS LNG
A BG Group business

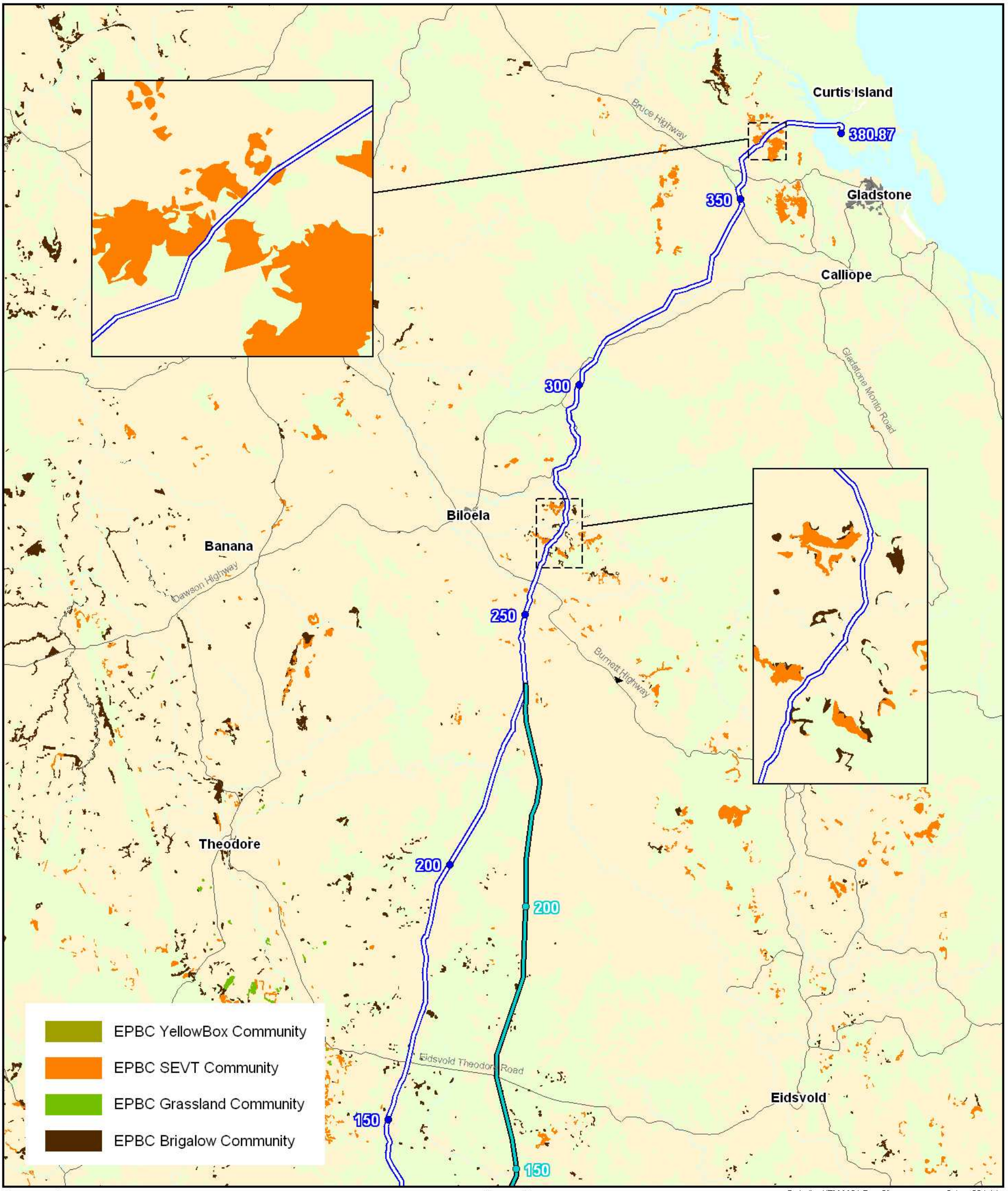
Project	Queensland Curtis LNG Project
Client	QGC - A BG Group business

Title **EPBC Communities - Central Area**

Map 2 of 3

ERM
Environmental Resources Management Australia Pty Ltd

Drawn	Mipela	**Annex 13.2**	**Figure 13.8**
Approved	CD	File No:	EO5-P-MA-96203
Date	17.07.09	Revision	A



Legend:

- Export Pipeline & Kilometre Point
- Export Pipeline Option 2 & Kilometre Point
- Lateral Pipeline & Kilometre Point
- Upstream Infrastructure Corridor & Kilometre Point

Source Note:

1:250,000 Topographic vector copyright Geoscience Australia
Environment Protection & Biodiversity Conservation data copyright QLD Herbarium

Projection UTM MGA Zone 56 Datum GDA 94

0 10 20 30 40

Kilometres

N

QUEENSLAND CURTIS LNG
A BG Group business

Project	Queensland Curtis LNG Project	Title	EPBC Communities - Northern Area
Client	QGC - A BG Group business		Map 3 of 3

ERM
Environmental Resources Management Australia Pty Ltd

Drawn	Mipela	Annex 13.2	Figure 13.9
Approved	CD	File No:	E05-P-MA-96204
Date	17.07.09	Revision	A

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

Desktop studies also indicate the presence of the two SEVT communities REs 11.9.4 and 11.11.18 along the pipeline corridors. A small fragment (<0.1 ha) of SEVT community RE 11.9.4 is mapped as occurring along the Option 2 Export Pipeline at KP 83 and a larger area (0.8 ha) along the Option 1 Export Pipeline at KP 129.8-130.1. Mapping also indicates the occurrence of one community of RE 11.9.4 along the Lateral at KPs 145.8-146 and 147.4-147.6. The RE 11.11 18 makes up approximately 5% of the mixed community RE 11.11.15/11.11.18 mapped at KP 364-365 along Option 1 and Option 2 Export Pipeline. Groundtruthing surveys found this area not to be a mixed community, but rather a community solely made up of RE 11.11.18. This area was found to be in a degraded condition.

It is estimated that the total area of SEVT communities that occur within the pipeline corridors (based on using the Option 2 Export Pipeline) is approximately 2 ha. The desktop mapping indicates that use of the Option 1 Export Pipeline would require clearing of an additional 0.7 ha.

A complete list of the mapped position of the all EPBC listed communities transected by the pipeline corridors is set out in **Table 4**. These communities are shown in **Figure B.7-B.9 [EO5-P-MA-961039, 40 and 41]**).

Table 4 Location of EPBC Act Listed REs along the Proposed Pipeline Corridors

EPBC Act Listed Community	RE	Approximate KP				Survey Sites
		Option 1 Export Pipeline	Option 2 Export Pipeline	Lateral	UIC	
Brigalow	11.3.1(dominant RE in mosaic)				119.3-119.4	
	11.4.3(dominant RE in mosaic)	4.5-5 7.9	4.5-5 7.9		91.9-92.1 118.4-118.5	M4, M40
	11.9.1(dominant RE in mosaic)	85.6				
	11.9.5 (dominant RE in mosaic)	40.1-40.5 49.2 54.2-55 65.1-65.5 262.7-262.9 263.5	40.1-40.5 262.7-262.9 263.5	43.8-44	112.6 167.6-167.9	M10
	11.9.5 (sub-dominant RE in mosaic)	80.1-81.3 81.6-82.2 129.8-130.1	73.9		140.1-140.2	
	11.9.6 (sub-dominant RE in mosaic)	49.2 54.2-55 65.1-65.5				
	11.12.21 (dominant RE in mosaic)	177.4-177.6				
Grassland	11.9.12 (dominant RE in mosaic)	95.9-96.2				
SEVT	11.9.4 (dominant RE in mosaic)	129.8-130.1	73.9	145.8-146 147.4-147.6		
	11.11.18 (sub-dominant RE in mosaic)	364-365	364-365			M51

4.1.3 EPBC Act Listed Flora Species

Review of the Queensland Herbarium HERBRECS, WildNet and the EPBC Act Protected Matters databases for the study area identified 119 EVR plant species that have ranges that occur within and/ or in the vicinity of the pipeline corridors (**Attachment 7** of **Appendix 4.2**). These included 48 species listed under the provisions of the EPBC Act including 9 Endangered, and 39 Vulnerable species.

Based on available ecological information, 32 of these EPBC Act Listed flora species (26 Vulnerable and 6 Endangered) have potential habitat within the pipeline alignments (**Table 5**). These species and their preferred habitats were targeted during initial field survey work and will be targeted during the planned detailed alignment surveys that will be undertaken before alignment finalisation and the commencement of construction activities.

The field surveys to date have observed two EVR species within or in the close proximity of the Export Pipeline alignments. These include:

- *Cadellia pentastylis* (Ooline) at approximate KP 227 (Site M36) along the Option 1 Export Pipeline, and
- A small population of *Cycas megacarpa* between KPs 296.5-298.5 (Sites M56 and M 57) and two additional plants at approximate KPs 301 and 305 along the Option 1 and Option 2 Export Pipeline corridors.

The initial field surveys did not detect the presence of any EPBC Act Listed species within the proposed 100 m UIC corridor, however, four EPBC Act Listed species were recorded within the vicinity. These are:

- *Acacia curranii*
- *Acacia wardellii*
- *Calytrix gurulmundensis and,*
- *Philotheca sporadica*.

The known locations of EPBC Act Listed flora species, according to Herbarium records and/or field surveys are presented in **Figure B.10-B.12.** Note that as it was not as yet possible to undertake detailed flora surveys of the entire length of the pipeline corridors, it is anticipated that additional EPBC Act Listed flora species will be found in a number of locations additional to those shown in **Figure B.10-B.12** when the detailed alignment inspection is conducted.

Table 5. EPBC Act Listed Flora Species Recorded and With Preferred Habitat Within the Pipeline Corridors

Common Name	Scientific Name	EPBC	Preferred Habitat	Source^	Preferred habitat present				Comments
					Option 1 Export Pipeline	Option 2 Export Pipeline	Lateral	UIC	
Chinchilla Wattle	*Acacia chinchillensis*	V	Occurs in south-eastern Qld N of Chinchilla and near Tara. Grows in ironbark *Eucalyptus*, *Callitris columellaris*, *Casuarina* woodland, in sandy or gravelly soils (ABRS, 2001).	1,2,3,4	Yes	Yes	No	Yes	Suitable habitat in RE 11.5.1
Curly-bark Wattle	*Acacia curranii*	V	Only known in Gurulmundi wildflower area north of Miles.	1,2,3,4	Yes	Yes	No	Yes	Field surveys did identify potential habitat in the vicinity of the UIC, in particular areas of landzone 7
Hando's Wattle	*Acacia handonis*	V	Understorey plant in *Eucalyptus* forests on sandstone ridges. Restricted to Barakula State Forest.	1,2,3	No	Yes	No	No	Rapid assessment in Barukula SF indicated no / low numbers likely but detailed survey required to confirm
Tara Wattle	*Acacia lauta*	V	Found from Tara to Inglewood 1) Property "Marron Glen", 2) 15km nth of Tara and 3) 16km east of Tara.	1,2,3	No	No	No	Yes	
Wardell's Wattle	*Acacia wardellii*	V	Ridge crests with loamy or gravely soil. Coloniser of disturbed areas – Thomby Range and a few ridges east of the Condamine.	1,2,3,4	No	No	No	Yes	Qld Herbarium records indicate potential habitat may occur along the UIC between KP 70-90. Verified Qld Herbarium record and found one other very large population 1 km long along an existing pipeline easement. Identified two trees with large

Common Name	Scientific Name	EPBC	Preferred Habitat	Source^	Preferred habitat present				Comments
					Option 1 Export Pipeline	Option 2 Export Pipeline	Lateral	UIC	
									numbers of seedlings spreading along recent disturbances. Appears to like disturbance and/or fire.
None known	*Atalaya collina*	E	Grows on hillsides, in remnant dry scrubs, together with *A. salicifolia*, but is not as common as that species (Reynolds, 1991)	3	Yes	Yes	No	No	Potential near Mt Larcom
Ooline	*Cadellia pentastylis*	V	Clay plains, sandstone and residual ridges in association with vine thickets, brigalow, belah and red bauhinia.	1,2,3,4	Yes	Yes	Yes	Yes	Initial field survey identified trees around KP 185 along the UIC and at KP 230 On the Option 1 Export Pipeline.
Yellow Fringed Myrtle	*Calytrix gurulmundensis*	V	Found on lateritic sandstone ridges. Localised and patchy distribution.	1,2,3,4	Yes	Yes	No	No	Known records within Gurulmundi and Barakula SF. Field surveys recorded small isolated patches spreading throughout the Gurulmundi SF. Plants were dense in disturbed sunlit areas.
Silver Commerson ia	*Commersonia argentea* *syn Commersonia sp.(Cadarga G.P. Guymer 1642)*	V	Stony ridges, north of Chinchilla	1	Yes	Yes	No	No	Potential habitat possible north of Chinchilla
Cossinia	*Cossinia*	E	Small tree up to 7 m found	1,2,3	Yes	Yes	No	No	

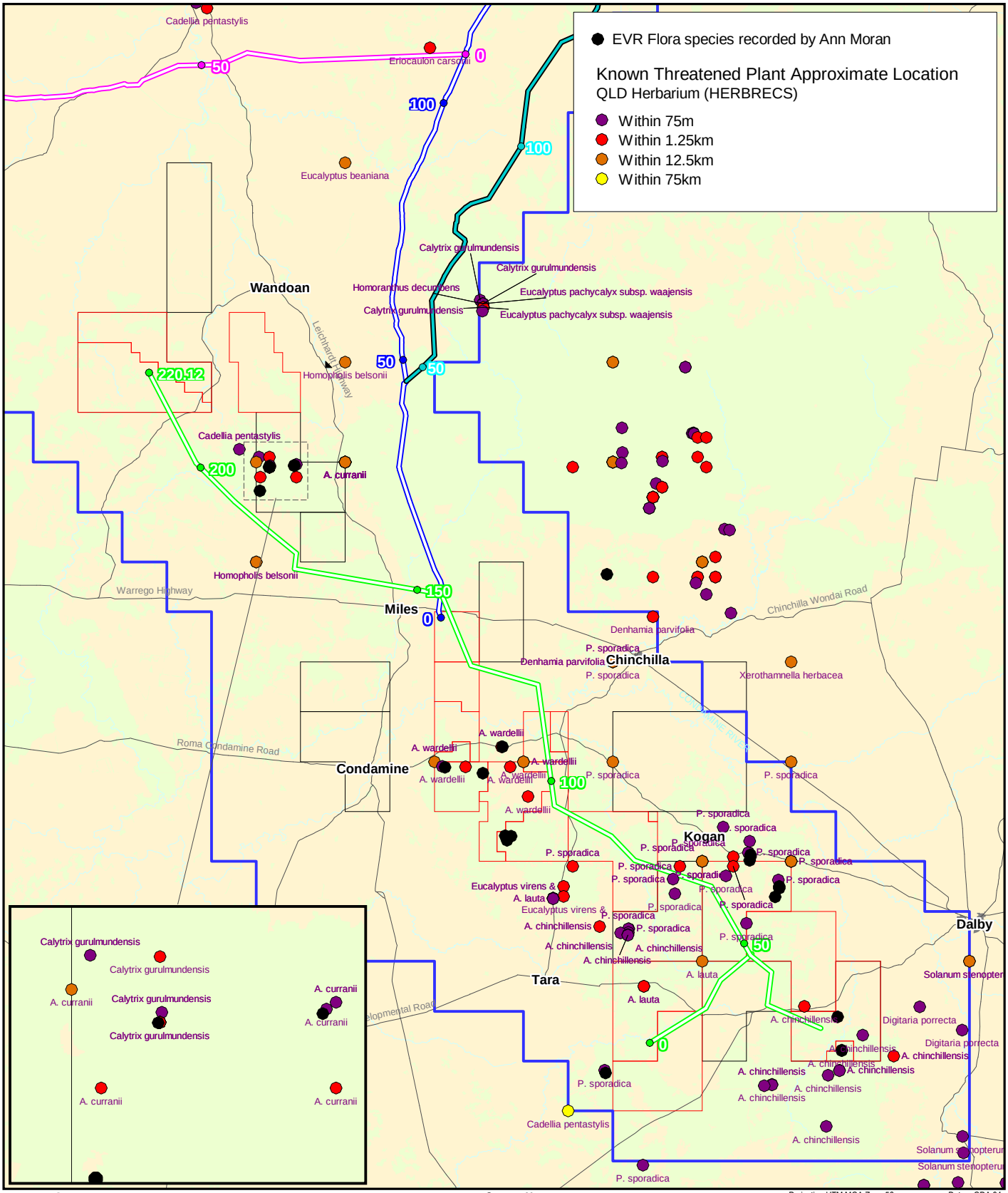
Common Name	Scientific Name	EPBC	Preferred Habitat	Source^	Preferred habitat present				Comments
					Option 1 Export Pipeline	Option 2 Export Pipeline	Lateral	UIC	
	australiana		in depauperate rainforest relicts, usually on volcanic soil (Stanley and Ross, 1986). Recorded at Kingaroy, Gympie, Munholme Ck, Burnett River (Qld Herbarium)						
Wedge-leaf Tuckeroo	*Cupaniopsis shirleyana*	V	Depauperate rainforests (Stanley and Ross, 1983).	1,2,3	Yes	Yes	No	No	Known in Mt Larcom area
Large-fruited Zamia	*Cycas megacarpa*	E	Stony clay loams on hill tops and steep slopes. Commonly in spotted gum and ironbark open forest and woodland with a grassy understorey (DNR, 1999). Known from KP 280-380.	1,2,3	Yes	Yes	Yes	No	Herbarium records close to Options 1 Option 2 Export Pipeline. Tentative sighting by land agent along Option 1 and Option 2 Export Pipeline at approximate KP 282. These records to be confirmed and preferred alignments to be surveyed in April/May 2009.
Small-leaved Denhamia	*Denhamia parvifolia*	V	Found in semi-evergreen vine thickets. Brown loam or clay loam soils.	1,2,3	No	No	Yes	Yes	
King Blue Grass	*Dichanthium queenslandicum*	V	Endemic to Qld black soil plains. Occurs in RE's 11.8.11, 11.3.21	1,2,3	Yes	Yes	No	No	
Tricolour Diuris	*Diuris tricolor (sheaffiana)*	V	Sandy soils, often in Callitris woodlands. Primarily a NSW species with scattered	1	Yes	Yes	No	Yes	

Common Name	Scientific Name	EPBC	Preferred Habitat	Source^	Preferred habitat present				Comments
					Option 1 Export Pipeline	Option 2 Export Pipeline	Lateral	UIC	
			records in Qld.						
Salt Pipewort, Button Grass	*Eriocaulon carsonii subsp. orientale*	E	Known in wet poorly drained soils. Mound Springs areas near Injune.	1,2,3	Yes	Yes	Yes	No	
Tony's ironbark	*Eucalyptus beaniana*	V	Rocky Areas such as Isla Gorge Robinson Gorge and Mundubbera	1,2,3	Yes	Yes	Yes	No	
Pumpkin Gum	*Eucalyptus pachycalyx*	E	On skeletal sandy soils (Botanic Gardens Trust, 2009)	1,2,3	Yes	Yes	Yes	Yes	
Shiny-leaved Ironbark	*Eucalyptus virens*	V	Sandstone ridges. Four populations – 1) Coolmunda Conservation Park 2) Tara, 3) NE of Eidsvold and 4) Maranoa River near Mt Moffatt.	1,2,3	No	No	No	Yes	
None known	*Homopholis belsonii*	V	Known from near Gurulmundi, 30km north of Miles in the Darling Downs district (Stanley and Ross, 1989).	1,2,3	Yes	Yes	No	Yes	
None known	*Homoranthus decumbens*	V	Found in two separate locations 1) Blackdown Tablelands and 2) State Forest 302, north of Chinchilla.	1,2,3	Yes	Yes	Yes	Yes	
None	*Leucopogon*	V	Mainly on rocky slopes, cliffs	1	Yes	Yes	Yes	No	

Common Name	Scientific Name	EPBC	Preferred Habitat	Source^	Preferred habitat present				Comments
					Option 1 Export Pipeline	Option 2 Export Pipeline	Lateral	UIC	
known	*cuspidatus*		and rocky outcrops. Commonly in woodland or open woodland and sometimes in heath or shrubland communities (M. Edginton, pers. comm.).						
None known	*Macrozamia crassifolia*	V	Restricted to the Eidsvold – Mundubbera district in Queensland. Found on sandy soils over granite (DEW 2007).	2,3	Yes	Yes	No	No	
None known	*Macrozamia fearnsidei*	V	Grows in open forest on sandy soils of sandstone origin either on rocky slopes or in gullies near ephemeral streams at approx 300-400m altitude. Restricted to central Qld (DNR 1999)	2,3	No	No	Yes	No	
None known	*Parsonsia larcomensis*	V	Recorded from 350-750 m elevation. It occurs in open heathland and shrubland at or near the summits of mountain peaks growing in shallow, loamy soils. Restricted to central east and south east Queensland and is confined to the Mt Perry area near Rockhampton (DRN 1999)	1,2,3	Yes	Yes	No	No	Potential near Mt Larcom

Common Name	Scientific Name	EPBC	Preferred Habitat	Source^	Preferred habitat present				Comments
					Option 1 Export Pipeline	Option 2 Export Pipeline	Lateral	UIC	
None known	*Philotheca sporadica*	V	On residual lateritic rises. Known as widespread in patches in UIC area.	1,2,3,4	No	No	No	Yes	
None known	*Picris evae*	V	Small daisy in rocky and gravelly areas	2,3	Yes	Yes	Yes	Yes	
None known	*Polianthion minutiflorum*	V	Known from five areas in eastern Queensland, from Redcliffe Vale south to Kingaroy, usually in forest and woodland on sandstone slopes and gullies with skeletal soil, or sometimes deeper sands adjacent to deeply weathered laterite (Kellerman et al 2006)	3	Yes	Yes	No	No	Potential in Biloela Area
Quassia	*Quassia bidwillii*	V	Below 650m in rainforests, open forest, woodland and mangroves (DNR, 1999).	1,2,3	Yes	Yes	No	No	
Native Thistle	*Rhaponticum australe (syn Stemmacantha australis)*	V	On heavy clays derived from basalt (DNR, 1999).	1,2,3	Yes	Yes	No	No	
None known	*Trymalium minutiflorum*	V	Found up to an altitude of 340 m on sandy soil or light brown gravelly loam derived from sedimentary rocks.Been recorded in Callide Ranges, Goodger and Bileola areas (DNR	1,2	Yes	Yes	No	No	

Common Name	Scientific Name	EPBC	Preferred Habitat	Source^	Preferred habitat present				Comments
					Option 1 Export Pipeline	Option 2 Export Pipeline	Lateral	UIC	
			1999).						
Durong Sage	*Xerothamnella herbacea*	E	Found in Brigalow, Low chenopod shrubland Records Pelican Back Rd Chinchilla,Theodore S F (Qld Herbarium)	1,2,3	Yes	Yes	No	No	



Legend:

- Export Pipeline & Kilometre Point
- Export Pipeline Option 2 & Kilometre Point
- Lateral Pipeline & Kilometre Point
- Upstream Infrastructure Corridor & Kilometre Point
- Gas Fields - PL & PLA
- Gas Fields - ATP

Source Note:

1:250,000 Topographic vector copyright Geoscience Australia
EVR data sourced from Queensland Herbarium

Projection UTM MGA Zone 56 Datum GDA 94

0 10 20 30 40

Kilometres

N

QUEENSLAND CURTIS LNG
A BG Group business

Project	Queensland Curtis LNG Project
Client	QGC - A BG Group business

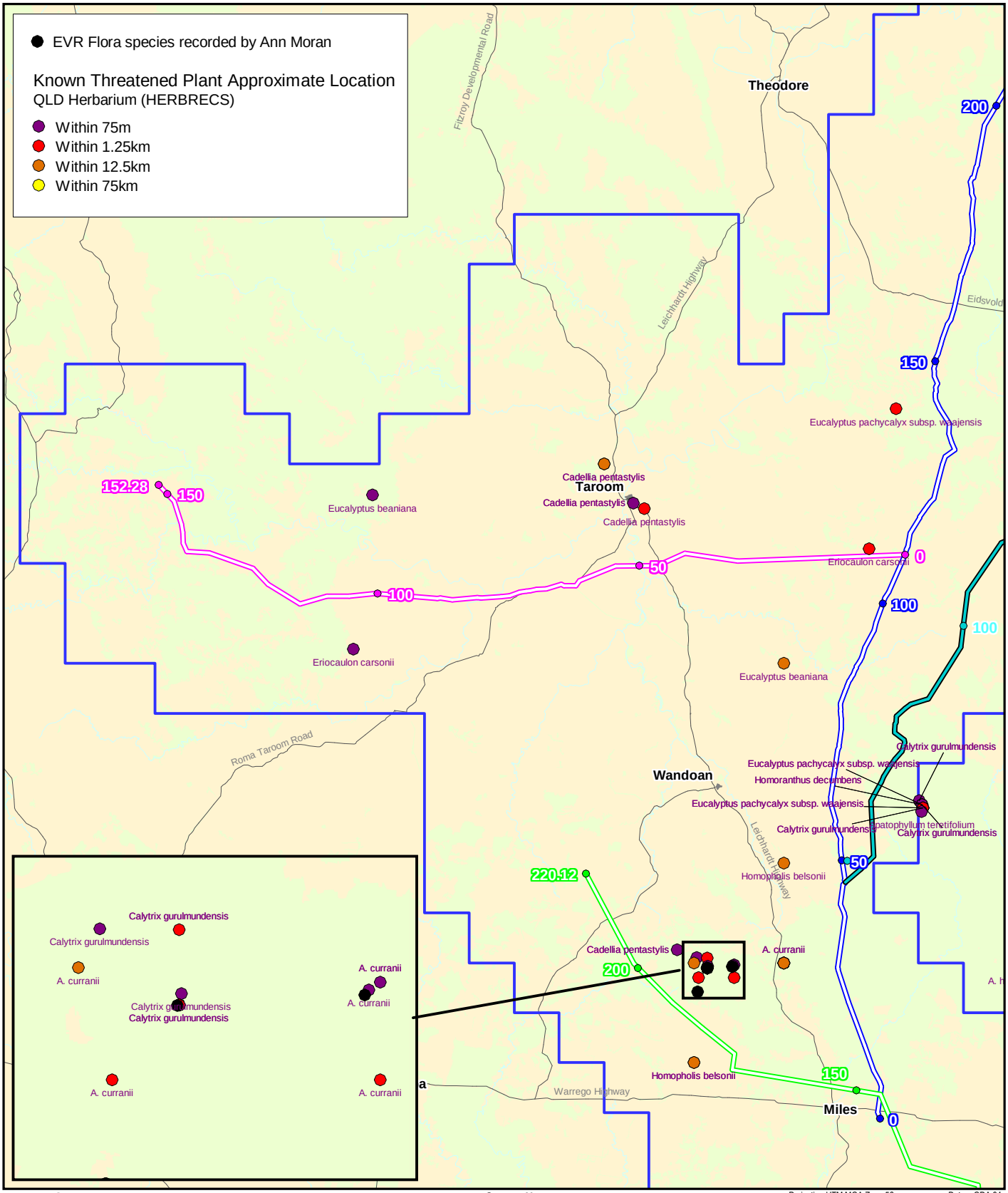
Title **Known EPBC Listed Flora Species Locations**

Map 1 of 3

ERM
Environmental Resources Management Australia Pty Ltd

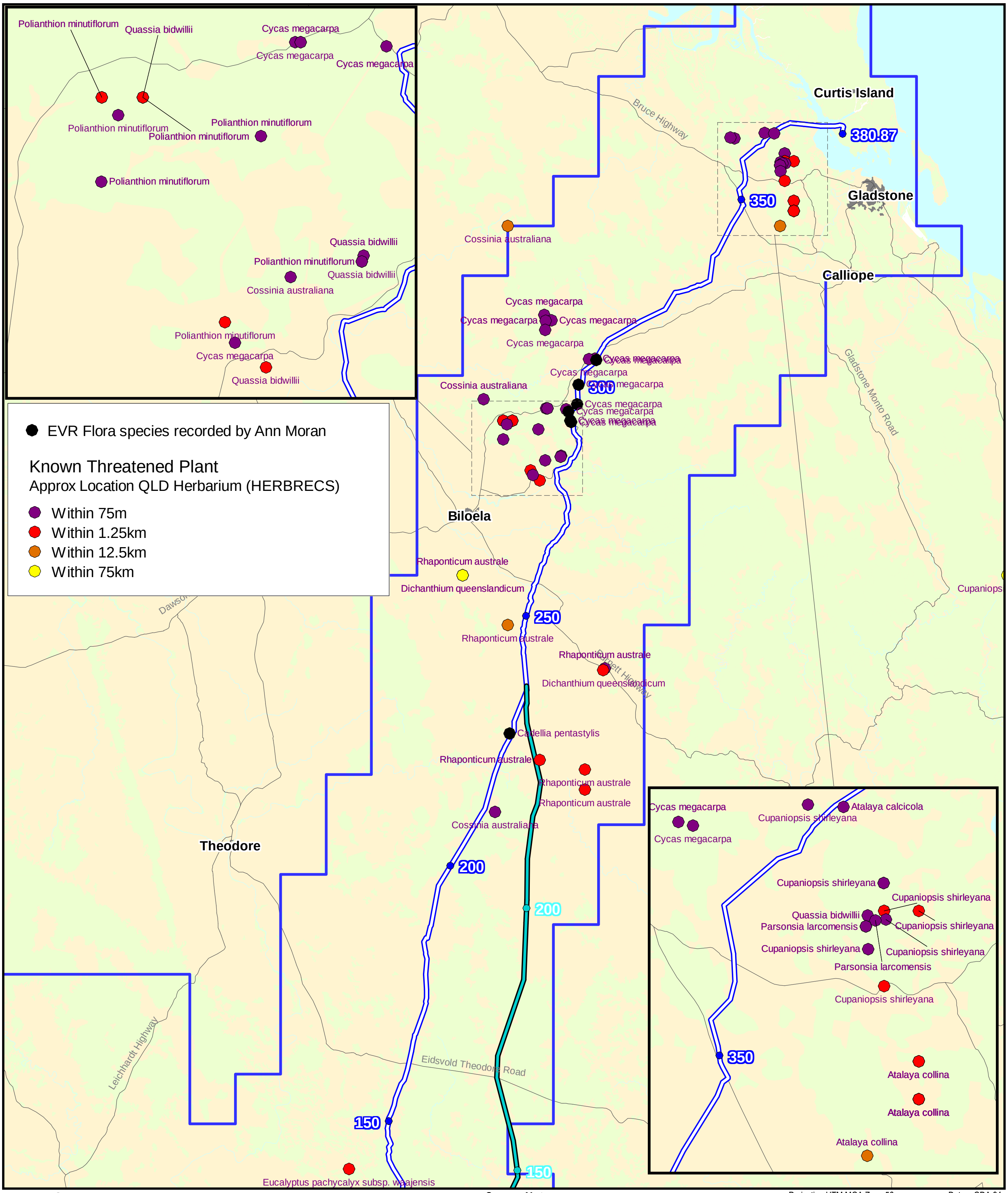
Drawn	Mipela	**Annex 13.2**	**Figure 13.10**
Approved	CDP	File No:	EO5-P-MA-96193
Date	17.07.09	Revision	A

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



QUEENSLAND CURTIS LNG A BG Group business	Project: Queensland Curtis LNG Project	Title: **Known EPBC Listed Flora Species Locations**	
	Client: QGC - A BG Group business		Map 2 of 3
ERM Environmental Resources Management Australia Pty Ltd	Drawn: Mipela	**Annex 13.2**	**Figure 13.11**
	Approved: CDP	File No: EO5-P-MA-96194	
	Date: 17.07.09	Revision: A	

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



Legend:

- Export Pipeline & Kilometre Point
- Export Pipeline Option 2 & Kilometre Point
- Lateral Pipeline & Kilometre Point
- Upstream Infrastructure Corridor & Kilometre Point

Source Note:

1:250,000 Topographic vector copyright Geoscience Australia
EVR Data sourced from Queensland Herbarium

Projection UTM MGA Zone 56 | Datum GDA 94

0 10 20 30 40
Kilometres

N

QUEENSLAND CURTIS LNG
A BG Group business

Project	Queensland Curtis LNG Project	Title	Known EPBC Listed Flora Species Locations
Client	QGC - A BG Group business		Map 3 of 3
Drawn	Mipela	Annex 13.2	Figure 13.12
Approved	CDP	File No:	EO5-P-MA-96195
Date	17.07.09	Revision	A

ERM
Environmental Resources Management Australia Pty Ltd

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

4.1.4 Existing Weed Impacts

Many plant communities have been substantially degraded by Buffel and Guinea Grass, both of which have the capacity to displace native ground storey species and alter fire regimes irrevocably. Buffel Grass is now recognised as an emerging environmental weed of considerable importance (Best 1998; Clarke *et al*. 2005; Greenfield 2007). It is also widely used in the region as a pasture grass.

4.2 Fauna Environment

4.2.1 Fauna Habitats

The pipeline corridors encompass vegetated and cleared grazing lands, cropping lands, roadsides, travelling stock reserves, Council lands, State Forests and Resource Reserves.

Remnant vegetation in the corridors consists of nine broad habitat classifications. The area of each broad vegetation type that is identified by the Queensland Herbarium RE mapping as being transected by the proposed pipeline corridors is set out in **Table 2**.

A review of fauna databases identified a number of fauna species that have been recorded from, or that may potentially utilise habitat, within the wider area. A total of 322 fauna species were identified comprising of 1 insect, 55 fish, 13 crustaceans, 16 amphibians, 70 reptiles, 145 birds and 22 mammals (**Attachment 8** of **Appendix 4.2**).

During the field assessment 211 fauna species were recorded, consisting of 13 amphibians, 24 reptiles, 145 birds and 29 mammals (**Attachment 8** of **Appendix 4.2**).

4.2.2 EPBC Act Listed Fauna Species

Database searches identified 30 fauna species listed under the EPBC Act and of these 26 were considered to potentially occur in the area. They include 1 Mollusc, 1 Frog, 2 Freshwater fish, 8 reptiles, 8 birds and 6 mammals.

A list of the EPBC Act Listed fauna species, together with their preferred habitat and an indication as to whether this habitat is present within the project area is given in **Table 6**.

Aquatic EPBC Act Listed fauna 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 the UIC are located in the Condamine River catchment which is part of the Murray-Darling system and Murray Cod have been recorded in this area. The Australian Lung Fish is known from the Mary and the Burnett River systems. The Option 2 Export Pipeline transects a small area of the upper reaches of the Burnett River catchment area. 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.

The EPBC MNES database also identified a number of marine species as potentially occurring in the area. These are dealt with in **Annex 13.3**.

Table 6 EPBC Act Listed Fauna of the Pipeline Corridors

Common Name	Scientific Name	EPBC Act	Source	Preferred Habitat	Preferred habitat present				Comments
					EP1	EP2	L	UIC	
Molluscs									
Boggomoss Snail	*Adclarkia dawsonensis*	CE	1	One subpopulation occurs on private property near Taroom. The second at a camping and water reserve at the Isla-Delusion crossing on the Dawson River. Possible occurrence on Cockatoo Creek.	yes	yes	yes	no	Highly restricted distribution. Population estimated at less than 600.
Amphibians									
Kroombit Tinker Frog	*Taudactylus pleione*	V	2	12 small rainforest patches above 500m at Kroombit Tops	yes	yes	no	no	Highly restricted distribution
Fish									
Australian Lungfish	*Neoceratodus forsteri*	V		Found in the Mary and Burnett River systems	no	yes	no	no	
Murray Cod	*Maccullochella peelii peelii*	V	2	Found in the Murray-Darling river system	no	no	no	yes	
Reptiles									
Five-clawed Worm-skink	*Anomalopus mackayi*	V	2	Grasslands on cracking clay soils. Darling Downs area.	no	no	no	yes	
Collared Delma	*Delma torquata*	V	2	Brigalow and Eucalypt communities – SE Qld but disjunct occurrences elsewhere.	yes	yes	yes	yes	
Ornamental Snake	*Denisonia maculata*	V	2	Found in cracking clay soils in open forests, woodlands and riparian habitats. Shelters under fallen timber and in soil cracks.	yes	yes	yes	no	
Yakka Skink	*Egernia rugosa*	V	1,2	Dry open forests or woodland with dense ground vegetation, rocky areas, fallen timber and other debris.	yes	yes	yes	yes	
Dunmall's Snake	*Furina dunmalli*	V	1,2	Dry sclerophyll forest and woodland and Brigalow scrub on floodplains of cracking soils.	yes	yes	yes	yes	
Brigalow Scaly-foot	*Paradelma orientalis*	V	1,2	Eucalypt and Acacia woodlands, usually found under logs and debris.	yes	yes	yes	yes	
Fitzroy River Turtle	*Rheodytes leukops*	V	1,2	Confined to fast flowing waters in the Fitzroy River and tributaries.	yes	yes	no	no	Unlikely to occur in the study area.
Grassland Earless Dragon	*Tympanocryptis*	E	2	Black, cracking clay soils of the Darling	no	no	no	yes	

Common Name	Scientific Name	EPBC Act	Source	Preferred Habitat	Preferred habitat present				Comments
					EP1	EP2	L	UIC	
	pinguicolla			Downs where it is often found in agricultural cropping and grazing areas.					
Birds									
Yellow Chat (Dawson)	*Epthianura crocea macgregori*	CE	2	Samphire and low shrublands in the northern parts of Curtis Island. May occur in a very limited area in proximity to the main line.	yes	yes	no	no	
Red Goshawk	*Erythrotriorchis radiatus*	V	2	In association with large tracts of intact forest and woodland. Fringes of rainforest and mountainous forest along the Great Dividing Range.	yes	yes	yes	no	More likely to occur in the northern parts of the study area. Doubtful records from the south.
Squatter Pigeon (Southern Subspecies)	*Geophaps scripta scripta*	V	1,2	Forests and woodlands in proximity to water courses.	yes	yes	yes	no	Now absent from the southern parts of the study area but may occur to the north.
Swift Parrot	*Lathamus discolor*	E/Ma	2	Seasonal vagrant from Tasmania where it breeds.	yes	yes	yes	yes	
Southern Giant-Petrel	*Macronectes giganteus*	E/Mi	2	Marine species, not recorded from the study area.	no	no	no	no	
Star Finch (eastern), Star Finch (southern)	*Neochmia ruficauda ruficauda*	E	2	Sparsely distributed along well vegetated watercourses. Possibly more abundant in the northern parts of the study area. No recent records from the south.	yes	yes	yes	no	
Cotton Pygmy-Goose	*Nettapus coromandelianus*	Ma/Mi	1,2	Freshwater lakes, swamps and impoundments.	yes	yes	yes	yes	
Plains-wanderer	*Pedionomus torquatus*	V	1	Open woodlands and grasslands in western Qld. Not recorded in the study area.	no	no	no	no	
Superb Parrot	*Polytelis swainsonii*	V	2	Not known from the study area. Found in NSW.	no	no	no	no	
Australian Painted Snipe	*Rostratula australis*	V	1,2	Freshwater swamps, marshes and seasonally inundated grasslands.	yes	yes	yes	yes	
Black-breasted Button-quail	*Turnix melanogaster*	V	2	Vine thickets and rainforest habitats. Sometimes in adjacent, disturbed but well vegetated habitats. SE Qld and	yes	yes	yes	yes	

Common Name	Scientific Name	EPBC Act	Source	Preferred Habitat	Preferred habitat present				Comments
					EP1	EP2	L	UIC	
				northern NSW.					
Mammals									
Large-eared Pied Bat, Large Pied Bat	*Chalinolobus dwyeri*	V	2	Cave or tree-roosting bat usually found in association with sandstone escarpments and gorges. Kroombit Tops, Carnarvon Ranges, Cania Gorge.	yes	yes	yes	no	
Northern Quoll	*Dasyurus hallucatus*	E	2	Patchy occurrence in northern parts of the study area in forests and woodlands. Records from Carnarvon Range and parts of the Great Dividing Range.	yes	yes	yes	no	
Spotted-tailed Quoll (Southern Subspecies)	*Dasyurus maculatus maculatus*	E	1,2	Rainforest and wet sclerophylly forest habitats is south east Qld. Possibly a patchy distribution in the study area.	yes	yes	yes	no	
Semon's Leaf-nosed Bat	*Hipposideros semoni*	E	2	Dubious records from St Mary's Forest. Otherwise only known from northern Qld.	no	no	no	no	
Eastern Long-eared Bat	*Nyctophilus timoriensis*	V	1,2	Arid woodlands in the southern parts of the study area.	no	no	no	yes	
Grey-headed Flying-Fox	*Pteropus poliocephalus*	V	1,2	Coastal forests, mangroves and woodlands.	yes	yes	no	no	
False Water Rat	*Xeromys myoides*	V	2	Coastal mangroves and samphire habitats. Patchy distribution along the Qld coast.	yes	yes	no	No	

***Status:** Commonwealth (EPBC) listed: **EX** = Extinct; **CE** = Critically Endangered; **EN** = Endangered; **VU** = Vulnerable; **Mi** = Migratory Species, **Ma** = Marine Species.
[1]Wildlife Online [2]EPBC Protected Matters search

Field studies identified four EPBC Act Listed fauna species within the CSG Field, in proximity to the Collection Header. These are:

- Eastern Long-eared Bat (Nyctophilus timoriensis)- Vulnerable under the EPBC and the NC Act
- White-throated Needletail (Hirundapus caudacutus) – Migratory species
- Fork-tailed Swift (Apus pacificus) – Migratory and Marine species, and
- Large-eared Pied Bat (Chalinolobus dwyeri)- Vulnerable under the EPBC and the NC Act (Tentative Record at Gurulmundi SF).

Field surveys also recorded the EPBC Act listed marine species the Magpie Goose (Anseranus semipalmata) at Lake Broadwater, just outside the south-east corner of the CSG Field:

All records of protected fauna have been submitted to the EPA WildNet database.

EPBC Act Listed fauna species recorded during the survey are described below.

Eastern Long-eared Bat, *Nyctophilus timoriensis*

EPBC: Vulnerable

This species was encountered only once during the survey in a relatively extensive tract of natural vegetation near Condamine. Previous records are also known from this area and also to the north of Miles near Gurulmundi State Forest. Other records are known from areas to the south and south-east of the CSG Field and the species is recorded infrequently across the NSW and Queensland Brigalow Belts. It is likely therefore, that this species occurs over much of the southern pipeline corridors, possibly restricted to larger tracts of intact native vegetation. The draft Biodiversity Action Plan for EPA Back on Track species in the Murray-Darling Region (EPA 2008d) indicates habitat fragmentation as a major threat to this species.

Large-eared Pied Bat, *Chalinolobus dwyeri*

EPBC: Vulnerable

Additionally, an echo-location call of an unknown bat species was recorded on the rocky escarpments in Gurulmundi State Forest. The call is similar to that reported for the EPBC Act Listed Large-eared Pied Bat (Pennay, *et. al*. 2004) but the identification can not be confirmed until further reference calls are obtained for this species. For the purposes of this report, a conservative approach is taken and this species has been assumed to occur in areas where suitable habitat exists.

White-throated Needletail, *Hirundapus caudacutus,* EPBC: Mi, and **Fork-tailed Swift, *Apus pacificus*,** EPBC: Mi, Ma

These birds were observed in the air space over the pipeline corridors and as in other parts of the continent, it is highly unlikely that they land. Both species possibly sleep on the wing and were observed flying ahead of summer storm fronts in the area. These birds are reliant upon flying insects that may originate in the Pipeline corridors area, but it is highly unlikely that they would be affected in any way by the proposed development.

Overall distributional range is not restricted to the Brigalow Belt Bioregion.

4.2.3 Aquatic Fauna

According to Queensland Museum records 55 fish species have been known to occur in watercourses in the broad vicinity of the pipeline corridors. Of these species, the Murray Cod and the Australian Lungfish are listed as Vulnerable under the EPBC Act.

4.2.4 Introduced Fauna

Twelve introduced species have been recorded within the wider study area, including 2 fish, 1 amphibian, 2 birds and 7 mammals. These species are included in **Attachment 8** of **Appendix 4.2**, where they are denoted as introduced species by an asterisk.

4.3 Wetlands

The UIC traverses the Condamine River and several nationally significant wetlands occur downstream, including the Ramsar-listed Narran Lake Nature Reserve approximately 450 km to the southwest. The Export Pipeline and Lateral traverse a number of significant watercourse catchments including the Auburn, Dawson, Nogoa and Calliope.

5 POTENTIAL IMPACTS

The potential impacts discussed here are based on desktop studies of the pipeline corridors and rapid field investigations of available sections of the alignments. While these studies aim to address all significant impacts of the proposed development on flora and fauna, they cannot rule out the possibility of undetected issues, especially along sections of the alignments not yet assessed in the field.

5.1 Reversible and Non-reversible Impacts

The pipelines are likely to be decommissioned within several decades. Subject to landholders choosing to manage their property in a manner that inhibits natural regrowth, the impacts associated with clearing for construction and maintenance are considered to be reversible within all vegetation types over the long term.

In areas of high conservation value and sensitivity, there is potential to allow tree and shrub vegetation to naturally re-establish over portions of the alignment with the exception of the area immediately over the pipelines. Keeping a strip on either side of the pipeline free of trees and shrubs may be all that is necessary to protect the pipe from potential root damage and facilitate ongoing pipeline inspection and necessary maintenance.

5.2 Potential Impacts on EPBC Act Listed Ecological Communities

5.2.1 Potential Impacts Associated with Clearing

Approximately 216 km of remnant vegetation is transected by the pipeline corridors which have a total length of 755 km.

The majority of the area to be cleared consists of eucalypt woodlands and forests. Very minor clearing will also be required to cross fragmented stands of brigalow which often occur on roadside verges or as wind breaks along the margins of pasture or cropping paddocks. Mostly, this will involve transecting relatively narrow, linear corridors. The Queensland Herbarium mapping also indicates a small number of locations where the alignments may impinge on SEVT, Native Bluegrass Grassland and freshwater wetland communities. The detailed field assessment will confirm the extent and locality of these features and it is considered likely that these will be largely, if not totally avoidable.

The estimated clearing footprints within each EPBC Act Listed Vegetation Community are shown in **Table 7**.

Table 7 Estimated Clearing Footprint Within EPBC Listed Vegetation Communities

EPBC Listed Vegetation Community	Total clearing footprint using Option 1 (ha)*	Total clearing footprint using Option 2 (ha)*
Brigalow	21.59	14.42
SEVT	3.17	2.47
Grassland	2.21	0
Weeping Myall	0	0
Total	26.97	16.89

* Offset initiatives not accounted for the purposes of this table

According to existing Herbarium RE mapping 17ha of EPBC listed community may be cleared if Option 2 for the Export Line is chosen. 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 actual area of clearing for the proposed pipeline is likely to be lower than the above estimate, as:

- The ROW may be able to utilise existing cleared infrastructure corridors through remnant vegetation (at least in part)
- Pipeline construction may not require clearing of the full 50 m corridor (100 m for the UIC) width within some sections of remnant vegetation, and
- Disturbance of remnant vegetation beside major watercourses may be avoided by the use of Horizontal Directional Drilling (HDD).

Existing Queensland Herbarium mapping indicates that there are no REs representative of EPBC Act Listed communities which, with the exception of RE 11.3.1, would require clearing in excess of 0.61% of that which occurs within 5 km of the pipeline corridor. None require clearing that would represent more than 0.007% of that which occurs within their Bioregion.

The Endangered Brigalow community RE 11.3.1 is traversed by the Collection Header (approximately 1 ha). This area amounts to approximately 1.3% of that within 5km either side of the pipeline corridors and approximately 0.001% of that which occurs in the Bioregion. The areas of RE 11.3.1 that are proposed to be crossed are small narrow remnants that exist along fencelines in farming areas. These remnants were found to be adversely impacted by edge effects and weed invasion.

The total area of the Endangered Brigalow Community RE 11.4.3 that is transected by the pipeline corridors is approximately 5 ha which equates to approximately 0.6% of that within 5 km either side of the pipelines and 0.0067% of that in the Bioregion. The areas of RE 11.4.3 that are transected by the corridors are also generally small narrow remnants that exist along roadsides or fencelines and therefore already impacted by edge effects and weed invasion. This was seen to be the case where ground surveys identified two areas mapped as RE 11.4.3 were in fact either degraded non-remnants (M40) or were found only to show characteristics of a Not of Concern community (M4 at KP 5) None-the-less, provided there are no other constructability or land access constraints it is recommended that minor adjustments to the alignment be made in order to miss the larger area (approximately 32 ha) mapped as RE 11.4.3 at KP 4.5-5 along the Option 1 and Option 2 Pipeline corridor.

The Option 1 Export Pipeline also transects a total of 8.3 ha of the Endangered Brigalow Community RE 11.9.5, while Option 2 transects 3.28 ha. The UIC transects an additional 4.14 ha of this RE and it is recommended that this could be significantly reduced by realignment at KP167.6-167.9.

The other Endangered Brigalow Communities transected by the pipeline corridors (REs 11.9.1, 11.9.6 and 11.12.21) are limited to narrow belts and small remnants transected by the Option 1 Export Pipeline.

SEVT communities are predominantly small and / or subdominant communities that detailed field investigations and alignment survey may well be able to avoid. One exception is the SEVT (RE 11.9.4) which occurs on the escarpments at the western end of the Lateral (KP 145.8-146 and KP 147.4-147.6). The ability to avoid these remnants would need to be determined by construction engineers in conjunction with determination of local scale alignment preferences.

The existing Queensland Herbarium Mapping indicates that the Option 2 Export Pipeline would require no clearing of Native Bluegrass Grassland Communities. It also indicates

that the Option 1 Export Pipeline would require transecting approximately 2.21 ha at one location, although detailed field survey would be required to confirm the extent and avoidability of this community if Option 1 was selected as the preferred alignment.

The additional Threatened Ecological Community which may also be transected by the pipeline corridors is the Endangered Weeping Myall Open Woodland Community. This Community is not mapped by the Queensland Herbarium RE mapping nor was it detected by the initial field studies. However, it is described as occurring within the Brigalow South Bioregion, generally in small patches of alluvial soils within REs 11.3.2 and 11.3.28. However, based on the fact that:

- The main location where the pipeline corridors transect one of the REs within which this Community potentially occurs (RE 11.3.2 at KP 2-8.2 of the UIC) has been identified as location where a realignment recommendation is likely to be able to be accommodated, and
- The initial field surveys did not record any communities which matched the description of Weeping Myall Open Woodland Community.

It is considered likely that the pipeline corridors will be able to avoid any areas containing this community. The detailed field assessments undertaken prior to alignment finalisation will confirm the avoidability of any such locations.

Although the potential clearing of EPBC Act Listed Communities is estimated to total approximately 17 ha, actual vegetation loss is likely to be considerably less because:

- Detailed field investigations will further refine the alignments to minimise the need to impact these communities, and
- Offset activities will be undertaken to replace unavoidable areas on a basis of at least 1:1.5 (in accordance with the Queensland Government's Environmental Offsets Policy (QGEOP) (EPA 2007).

5.2.2 Other (Non-clearing) Potential Impacts

Because of the small and fragmented nature of all EPBC Act Listed Vegetation Communities transected by the pipeline corridors, the potential impacts from the pipelines are largely associated with the direct impact of vegetation clearing during construction. As such, the majority of the following discussion focuses on clearing footprints. However, other potential impacts from the construction and operation of the pipeline exist, namely:

- Introduction and spread of declared and environmental weeds
- Introduction or proliferation of pest animals
- Release of contaminants and / or silt into watercourses, mangrove and wetland areas
- Altered hydrological and sedimentation regimes due to construction of the pipeline across the mainland marine wetland areas, and
- Changes to fire regimes, in particular increased fire regimes due to higher weed biomass along cleared easements.

While these potential impacts exist, the fact the pipeline corridors do not go through any large intact stands of these communities indicates that the potential for significant impacts from these developments is low. Nonetheless, additional mitigation measures to minimise potential impacts on EPBC Act Listed Communities are provided in **Section 6**.

5.3 Potential Impacts on EPBC Act Listed Flora Species

The pipeline alignments contain potential habitat for 32 EPBC Act Listed flora species. Detailed survey is required to confirm the presence or absence and potential presence of each of these flora species along the pipeline alignments.

It is anticipated that EPBC listed flora species recorded during the detailed alignment survey will generally be able to be avoided by alignment refinement and narrowing for short lengths. There may however be some populations which are unavoidable. Generally this would relate to species with restricted habitat niches from which a pipeline may not be able to deviate. For example, the rare Large-fruited Zamia (*Cycas megacarpa*) populations which occur on range spurs at KP 296.5-298.5, KP 301 and KP 305 which the Export Pipeline will need to follow for constructability purposes..

Table 8 identifies the potential impacts on each potential EPBC Act Listed flora species before and after mitigation measures. The analysis identifies that in the absence of appropriate mitigation measures there is a moderate to high potential to impact on these species. The high potential for impacts relates to species which are known to have restricted distributions and special extents. Assuming the successful implementation of the mitigation measures identified in **Section 6** more generally, the potential to impact all EPBC Act Listed flora species is low with the exception of:

- Large-fruited Zamia (*Cycas megacarpa*), and
- *Philotheca sporadica.*

For each of these species, which have populations which could potentially be dense within constrained alignment locations, the potential for impacts associated with clearing for construction may be moderate due to inability to avoid. Where such circumstances are identified, a Threatened species conservation plan would be developed and approval sort from DEWHA, prior to finalisation and development of the alignment.

Table 8 Potential for EPBC Act Listed Flora Species to be Impacted

Common Name	Scientific Name	Status	Habitat	Potential to be Impacted Without Mitigation Measures^	Mitigation Measures	Potential to be Significantly Impacted with Mitigation Measures
Chinchilla Wattle	*Acacia chinchillensis*	V	Occurs in south-eastern Qld N of Chinchilla and near Tara. Grows in ironbark *Eucalyptus*, *Callitris columellaris*, *Casuarina* sp. woodland, in sandy or gravelly soils (ABRS, 2001).	Moderate on Option 1, Option 2 and UIC	Clearance Survey	Low (easily avoidable)
Curly-bark Wattle	*Acacia curranii*	V	Only known in Gurulmundi wildflower area north of Miles.	High at and near Gurulmundi State Forest (restricted species)	Clearance Surveys. Exclusion area in Gurulmundi SF and area to north west	Low (Potentally High in Gurulmundi area without exclusion areas)
Hando's Wattle	*Acacia handonis*	V	Understorey plant in *Eucalyptus* forests on sandstone ridges. Restricted to Barakula State Forest.	Moderate on Option 2	Planning Survey and Clearance Surveys	Low (easily avoidable)
Tara Wattle	*Acacia lauta*	V	Found from Tara to Inglewood 1) Property "Marron Glen", 2) 15km nth of Tara and 3) 16km east of Tara.	Moderate on UIC	Clearance Survey	Low (easily avoidable)
Wardell's Wattle	*Acacia wardellii*	V	Ridge crests with loamy or gravely soil. Coloniser of disturbed areas – Thomby Range and a few ridges east of the Condamine.	Moderate on UIC	Clearance Survey	Low (restricted habitat type, easily avoidable)
Roadside	*Atalaya collina*	E	Grows on hillsides, in	Moderate on	Clearance Survey	Low (restricted

Common Name	Scientific Name	Status	Habitat	Potential to be Impacted Without Mitigation Measures^	Mitigation Measures	Potential to be Significantly Impacted with Mitigation Measures
Wallaby Grass			remnant dry scrubs, together with *A. salicifolia*, but is not as common as that species (Reynolds, 1991)	Options 1 and 2		habitat type, easily avoidable)
Ooline	*Cadellia pentastylis*	V	Clay plains, sandstone and residual ridges in association with vine thickets, brigalow, belah and red bauhinia.	Moderate	Clearance Survey	Low (low numbers anticipated, easily avoided)
Yellow Fringed Myrtle	*Calytrix gurulmundensis*	V	Found on lateritic sandstone ridges. Localised and patchy distribution.	High at and near Gurulmundi State Forest (restricted species)	Clearance Surveys. Exclusion area in Gurulmundi SF and area to north west	Low (Potentally High in Gurulmundi area without exclusion areas)
Silver Commersonia	*Commersonia argentea syn Commersonia sp.(Cadarga G.P. Guymer 1642)*	V	Stony ridges, north of Chinchilla	High on Option 2 (restricted species)	Clearance Survey	Low (low numbers anticipated, restricted habitat type, easily avoided)
Cossinia	*Cossinia australiana*	E	Small tree up to 7 m found in depauperate rainforest relicts, usually on volcanic soil (Stanley and Ross, 1986). Recorded at Kingaroy, Gympie, Munholme Ck, Burnett River (Qld Herbarium)	Moderate on Options 1 and 2	Clearance Survey	Low (restricted habitat type, easily avoidable)
Wedge-leaf	*Cupaniopsis*	V	Depauperate rainforests	Moderate on Options 1 and 2	Clearance Survey	Low (low numbers anticipated,

Common Name	Scientific Name	Status	Habitat	Potential to be Impacted Without Mitigation Measures^	Mitigation Measures	Potential to be Significantly Impacted with Mitigation Measures
Tuckeroo	*shirleyana*		(Stanley and Ross, 1983).			restricted habitat type, easily avoided)
Large-fruited Zamia	*Cycas megacarpa*	E	Stony clay loams on hill tops and steep slopes. Commonly in spotted gum and ironbark open forest and woodland with a grassy understorey (DNR, 1999).	High on Opitons 1 and 2	Clearance Survey	Moderate (populations expected on rocky slopes near KP 305 and near Mt Larcom, potential inability to avoid to be confirmed by detailed field assessment))
Small-leaved Denhamia	*Denhamia parvifolia*	V	Found in semi-evergreen vine thickets. Brown loam or clay loam soils.	Moderate on UIC and Lateral	Clearance Survey	Low (low numbers anticipated, restricted habitat type, easily avoided)
King Blue Grass	*Dichanthium queenslandicum*	V	Endemic to Qld black soil plains. Occurs in RE's 11.8.11, 11.3.21	Moderate on Options 1 and 2	Clearance Survey	Low (restricted habitat type, easily avoided)
Tricolour Diuris	*Diuris tricolor (sheaffiana)*	V	Sandy soils, often in Callitris woodlands. Primarily a NSW species with scattered records in Qld.	Moderate on Options 1 and 2 and UIC	Clearance Survey	Low (low numbers anticipated, easily avoidable).
Salt Pipewort, Button Grass	*Eriocaulon carsonii subsp. orientale*	E	Known in Wet poorly drained soils. Mound Springs areas near Injune Area	High (restricted species)	Clearance Survey, Erosion and Sedimentation Controls near watercourse crossings. Contamination	Low (restricted habitat type, easily avoided)

Common Name	Scientific Name	Status	Habitat	Potential to be Impacted Without Mitigation Measures^	Mitigation Measures	Potential to be Significantly Impacted with Mitigation Measures
					controls.	
Tony's ironbark	*Eucalyptus beaniana*	V	Rocky Areas such as Isla Gorge Robinson Gorge and Mundubbera	Moderate on Options 1 and 2	Clearance Survey	Low (low numbers anticipated, restricted habitat type, easily avoided)
Pumpkin Gum	*Eucalyptus pachycalyx*	E	On skeletal sandy soils (Botanic Gardens Trust, 2009)	Moderate	Clearance Survey	Low (low numbers anticipated, restricted habitat type, easily avoided)
Shiny-leaved Ironbark	*Eucalyptus virens*	V	Sandstone ridges. Four populations – 1) Coolmunda Conservation Park 2) Tara, 3) NE of Eidsvold and 4) Maranoa River near Mt Moffatt.	High on UIC (restricted species)	Clearance Survey	Low (low numbers anticipated, restricted habitat type, easily avoided)
None known	*Homopholis belsonii*	V	Known from near Gurulmundi, 30km north of Miles in the Darling Downs district (Stanley and Ross, 1989).	High (restricted species)	Clearance Survey	Low (low numbers anticipated, easily avoided)
None known	*Homoranthus decumbens*	V	Found in two separate locations 1) Blackdown Tablelands and 2) State Forest 302, north of Chinchilla.	Moderate	Clearance Survey	Low (low numbers anticipated, easily avoided)
None known	*Leucopogon cuspidatus*	V	Mainly on rocky slopes, cliffs and rocky outcrops. Commonly in woodland or open woodland and	Moderate on Options 1 and 2 and Lateral	Clearance Survey	Low (low numbers anticipated, restricted habitat type, easily avoided)

Common Name	Scientific Name	Status	Habitat	Potential to be Impacted Without Mitigation Measures^	Mitigation Measures	Potential to be Significantly Impacted with Mitigation Measures
			sometimes in heath or shrubland communities (M. Edginton, pers. comm.).			
None known	*Macrozamia crassifolia*	V	Restricted to the Eidsvold – Mundubbera district in Queensland. Found on sandy soils over granite (DEW 2007).	Moderate on Options 1 and 2	Clearance Survey	Low (low numbers anticipated, restricted habitat type, easily avoided)
None known	*Macrozamia fearnsidei*	V	Grows in open forest on sandy soils of sandstone origin either on rocky slopes or in gullies near ephemeral streams at approx 300-400m altitude. Restricted to central Qld (DNR 1999)	Moderate on Lateral	Clearance Survey	Low (low numbers anticipated, restricted habitat type, easily avoided)
None known	*Parsonsia larcomensis*	V	Recorded from 350-750 m elevation. It occurs in open heathland and shrubland at or near the summits of mountain peaks growing in shallow, loamy soils. Restricted to central east and south east Queensland and is confined to the Mt Perry area near Rockhampton (DRN 1999)	Moderate on Options 1 and 2	Clearance Survey	Low (low numbers anticipated, restricted habitat type, easily avoided)
None known	*Philotheca sporadica*	V	On residual lateritic rises. Known as widespread in patches in UIC area.	High	Planning and Clearance Survey,	Moderate (restricted habitat type, limited clearing may be

Common Name	Scientific Name	Status	Habitat	Potential to be Impacted Without Mitigation Measures^	Mitigation Measures	Potential to be Significantly Impacted with Mitigation Measures
					If necessary EPBC Act Listed Species Management Plans as part of EPA permit and DEWHA approval process	required for linear infrastructure if large patches unavoidable)
None known	*Picris evae*	V	Small daisy in rocky and gravelly areas	Moderate	Clearance Survey	Low (low numbers anticipated, easily avoided)
None known	*Polianthion minutiflorum*	V	Known from five areas in eastern Queensland, - Redcliffe Vale to Kingaroy, usually in forest and woodland on sandstone slopes / gullies with skeletal or sandy soil, adjacent to deeply weathered laterite (Kellerman et al 2006)	Moderate	Clearance Survey	Low (low numbers anticipated, restricted habitat type, easily avoided)
Quassia	*Quassia bidwillii*	V	Below 650m in rainforests, open forest, woodland and mangroves (DNR, 1999).	Moderate on Options 1 and 2	Clearance Survey	Low (low numbers anticipated, restricted habitat type, easily avoided)
Native Thistle	*Rhaponticum australe (syn Stemmacantha australis)*	V	On heavy clays derived from basalt (DNR, 1999).	Moderate on Options 1 and 2 and Lateral	Clearance Survey	Low (low numbers anticipated, restricted habitat type, easily avoided)
None known	*Trymalium minutiflorum*	V	Found up to an altitude of 340 m on sandy soil or light	High on Options 1 and 2 and Lateral	Clearance Survey	Low (low numbers anticipated, easily

Common Name	Scientific Name	Status	Habitat	Potential to be Impacted Without Mitigation Measures^	Mitigation Measures	Potential to be Significantly Impacted with Mitigation Measures
			brown gravelly loam derived from sedimentary rocks. Recorded in Callide Ranges, Goodger and Bileola areas (DNR 1999).	(restricted species)		avoided)
Durong sage	*Xerothamnella herbacea*	E	Found in Brigalow, Low chenopod shrubland. Records Pelican Back Rd Chinchilla,Theodore S F (Qld Herbarium)	High on Options 1 and 2 (restricted species)	Clearance Survey	Low (low numbers anticipated, restricted habitat type, easily avoided)

***Status:** Commonwealth (EPBC) listed: **E**= Endangered; **V**= Vulnerable

5.4 Potential Adverse Impacts on EPBC Act Listed Fauna

The pipeline alignments have has been selected to avoid as many large and connected areas of vegetation habitat as possible. With pipeline corridors of such length, however, it is not possible to avoid all areas that may provide fauna habitat. With successful implementation of appropriate environmental management controls, any potential impacts on fauna species are likely to be limited to direct impacts associated with construction of the proposed pipeline. The pipeline construction will require some clearing of vegetation and this generally equates to a loss of fauna habitat. This is unlikely to lead to significant long-term impacts on common fauna species due to presence of similar habitat, which these species could utilise, in areas adjacent to the pipeline.

Overall levels of vegetation disturbance are considered to be low relative to that retained in the immediate vicinity and regionally (**Attachment 10** of **Appendix 4.2** details the estimated clearing proportion for each RE type). **Table 9** lists EPBC Act Listed fauna species (and migratory and marine) that may potentially be impacted by the project and provides an assessment of Significant Impacts in accordance with the EPBC Significant Impact Guidelines, Policy Statement 1.1.

Table 9 Potential for EPBC Act Listed Fauna Species to be Impacted

Common Name	Scientific Name	EPBC Act	Source	Potential to be Impacted without Mitigation Measures				Mitigation Measures	Potential to be Impacted with Mitigation Measures			
				ML	ML 2	CL	UIC		ML	ML 2	CL	UIC
Molluscs												
Boggomoss Snail	*Adclarkia dawsonensis*	CE	1	high	high	mod	-	Field survey to determine if snail is present on the proposed pipeline route. Re-align to avoid populations	nil	nil	nil	-
Amphibians												
Kroombit Tinker Frog	*Taudactylus pleione*	V	2	mod	mod	-	-	Survey rainforest patches – avoidance .	low	low	-	-
Fish												
Australian Lung Fish	*Neoceratodus forsteri*	V	1,2		low			Avoid disturbance of aquatic habitats		nil		
Murray Cod	*Maccullochella peelii peelii*	V	2	-	-	-	mod	Avoid disturbance of aquatic habitats	-	-	-	low
Reptiles												
Five-clawed Worm-skink	*Anomalopus mackayi*	V	2	-	--	-	mod	Fauna spotter to remove entrapped reptiles from pipeline trench. Wildfire prevention during construction.	-	-	-	low
Collared Delma	*Delma torquata*	V	2	mod	mod	mod	mod	Fauna spotter to remove entrapped reptiles from pipeline trench. Wildfire prevention during construction.	low	low	low	low
Ornamental Snake	*Denisonia maculata*	V	2	mod	mod	mod	-	Fauna spotter to remove entrapped reptiles from pipeline trench. Wildfire prevention during construction.	low	low	low	-
Yakka Skink	*Egernia rugosa*	V	1,2	mod	mod	mod	mod	Fauna spotter to remove entrapped reptiles from pipeline trench. Wildfire prevention during construction. Respread cleared timber/vegetation over site.	low	low	low	low
Dunmall's Snake	*Furina dunmalli*	V	1,2	mod	mod	mod	mod	Fauna spotter to remove entrapped reptiles from	low	low	low	low

Common Name	Scientific Name	EPBC Act	Source	Potential to be Impacted without Mitigation Measures				Mitigation Measures	Potential to be Impacted with Mitigation Measures			
				ML	ML 2	CL	UIC		ML	ML 2	CL	UIC
								pipeline trench. Avoidance of Brigalow communities				
Brigalow Scaly-foot	*Paradelma orientalis*	V	1,2	mod	mod	mod	mod	Fauna spotter to remove entrapped reptiles from pipeline trench. Wildfire prevention during construction. Respread cleared timber/vegetation over site.	low	low	low	low
Fitzroy River Turtle	*Rheodytes leukops*	V	1,2	low	low	-	-	Site inspections. Avoidance of major water holes. Minimal disturbance to riparian areas.	low	low	-	-
Grassland Earless Dragon	*Tympanocryptis pinguicolla*	E	2	-	-	-	mod	Fauna spotter to remove entrapped reptiles from pipeline trench. Wildfire prevention during construction.	low	low	low	low
Birds												
Yellow Chat (Dawson)	*Epthianura crocea macgregori*	CE	2	low	low	-	-	Minimise damage to riparian areas. Directional drilling on mangrove and samphire areas.	low	low	-	-
Red Goshawk	*Erythrotriorchis radiatus*	V	2	low	low	low	-	Wildfire prevention during construction. Allow partial site regeneration.	low	low	low	low
Squatter Pigeon (Southern Subspecies)	*Geophaps scripta scripta*	V	1,2	low	low	low	-	Site inspections. Avoidance of major water holes. Minimal disturbance to riparian areas. Wildfire prevention during construction.	low	low	low	-
Swift Parrot	*Lathamus discolor*	E/Ma	2	low	low	low	low	Wildfire prevention during construction. Allow partial site regeneration.	low	low	low	low
White-throated Needletail	*Hirundapus caudacutus*	Mi	2	low	low	low	low	Found in the airspace above the pipeline alignment. Not known to land in Australia.	low	low	low	low
Star Finch (eastern), Star Finch (southern)	*Neochmia ruficauda ruficauda*	E	2	low	low	low	-	Site inspections. Minimal disturbance to riparian areas.	low	low	low	-

Common Name	Scientific Name	EPBC Act	Source	Potential to be Impacted without Mitigation Measures				Mitigation Measures	Potential to be Impacted with Mitigation Measures			
				ML	ML 2	CL	UIC		ML	ML 2	CL	UIC
								Wildfire prevention during construction.				
Cotton Pygmy-Goose	*Nettapus coromandelianus*	Ma/Mi	1,2	low	low	low	low	Site inspections. Avoidance of major water holes. Minimal disturbance to riparian areas. Wildfire prevention during construction.	low	low	low	low
Australian Painted Snipe	*Rostratula australis*	V	1,2	low	low	low	low	Minimal disturbance to riparian areas. Wildlife prevention during construction. Allow partial site regeneration.	low	low	low	low
Black-breasted Button-quail	*Turnix melanogaster*	V	2	low	low	low	low	Avoidance of SEVT habitats. Minimal disturbance to riparian areas.	low	low	low	low
Mammals												
Large-eared Pied Bat, Large Pied Bat	*Chalinolobus dwyeri*	V	2	low	low	low	-	Minimal disturbance in riparian areas. Prevention of wildfire during construction. Allow partial revegetation.	low	low	low	-
Northern Quoll	*Dasyurus hallucatus*	E	2	low	low	low	-	Allow partial revegetation after construction.	low	low	low	-
Spotted-tailed Quoll (Southern Subspecies)	*Dasyurus maculatus maculatus*	E	1,2	low	low	low	-	Avoidance of SEVT and rainforest habitats	low	low	low	-
Eastern Long-eared Bat	*Nyctophilus timoriensis*	V	1,2	low	low	low	low	Minimise clearance in remnant vegetation. Allow partial revegetation after construction.	low	low	low	low
Grey-headed Flying-Fox	*Pteropus poliocephalus*	V	1,2	low	low	-	-	Minimal disturbance in riparian areas. Prevention of wildfire during construction. Allow partial revegetation.	low	low	-	-

***Status:** Commonwealth (EPBC) listed: **CE** = Critically Endangered; **E** = Endangered; **VU** = Vulnerable; **Mi** = Migratory Species, **Ma** = Marine Species.
[1]Wildlife Online [2]EPBC Protected Matters search

Based on current information, the projected level of Significant Impacts for most species is low. Potential impacts include the following (which are further described under subheadings below):

- Removal of habitat such as mature vegetation, hollow-bearing trees and fallen logs, and therefore loss of nesting, shelter and foraging resources
- Fragmentation of habitat due to pipeline construction. These features may act as movement barriers, particularly to fossorial species, and alter movement patterns. They may also limit access to dry season fauna refuges associated with riverine environments
- Disturbance to fauna movement corridors and dry season fauna refuges (predominantly associated with rivers and creeks)
- The establishment of environmental weeds, particularly Buffel grass, has the potential to fundamentally destroy natural fauna habitats through altered fire regimes and removal of fauna food resources
- Noise and increased human activity, particularly during site development may restrict species movements, limit access to food or other resources
- Trenchfall - the potential for fauna to fall into and become trapped in the open pipeline trench during construction, and
- The elevated risk of wildfires as a result of construction activities including welding and machinery emissions.

5.4.1 Removal of Tree Hollows and Vegetation

Removal of mature vegetation in general reduces feeding resources and shelter for native fauna species. While it is recognised that the proposed loss of mature vegetation would not be significant, most of the fauna habitat within the study corridor has been heavily cleared and is now severely fragmented.

The great majority of the proposed pipeline route (85%) traverses cleared land. As a result of this and the fact the proposed alignment avoids remnant vegetation where possible, relatively small amounts of fauna habitat are proposed to be cleared. The total areas of each Faunal Habitat proposed to be cleared were calculated from the RE clearing calculations. Overall, an estimated 1462 ha of remnant habitat (i.e. all habitats combined) is proposed to be cleared along the pipeline corridors. The habitat types that are proposed to be cleared to the greatest extent are Eucalypt Woodland (1333 ha) and Riparian Eucalypt Woodland (47 ha). **Attachment 10** of **Appendix 4.2** indicates that the total estimated clearing area of each RE is a small percentage of the total area of that RE present within a 5 km butter of the alignment.

An important potential impact on fauna is the loss of hollow-bearing trees. A large number of Australian vertebrate fauna species are dependent on tree hollows for shelter and nesting, including (amongst others) parrots, owls, possums, gliders and bats (Gibbons *et al* 2002). Mature trees with hollows are a limited resource in many of the rural and grazed lands of central Queensland where widespread clearing has removed much of the mature vegetation. The formation of hollows suitable for use by vertebrate fauna does not occur until eucalypts are at least 120 years old, with large hollows rare in trees under 220 years old. Therefore, the replacement of lost hollows may not occur for very long periods. Large hollow-bearing trees are especially important habitat in strips of riparian vegetation along watercourses that occur in otherwise cleared land. Even single or widely scattered mature hollow-bearing trees can be important habitat, for example,

for hollow-roosting bats (Lumsden 2002). Hollow-bearing trees are likely to be present in varying but limited numbers in Eucalypt Woodland habitats along the pipeline route, and some of the highest quality hollow-bearing habitat is likely to occur in Riparian Eucalypt Woodland along watercourses.

Fallen logs and dead timber on the ground and understorey vegetation provide shelter (either underneath timber or within hollow logs) and food resources for a broad range of small ground-dwelling fauna. These include, but are not exclusive to, native rodents, dasyurid marsupials, bandicoots, lizards, snakes, frogs, and some birds. Large fallen logs also provide essential protection for fauna against bushfire. Loss or removal of fallen timber severely reduces the abundance and diversity of small ground-dwelling fauna. Impacts from removal of dead timber will reverse over time as dead tree limbs and fallen trees accumulate, but are likely to result in loss of fallen timber-dependent species in the short to medium term. Such impacts can be reversed in the short term by collecting dead timber and respreading it over the pipeline route after construction.

5.4.2 Habitat Fragmentation and Disturbance to Movement Corridors

The pipeline route traverses Riparian Eucalypt Woodland habitat fringing major watercourses, which has important fauna values as refugia for wildlife during dry periods and as corridors facilitating the movement of migratory and nomadic species. Such refugia and corridors are particularly important as much of the wider environment of the study corridor is fragmented as a result of clearing for agriculture. Additionally these watercourses are often the only source of water during the dry season and therefore assist populations to persist in a dry and largely cleared landscape. Fragmentation and disturbance of these habitats may be reversible in the medium to long term by natural revegetation and habitat rehabilitation or specific programs aimed at restoring habitat.

5.4.3 Access by Predators

Predators such as dingoes, and to a lesser extent, foxes and cats, are known to use roads and tracks extensively as they provide rapid and uncluttered access across the landscape and the relative lack of contact with vegetation also ensures minimal parasite contact. Tracks also have the potential to open up dense understorey habitats which may be important refugia for fauna.

5.4.4 Environmental Weeds

As described in previously, construction and maintenance of the pipeline has the potential to introduce new weeds and spread existing weeds. The presence of weeds has the potential to alter fauna habitat values, particularly through modification of vegetation structures and fire regimes. Recommendations aimed at controlling the introduction and spread of weed species are provided in **Section 6**.

5.4.5 Trenchfall: The Trap Created by the Open Pipeline Trench

An open trench will be required to facilitate the laying of the pipeline. The trenching will be progressive and therefore the full length of the pipeline will not be open at any given time. The open trench provides a temporary barrier to fauna movement and there is potential for ground-dwelling fauna to fall into the trench and become trapped. Here trapped species can be exposed to overheating, dehydration, predation and / or drowning. Fauna entrapment within pipeline trenches has been recognised as a key environmental issue by the Australian Pipeline Industry Association Code of Environmental Practice (APIA, 2009).

Published information from other Australian pipeline projects has demonstrated that pipeline trenches can entrap high numbers of a wide diversity of terrestrial animals (including EPBC Act Listed species), particularly reptiles, frogs and small mammals, with

the potential for very high levels of mortality (Ayers and Wallace, 1997, Woinarski et al., 2000, Doody et al., 2003, Wilson and Swan, 2004; Wilson, 2005).

5.4.6 Wildfire

Risks of fire may be increased through use of equipment and general construction activities, although generally, work areas are cleared of vegetation and leaf litter. Fire has been included here as a possible threat that needs to be considered in the course of construction activities.

5.4.7 Determination of Potential Impacts for EPBC Act Listed Fauna

A number of EPBC Act Listed fauna species identified as potentially occurring within the proposed pipeline route are species are nomadic, highly mobile or occupy very large home ranges. These include the Red Goshawk (*Erythrotriorchis radiates*), Squatter Pigeon (*Geophaps scripta scripta*) and Cotton Pygmy-goose (*Nettapus coromandelianus*). Given the small amount of remnant habitat to be cleared by construction of the pipeline corridors, compared to the area over which individuals of these species range, no significant impact is likely upon these species.

Several other EPBC Act Listed fauna species have the potential to be directly impacted if they are present along the pipeline route in woodland and brigalow habitats, but also have preferred habitat types that are well represented in the immediate vicinity of the alignment. These include the Brigalow Scaly-foot (*Paradelma orientalis*), Yakka Skink (*Egernia rugosa*) and Northern Quoll (*Dasyurus hallucatus*). Although there is potential for some direct impact on these species, the small amount of habitat to be cleared combined with the implementation of appropriate mitigation recommendations should result in minimal impacts on these EPBC listed fauna species.

Potentially present EPBC Act Listed species that may be susceptible to entrapment in the open pipeline trench is made up of one frog, seven reptiles and one mammal. These include the Collared Delma (*Delma torquata*), Brigalow Scaly-foot (*Paradelma orientalis*), Yakka Skink (*Egernia rugosa*), Ornamental Snake (*Denisonia maculata*), Dunmall's Snake (*Furina dunmalli*) and Northern Quoll (*Dasyurus hallucatus*).

The detailed distributions of several of the EPBC Act Listed fauna species identified are poorly known, as they are particularly secretive or cryptic in their habits. It is therefore difficult to assess the likely presence of these species. These include Dunmall's Snake and Ornamental Snake. In the absence of adequate data the precautionary principle has been applied, and it is assumed that these reptile species are present, particularly in remnant woodland and brigalow habitats on cracking clay soils. As these habitats only make up a small area of the alignment, and provided mitigation measures outlined in **Section 6** are implemented, significant impacts on these species is considered to be minimal

5.4.8 Impacts on Migratory and Marine Species

In addition to EPBC Act Listed species, the EPBC Act lists Migratory and Marine fauna, of which 2 species were identified by desktop studies and one was identified in field surveys. These species are included in **Table 9** and are bird species that occur fleetingly in the pipeline area. 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).

The level of disturbance proposed to native vegetation and other resources used by fauna is projected to be negligible, and so for migratory and marine species, impacts are projected to be even less. Of the three species, one, the Cotton Pygmy-Goose, is a water bird that occurs in large water bodies and because the pipeline is aligned to avoid large water expanses, impacts on this species are projected to be negligible. The second species, 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 so impacts are projected to be negligible. The third, the White-throated Needletail, is an aerial forager and not known to land or breed in Australia. It ranges over vast areas of the eastern Australia and is not confined to a particular bioregion. It is also highly unlikely that a development such as this would have any impact on the species.

5.5 Potential Impacts on Aquatic Fauna

Freshwater aquatic environments along the pipeline corridors are small in extent and therefore it is recommended that these areas are avoided wherever practicable. In situations where the pipelines have no alternative but to traverse these features (eg water course crossings), the crossings should be made at right angles and should involve minimal clearing. No significant indirect impacts on freshwater aquatic flora are considered likely provided that mitigation measures as outlined in **Section 6** are employed.

5.6 Potential Impacts on Wetlands

The UIC traverses the Condamine River and several nationally significant wetlands occur downstream, including the Ramsar-listed Narran Lake Nature Reserve approximately 450 km to the southwest. As it is approximately 450 km southwest of the pipeline there is low potential for the proposed activities to impact upon this wetland.

6 MITIGATION AND REHABILITATION RECOMMENDATIONS

6.1 Alignment-specific recommendations

From an ecological perspective, Option 2 is considered to be the most desirable option of the two Export Pipeline alignments.. This is due to the significantly smaller areas of Threatened Ecological Communities that fall within the Option 2 corridor. The main negative impact of the Option 2 alignment is that it transects larger remnants of Not of Concern Ecological Communities; however, this is considered to be the least ecological impact.

Other more minor realignment recommendations that were identified during the initial field inspection are shown in **Table 10**.

Table 10 Ecologically Preferred Alignment Suggestions

KP	Reason	Preferred Alignment	Ecological Desirability
Option 1 and Option 2 Export Pipeline Alignments			
4.5-5	Runs along the edge RE 11.4.3 remnant listed as Endangered under both the EPBC and VM Act.	To move the corridor 200m to the east.	High
12.4-12.8	Runs along the edge of freshwater wetland community RE 11.3.27	Move the alignment approximately 100m to the west of this remnant	High
292.7-262.9 and 263.5	Transects two small remnants of the mixed community of RE 11.9.5/11.9.7. RE 11.9.5 is listed as Endangered under the EPBC and VM Act and RE 11.9.7 is listed as Of Concern under the VM Act.	Move the alignment 200 m to the east	High
307	Runs along the edge of an area of State habitat for EPBC Act Listed species	Move the alignment 200 m to the east,	
Option 1 Export Pipeline			
130	Passes through a small mixed community of 11.9.4b/11.9.5 listed as Endangered under both the EPBC and VM Act.	Move the alignment 700 m east	High
177	Passes through a small roadside remnant of RE 11.12.21 listed as Endangered under both the EPBC and VM Act	Move the alignment 200 m to the west	High
Lateral			
43.9	Passes through a small fragment of the EPBC and VM Act Endangered community RE 11.9.5.	Move alignment 150 m to the north.	?
147.4-147.6	Transects a community of 11.9.4 listed as Endangered under both the EPBC and VM Act	Move the alignment 200 m to the east	High
UIC			
2-8.2	Runs through a mixed community of Of Concern communities RE 11.3.2 and RE 11.3.18 and riparian woodlands RE 11.3.25	Move the alignment south of this area	High
147.2-148	Transects 4.14 ha of Endangered Brigalow Community RE 11.9.5	Move the alignment 500 m south	High

Additional alignment preferences will be identified during the detailed surveys that are expected to be undertaken prior to alignment finalisation.

6.2 Mitigation and Rehabilitation Recommendations

The following mitigation measures will be undertaken to help ensure that significant impacts on flora and fauna are avoided:

- Detailed field investigations will be undertaken of the preferred alignments prior to finalisation
- The corridor impacted for pipeline construction within all areas of remnant vegetation will be minimised (i.e. 40m width). Clearing widths should be minimised wherever possible
- Clearing width will be minimised in beds and banks of watercourses and in areas with Endangered and Of Concern vegetation. It is recognised that battering of steep watercourse banks may require clearing widths in excess of 40m width
- Clearing of remnant vegetation areas will be avoided for the purposes of siting construction camps and where possible, vehicle access tracks
- Existing roads and tracks will be utilised for access where practicable
- Clearing boundaries within remnant vegetation areas will be clearly marked in the field
- Vegetated creeklines, fencelines and road reserves will be crossed at approximately 90 degrees whenever possible and at locations with reduced vegetation to limit the extent of clearing
- The EMP will include appropriate requirements in relation to management of waste and potential contaminants
- A fire extinguisher and personnel trained in fire fighting will be on-hand during welding operations to minimise damage caused by accidental fires
- Topsoil will be removed and re-spread across rehabilitation areas as soon as possible following disturbance (preferably within 12 months)
- Care will be taken to ensure hydrological characteristics are not altered and appropriate soil and erosion management will be implemented in and adjacent to riparian areas
- Drainage will be reinstated at watercourse crossings immediately following completion of construction;
- Ensure no permanent barrier to fish movement at any stage of the Project
- Design, install and maintain effective erosion and sediment control structures during construction and operation (especially near wetlands, watercourses, steep areas and areas of erodible / dispersive soils)
- The treatment and disposal of hydrotest water will be in accordance with the recommendations made in the CSIRO Manufacturing and Infrastructure Technology report (2005)
- Monitoring of weed infestations within disturbed areas will occur at least monthly during construction and then quarterly for a period of two years following construction. Appropriate weed control measures will be applied. Following the two year period, the frequency of monitoring will be reconsidered dependent on the success of control measures and the level of infestations

- A Weed Management Plan that addresses the construction, rehabilitation and operation phases of the project will be prepared prior to construction. This Plan should include hygiene protocols to minimise the likelihood of introduction and spread of environmental, agricultural and declared weeds
- All vehicles and plant will have certification that they are weed-free prior to their initial commencement of works and when moving from weed infested to weed free sections of the pipeline route
- All vehicles will remain on designated access roads and tracks and within defined pipeline construction area and associated work / camp sites
- Whenever practicable fauna handlers will be present to survey for, and as necessary relocate wildlife immediately prior to and during clearing activities
- Trenching will occur progressively to minimise the period of time the trench is open and the length of open trench. The length of open trench at any one time will be the minimum practicable. Ramps and trench plugs with slopes of no greater than 50% (APIA, 2009) will be located at least every 500 m to assist escape for some species. Where possible, trench plugs will coincide with stock and wildlife trails. Some form of cool insulated cover will be provided. Branches, ramped gangplanks or similar will also be used to create 'ladders' at regular intervals to assist small fauna to exit the trench (APIA, 2009)
- Qualified fauna spotters and handlers will be employed to survey the open trench, record and remove any trapped fauna species. Such surveillance will occur along the entire length of the trench and not merely those areas described as fauna habitats or sensitive areas, as trench fall can entrap significant numbers of fauna along any part of the trench
- Fauna spotters and handlers will be qualified or appropriately trained to assess and handle any injuries to native fauna that may occur due to trenchfall. Qualified veterinarian staff will be available to assess and treat or euthanise (as necessary) any large native vertebrates
- Consideration will be given to the use of temporary fencing to exclude access to the trench by livestock and larger native wildlife (APIA, 2009). Fauna searches will be conducted at least daily
- Vegetative waste as a result of clearing will be mulched or distributed across adjacent areas where it may provide refuge for terrestrial species, encourage regrowth and minimise weed infestations. It will not be burnt
- Subject to construction requirements and landholder preferences, trees and shrubs will be allowed to naturally regenerate on those parts of the cleared pipeline corridor that are not required to be kept tree free for pipeline protection and maintenance access purposes
- Linear features such as roads and pipelines will be built to a standard sufficient to allow for their intended purpose but will be allowed to revegetate as much as possible so as to minimise their impact on terrestrial fauna movements
- Vehicle movements will be restricted at night as far as practicable
- Vehicles will travel along the ROW at appropriate speeds that minimise environmental risks

- Areas where initial seeding and natural regeneration is not successful (i.e. has not achieved 50% of the desirable species cover on adjoining undisturbed areas within 24 months) will be reseeded with native groundcover species (or with dominant pasture species in existing pasture areas)
- Rehabilitation of lands will be negotiated with landholders where applicable. Unless infrastructure is to be retained for other use (roads), areas will be ripped and allowed to naturally revegetate. Hardened road surfaces will be removed or regraded to restore the original land surface as much as possible;
- Vehicle tracks will be minimised and defined on alignment sheets following the rehabilitation of the corridor post-construction;
- Where possible, native shrubs will be allowed to regenerate to reduce the barrier to fauna movement, especially for small ground-dwelling fauna; and
- Offsets will be established where impacts to native vegetation and fauna habitats are unavoidable. These areas will be managed with a strong conservation focus and aim to provide vital protection for flora and fauna in this region where other protected areas (Conservation Parks and National Parks) are absent. It is proposed that such areas will have conservation plans developed for them and active conservation management will be undertaken. This would include flora and fauna monitoring to assess the efficacy of conservation practices and to feedback into the development of improved future practices.

6.3 Environmental Offsets

As detailed in **Section 7.7** of **Annex 13.1**, an environmental offsets strategy is currently under development and will be implemented prior to the commencement of the Project. This strategy will be developed in accordance with:

- The requirements, in particular the eight principles, prescribed in the DEWHA's *Draft Policy Statement: Use of Environmental Offsets under the Environment Protection and Biodiversity Conservation Act 1999,* and
- The requirements of the Queensland Environmental Offsets Policy and any other specific-issue offset policies that may be applicable.

The offset strategy will identify the environmental offset activities which will be established to compensate for all ecological impacts (e.g. the disturbance of EPBC listed Ecological Communities, Fauna and Flora species, loss of vegetation and the fragmentation of EPBC listed fauna habitat and movement corridors) where clearing within areas of remnant vegetation is unavoidable.

These environmental offset activities will incorporate the following principles:

- Offsets should only be utilised in situations where impacts on environmental values are unavoidable.
- The offset must directly relate to the environmental value that will be impacted, often referred to as the "like for like" principle.
- The offset may be either direct or indirect actions. A direct action usually requires the on-ground maintenance and/or improvement of the protected matter. An indirect action, however, includes a wide range of actions that improve the knowledge and understanding of a protected matter in order to facilitate its conservation.

- The implementation of the offset must be timed to minimise the time lag between the impact and the delivery of the offset.
- Where possible the offset will be located in the vicinity of the impact.
- The offset must be legally secured
- Mechanisms will be put in place to ensure that the offset is enforceable, monitored and audited.

The QC LNG Offset Strategy will set out a process to identify landholders within offset priority areas. In the first instance, sites will be identified on the basis of their conservation values and similarity to those areas likely to be impacted ("like for like").

Where offset areas are established, management and monitoring plans will be developed in order to guide the strategic development of these areas, identifying key values, threats and the environmental management strategies required to achieve the appropriate conservation outcomes.

The environmental management of these areas will generally encompass:

- Fire management planning and activities (e.g. firebreak grading, fire mapping, fire response planning)
- Livestock exclusion (e.g. fencing)
- Weed control
- Feral animal control activities (e.g. fox and rabbit baiting), and
- Flora and fauna monitoring in order to assess implemented management strategies.

7 CONCLUSION

The proposed mitigation and rehabilitation measures will enable the pipeline corridors to be developed and operated without significant impact on any EPBC Act MNES.

8 REFERENCES

Australian Pipeline Industry Association (APIA), (2009) Environmental Code of Practice: Onshore Pipelines. Australian Pipeline Association Ltd. March 2009.

Ayers, D. and Wallace, G. 1997. Pipeline trenches: an under-utilised resource for finding fauna. Pp.349-357 in: Hale, P. and Lamb, D. (eds) *Conservation Outside Nature Reserves*. Centre for Conservation Biology, The University of Queensland, Brisbane.

Baker, J. Grigg, C.J, and Tyler, M. (1995). *A Field Guide to Australian Frogs*. Sydney, Surrey Beatty and Sons.

Best, R. A. (1998). The effect of introduced Buffel grass (*Cenchrus ciliaris* L., Poaceae) on the diversity and abundance of invertebrates in semi-arid central Australia. Darwin, NT Northern Territory University. Masters Thesis.

Botanic Gardens Trust (11/03/2009). PlantNET - The Plant Information Network System of Botanic Gardens Trust, Sydney, Australia (version [2.0.]). http://plantnet.rbgsyd.nsw.gov.au

Briggs, S. V. Seddon, J.A. and Doyle, S.J. (2007). 'Structures of bird communities in woodland remnants in central New South Wales, Australia.' *Australian Journal of Zoology* 55(1): 29-40.

Clarke, P. J. Latz, P.K and Albrecht D.E (2005). 'Long-term changes in semi-arid vegetation: Invasion of an exotic perennial grass has larger effects than rainfall variability.' *Journal of Vegetation Science* 16: 237-248.

Cogger, H. G. (2000). Reptiles and Amphibians of Australia, Reed Books.

Department of the Environment, Water, Heritage and the Arts (DEWHA). (2006). *EPBC Act Policy Statement 1.1 Significant Impact Guidelines- Matters of National Significance*, DEWHA, Canberra

Department of the Environment, Water, Heritage and the Arts (DEWHA). (2008ads). Commonwealth Listing Advice on Weeping Myall Woodlands. [Online] DEWHA, Canberra.

Department of the Environment, Water, Heritage and the Arts (DEWHA). (2009).Threatened Species under the Environmental Protection and Biodiversiy Conservation Act, DEWHA, Canberra, viewed 2 June 2009, http://www.environment.gov.au/biodiversity/threatened/species.html

Department of Natural Resources. 1999. Species Management Manual Volume 3. Environmental Management, Forest Resources. November 1999.

Department Natural Resources and Water (DNRW), (2006), Policy for Vegetation Management Offsets [Online], 20 November 2006.

Doody, J.S., West, P., Stapley, J., Welsh, M., Tucker, A., Guarino, E., Pauza, M., Bishop, N., Head, M.,Dennis, S., West, G., Pepper, A. and Jones, A. (2003). 'Fauna by-catch in pipeline trenches:conservation, animal ethics, and current practices in Australia'. *Australian Zoologist* 32:410-419.

Duncan, A., Baker, G.B and Montgomery, N. (1999). The Action Plan for Australian Bats. Biodiversity Group, Environment Australia, Canberra.

Ehmann, H. 1992. *Encyclopaedia of Australian Animals: Reptiles*, Collins, Angus and Robertson Pty Ltd, Sydney.

Environmental Protection Agency (EPA). (2007). Regional Ecosystem Description Database (REDD), (Database) [Online] Accessed: December 2008, Available: http://www.epa.qld.gov.au/nature_conservation/biodiversity/regional_ecosystems/

Environmental Protection Agency (EPA). (2008a). Brigalow Belt Biodiversity Planning Assessment. Version 1.3, September 2008.

Environmental Protection Agency (EPA). (2008b). Biodiversity Planning Assessment - Brigalow Belt South Flora Expert Panel Report. EPA, Environmental Planning South West District. June 2008.

Environmental Protection Agency (EPA). (2008c). Biodiversity Planning Assessment - Brigalow Belt South Fauna Expert Panel Report. EPA, Environmental Planning South West District. June 2008.

Environmental Protection Agency (EPA). (2008d). Queensland Murray-Darling 'Back on Track' Biodiversity Action Plan E. P. A. Threatened Species Unit. Brisbane, Qld.

Garnett, S.T. and Crowley, G.M. (2002). The Action Plan for Australian Birds. Environment Australia, Canberra.

Gentle, M. N. Saunders, J.R. and Dickman.C.R. (2007). 'Poisoning for production: how effective is fox baiting in south-eastern Australia?' *Mammal Review* 37: 177-190.

Gibbons, P. Lindenmayer, D. Barry, S and Tanton, M (2002) 'Hollow selection by vertebrate fauna in forests of southeastern Australia and implications for forest management', *Biological Conservation* 1: 1-12

Greenfield, B. (2007). SA Arid Lands Buffel grass management plan, DRAFT. Port Augusta, SA, SA Government.

Greer, A.E. (2005). Encyclopedia of Australian Reptiles. Australian Museum Online http://www.amonline.net.au/herpetology/research/encyclopedia.pdf

Kellerman. J, Rye. B and Thiele K (2006) 'Polianthion, a new genus of Rhamnaceae (Pomaderreae) from Western Australia and Queensland', *Australian Systematic Botany,* 19 (2) 169-181.

Lumsden, L. Bennet, A and Silins, J (2002) 'Location of roosts of the lesser long-eared bat Nyctophilus geoffroyi and Gould's wattled bat Chalinolobus gouldii in a fragmented landscape in south-eastern Australia' *Biological Conservation* 2: 237-249.

McKenzie, N.L. Burbidge, A.A. Baynes, A. R. Brereton, R.N. Dickman, C.R. Gordon, G. Gibson, L. A Menkhorst, P.W. Robinson, A.C. Williams, M.R. and Woinarski, J.C.Z (2007). "Analysis of factors implicated in the recent decline of Australia's mammal fauna." *Journal of Biogeography* 34(4): 597-611.

Menkhorst & Knight, (2004). *A Field Guide to the Mammals of Australia*. Second Edition, Oxford University Press, Melbourne.

Morcombe, M. (2003). *Field Guide to Australian Birds*, Second Edition. Steve Parish Publishing, Archerfield.

Munro, N. T, Lindenmayer, D. and Fischer, J. (2007). 'Faunal response to revegetation in agricultural areas of Australia: A review.' *Ecological Management & Restoration* 8(3): 199-207.

Neldner, V.J., Wilson, B. A., Thompson, E.J. and Dillewaard, H.A. (2005) 'Methodology for Survey and Mapping of Regional Ecosystems and Ecological Communities in Queensland'. Version 3.1. Updated Version date: 5 August 2005. September 2005. Queensland Herbarium, Environmental Protection Agency, Brisbane. 128 pp.

NLWRA 2001. 'Australian Native Vegetation Assessment 2001'. National Land and Water Resources Audit, Land and Water Australia, Canberra.

NLWRA 2002. 'Australian Terrestrial Biodiversity Assessment 2002'. National Land and Water Resources Audit, Land and Water Australia, Canberra.

Pennay, M. (2002). Vertebrate Fauna Survey, Analysis and Modelling Projects, NSW Western Regional Assessments, Brigalow Belt South. Stage 2. N. N. P. a. W. Service. Sydney, NSW, NSWPWS.

Priddel, D. Wheeler, R and Copley P (2007). 'Does the integrity or structure of mallee habitat influence the degree of Fox predation on Malleefowl (Leipoa ocellata)?' *Emu* 107(2): 100-107.

Reynolds, S.T. 1991. 'New species and changes in Sapindaceae from Queensland'. *Austrobaileya* 3(3): 492.

Robinson, M (1998) *A field guide to Frogs of Australia,* Reed New Holland, Sydney

Salo, P. Korpimaki, E. Banks, E. Nordstrom, M and Dickman, C. (2007). 'Alien predators are more dangerous than native predators to prey populations', *Proceedings of the Royal Society B-Biological Sciences* 274(1615): 1237-1243.

Stanley T. D. and Ross E. M. 1989. Flora of south-eastern Queensland, Volume 3. Queensland Herbarium, Department of Primary Industries, State of Queensland.

Strahan, R. (1995). *The Mammals of Australia,* Reed New Holland, Sydney.

Wilson, S. (2005). *A Field Guide to Reptiles of Queensland*. Reed New Holland, Sydney.

Wilson, S. and G. Swan (2003). *A Complete Guide to the Reptiles of Australia*. Sydney, Reed New-Holland.

Wilson, S.K. and Knowles, D.G. (1988). *Australia's Reptiles*. Cornstalk, Sydney.

Woinarski, J.C.Z., Armstrong, M., Brennan, K., Connors, G.T., Milne, D., McKenzie, G. and Edwards, K.(2000). 'A different fauna? Captures of vertebrates in a pipeline trench, compared with conventional survey techniques; and a consideration of mortality patterns in a pipeline trench'. *Australian Zoologist* 31:421-431