ANNEX 13.1 – CSG FIELD

STAND ALONE REPORT ON MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

Doc. No. QC LNG-00-N-RP02

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1.0 PURPOSE

This Annex considers the CSG Field Component of the Queensland Curtis LNG Project. An overview of the CSG Field Component is provided in **Volume 1, Chapter 7** of the EIS.

All EPBC Act MNES in the Coal Seam Gas (CSG) Field are flora or fauna related and this report provides specialist flora and fauna assessments of the CSG Field shown in **Figure A.1 [QC02-T-MA-0031]**. The CSG Field is located within the Surat Basin, a resource region in southern Queensland. The tenures are within the Dalby Regional Council and in the vicinity of Miles, Chinchilla, Condamine and Tara townships. The Condamine River bisects the tenure areas which are predominantly rural and used for grazing and dry land cropping. Rural residential blocks occur through central portions of the CSG Field, particularly in the vicinity of Tara.

The area is 468,700 ha and is located in the Surat Basin. The CSG Field extend from near Wandoan in the north to south-east of Tara in the south.

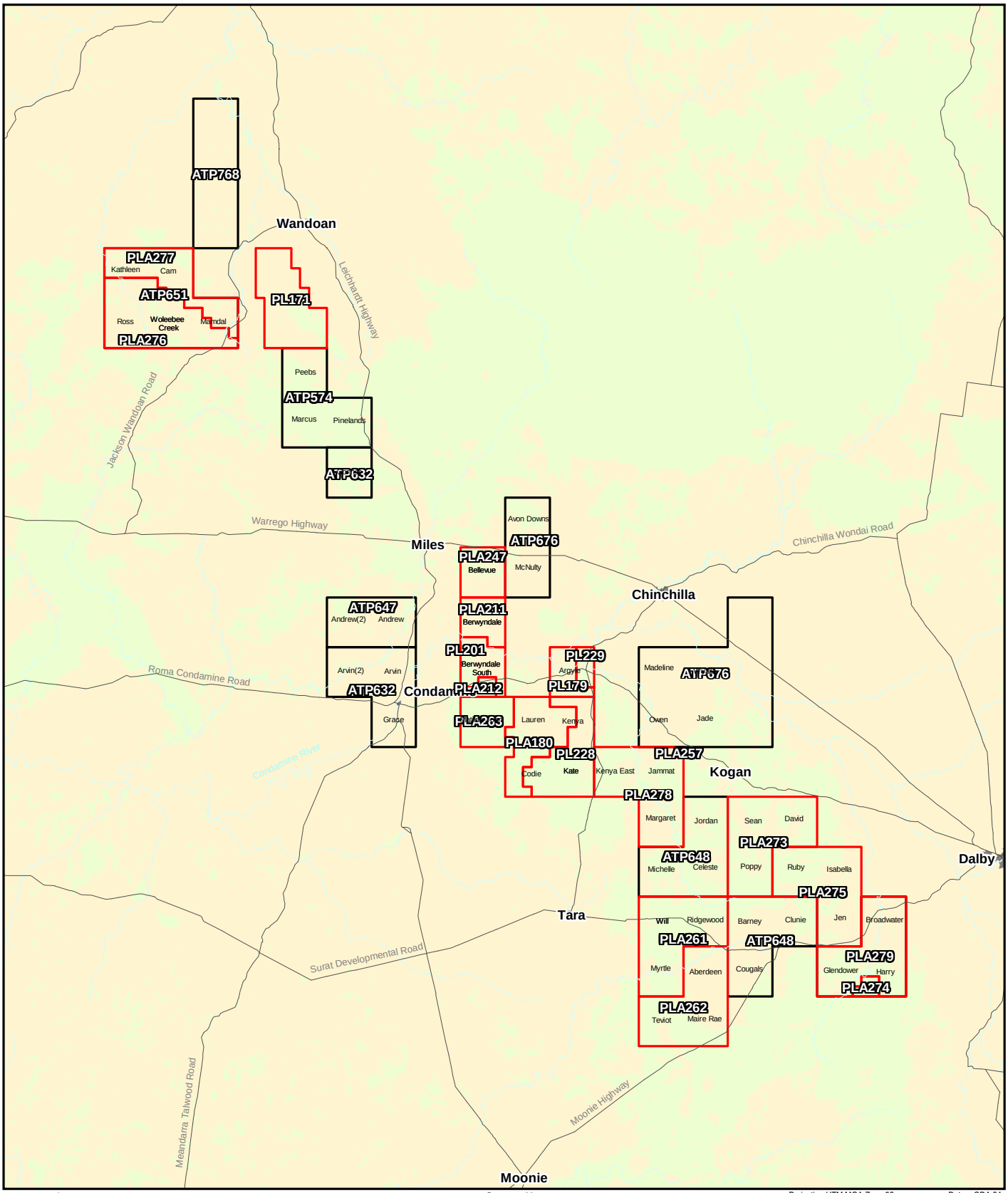
The flora and fauna studies considered publically available databases and published information on the project area as well as detailed field surveys undertaken throughout the CSG Field.

This report details the existing nature conservation values of the CSG Field 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.



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Project	Queensland Curtis LNG Project	Title	Gas Field - Overview
Client	QGC - A BG Group business		
Drawn	Mipela	Annex 13.1	Figure 13.1
Approved	CD	File No:	QC02-T-MA-00031
Date	17.07.09	Revision	A

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2.0 BACKGROUND

2.1 Existing Environmental Authority Conditions

Thirteen Petroleum Leases (PL) (including current applications) and four pipeline licences are held within the CSG Field acreage. These tenures are subject to one Project Environmental Authority under the *Environmental Protection Act 1994* (Qld) for activities in the Walloon Fairway area (excluding PL 201and PLA 180).

The environmental protection conditions stipulated in the EA that relate to vegetation management, riverine areas and Environmentally Sensitive Areas are shown in **Attachment 2** of **Appendix 3.2**. They include:

- Minimise disturbance to vegetation
- Minimising disturbances near riverine areas, watercourses and water bodies
- Minimise disturbance in or near category A or B Environmentally Sensitive Areas (ESAs)
- Not conducting any activities within category C ESAs without approval from the relevant administering authority
- Where no reasonable alternative exists, disturbance within (or within 500 m of) an endangered regional ecosystem must be located according to the following order of preference:

  a. Pre-existing disturbance areas within the 500 m buffer of the ESA

  b. >100 m from the ESA

  c. <100 m but outside the ESA

  d. Pre-existing disturbance areas within the ESA

  e. Areas within the ESA of lower environmental value

  f. Within the ESA but not to exceed 10 % of a polygon mapped as an endangered regional ecosystem (and all reasonable effort is made to minimise the area cleared and to avoid clearing mature trees).

- This unavoidable clearing within an endangered regional ecosystem (or within 500 m cannot be:

  g. >10 % of a polygon mapped as an endangered regional ecosystem

  h. >3,600 m^2 for the operational area of a drill site within an endangered regional ecosystem

  i. >30 m^2 for construction of a sump within an endangered regional ecosystem

  j. >6 m in width for tracks that are necessary within an endangered regional ecosystem

  k. >12 m in width for pipeline construction purposes that are necessary within an endangered regional ecosystem.

2.2 Existing QGC Environmental Clearance Procedures

The existing QGC field development activities are undertaken in accordance with the Level 1 EA for the petroleum activities on its CSG Field. The standardisation of environmental management across the CSG Field has progressed under a project Environmental Management Plan which details the potential impacts, environmental protection objectives and environmental mitigation measures/controls for petroleum activities to be undertaken (**Attachment 3** of **Appendix 3.2**). This has been prepared in consultation with the EPA to meet their regulatory requirements.

There are effectively two stages at which QGC currently ensures that future infrastructure locations avoid or minimises disturbance of EPBC listed communities). These are:

- macro-scale avoidance, where planning avoids known areas of EPBC Act Listed Ecological Communities through desktop reference to existing government Regional Ecosystem (RE) mapping, and
- micro-scale avoidance, where the site clearance procedure allows infrastructure to avoid or minimise disturbance of unmapped communities, as well as listed flora species, fauna habitat features and other environmental values and features of significance.

Initial desktop assessments identify the known locations of EPBC Act Listed Ecological Communities and this information is used in the planning phase for locating any infrastructure so as to avoid and minimise disturbance to these communities.

Once a generally desirable location for each proposed well (or other infrastructure) is identified, a significant amount of flexibility remains in relation to its precise location. The current QGC environmental clearance procedure (**Attachment 4** of **Appendix 3.2**) allows the environmental officer to relocate the proposed location by up to 50 m without need for consultation with the geologist. Where the environmental officer identifies a need to relocate a proposed well site by greater than 50 m, this is to be done in consultation with the QGC geologist. An identical and concurrent procedure is used by the cultural heritage monitors and construction engineers. The environmental clearance survey facilitates avoidance of unmapped communities and flora species as well as fauna habitat values and other environmental values and features. An example of a completed environmental clearance checklist is provided in **Attachment 5** of **Appendix 3.2**.

3.0 ASSUMPTIONS AND LIMITATIONS

The northern most tenements shown as EPP768 and PL171 in **Figure A.1 [QC02-T-MA-0031]** were included as part of the CSG Field after the fieldwork was completed. As such, the assessment of these areas was limited to a desktop assessment. Field assessment of these areas will be completed within the next few months and the results will be available for inclusion in the supplementary EIS.

Scale-dependant inaccuracies are found to occur within 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.

During the flora and fauna assessment, wherever possible at least one occurrence of each RE was visited and ground truthed. However, it was not possible to ground truth every RE occurrence in the CSG Field due to landholder access constraints. As such, the existing Queensland Herbarium RE mapping was used to estimate the areas of each RE type which occur within the CSG Field and the wider study area. Fauna habitat mapping has been derived from the same sources and is subject to similar assumptions and limitations.

Detailed flora and fauna assessments were carried out over as much of the CSG Field as possible, however a significant degree of extrapolation was required when applying these values to the whole of the CSG Field. When compiling the desktop assessment, a species was considered to occur in the area if it was recorded in database searches for the region and based on existing knowledge of the species' ecological requirements, suitable habitat was considered to occur in the area. When analysing field survey results, the extrapolation of fauna values was based upon the assumption that the habitat type in which a species was recorded, was also likely to support that species elsewhere. Both desktop and field surveys may therefore have over-estimated the distributional extent of some species. Thus a precautionary approach has been adopted throughout this assessment and such assumptions are explicitly stated in the relevant discussions.

Whilst parts of the CSG Field are cleared and likely to be suitable for locating some of the project's infrastructure the specific locations for wells, 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.

4.0 ASSESSMENT METHODOLOGY

4.1 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.'*

4.2 Flora Assessment

4.2.1 Determination of Significance Level

Threatened Ecological Communities

Threatened 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 CSG Field 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 Designation	EPBC Threatened 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	

Threatened Species

Threatened 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*
- Conservation dependent

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

4.2.2 Flora Desktop Assessment

The flora desktop assessment included:

- Review of Queensland Herbarium HERBRECS data, WildNet database and DEWHA Protected Matters flora data which was initially sourced 10 April 2008 and updated 8 December 2008. The data search area was rectangular, covering an area at least 10 km either side of the CSG Field (equating to the area -25.822778° S to -27.435833°S and 149.460278°E to 151.179722°E)
- Review of Queensland Herbarium RE mapping (Version 5.0, 2005) for a 10 km buffer around the CSG Field to establish those Ecological 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 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 Landscape 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.

A complete list of the EPBC Act Listed flora species that desk top studies identified as potentially occurring within and in the vicinity of the CSG Field is provided in **Attachment 8** of **Appendix 3.2**.

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.

4.2.3 Flora Field Assessment

Field surveys of the CSG Field were conducted between 17 July and 9 September 2008, and the 22 and 23 of January 2009, by Unidel Botanist, Ann Moran (CV provided in **Attachment 6** of **Appendix 3.2**). Representative portions of the CSG Field were traversed by vehicle and / or foot.

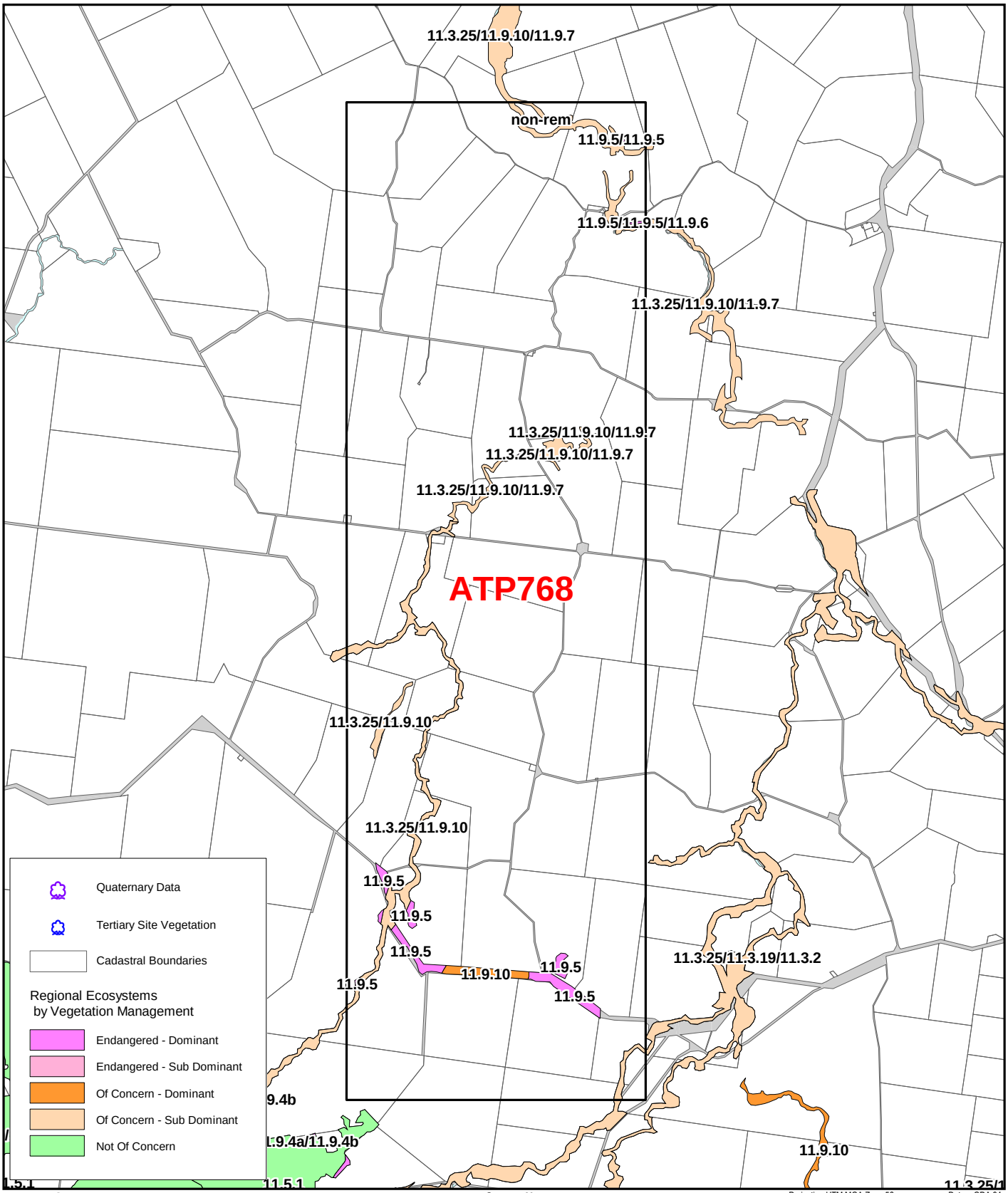
The field surveys included:

- 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 126 sites through the CSG Field. Of these, 45 sites were detailed Tertiary level assessments and the remainder were assessed to Quaternary level. Quaternary assessments recorded dominant canopy species, while Tertiary assessments recorded an inventory of all woody flora species, their average height and their approximate abundance (including native and exotic flora species). Where possible, at least one Tertiary survey site was located within each RE type present in the CSG Field. Landowner access constraints prohibited surveys within some RE types. Tertiary assessments also included targeted searches for potential EPBC Act Listed and regionally significant flora species. Comprehensive flora species lists and detailed abundance data were not collected or considered necessary for the purposes of this assessment, and
- Observations on the wider environment of the CSG Field so that the potential impacts associated with proposed activities could be considered in the local, regional and State contexts.

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 RE type
- 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.

Locations of Tertiary and Quaternary sites are shown in **Figures A.2-A.13**.



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Kilometres

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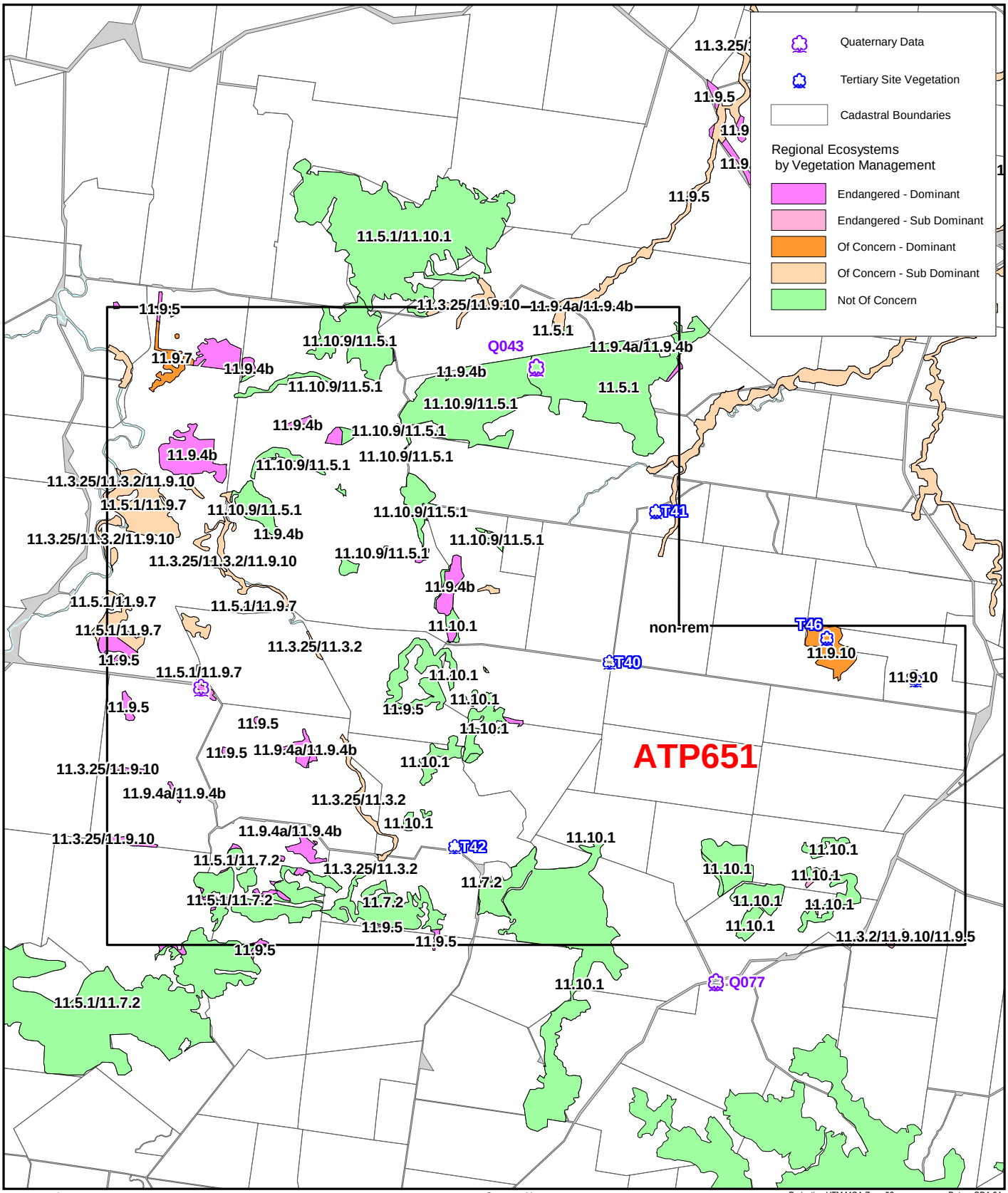

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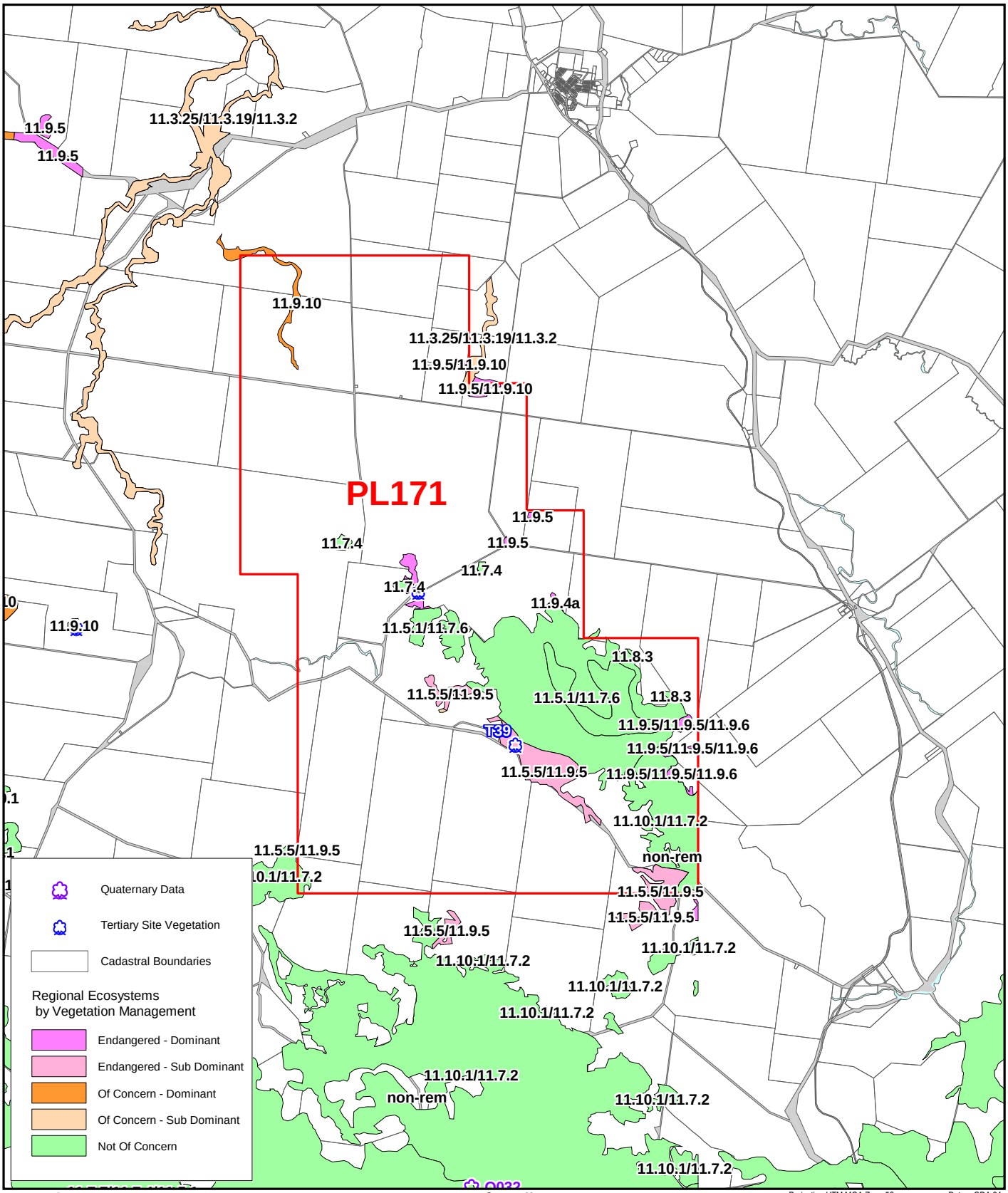

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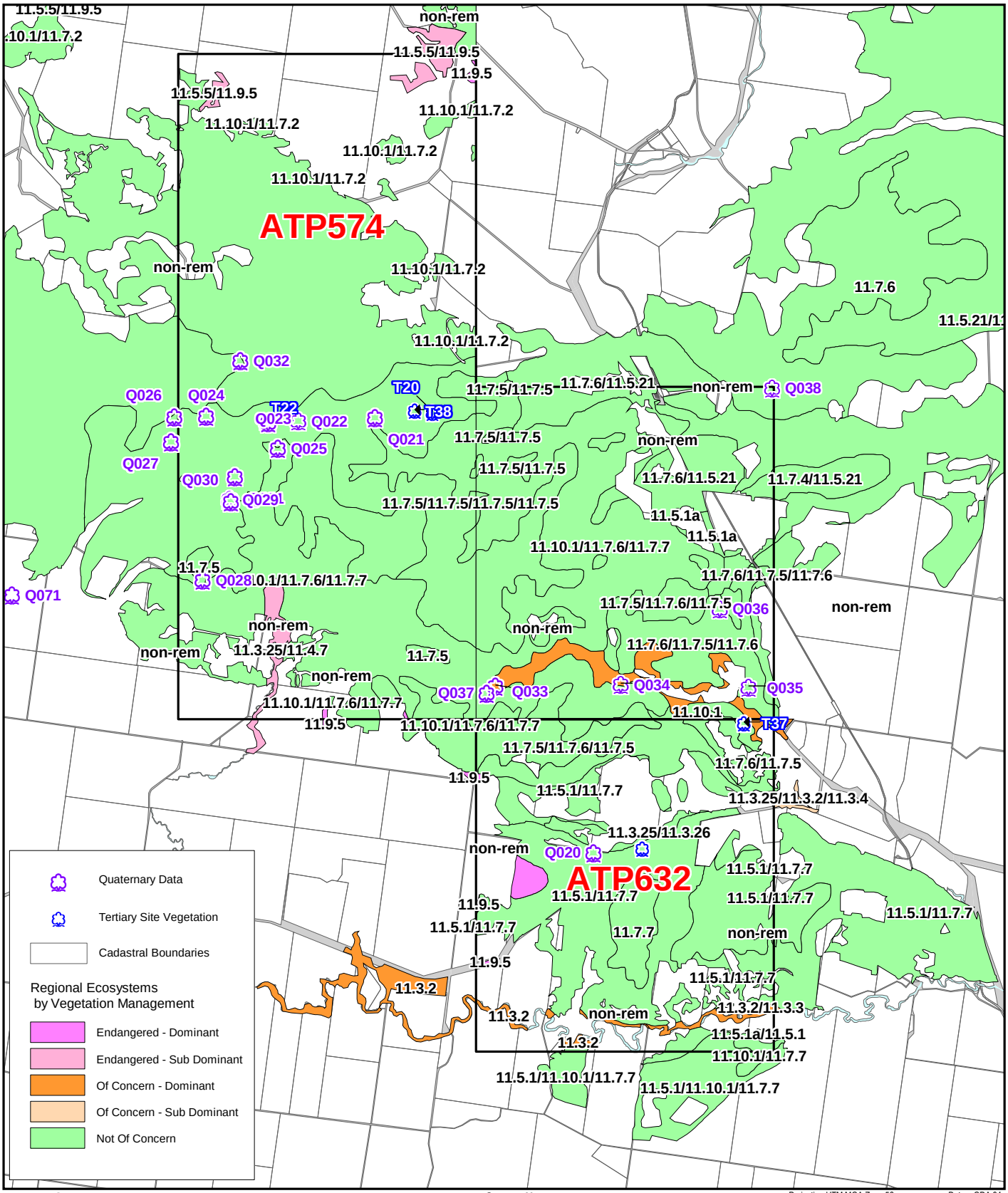

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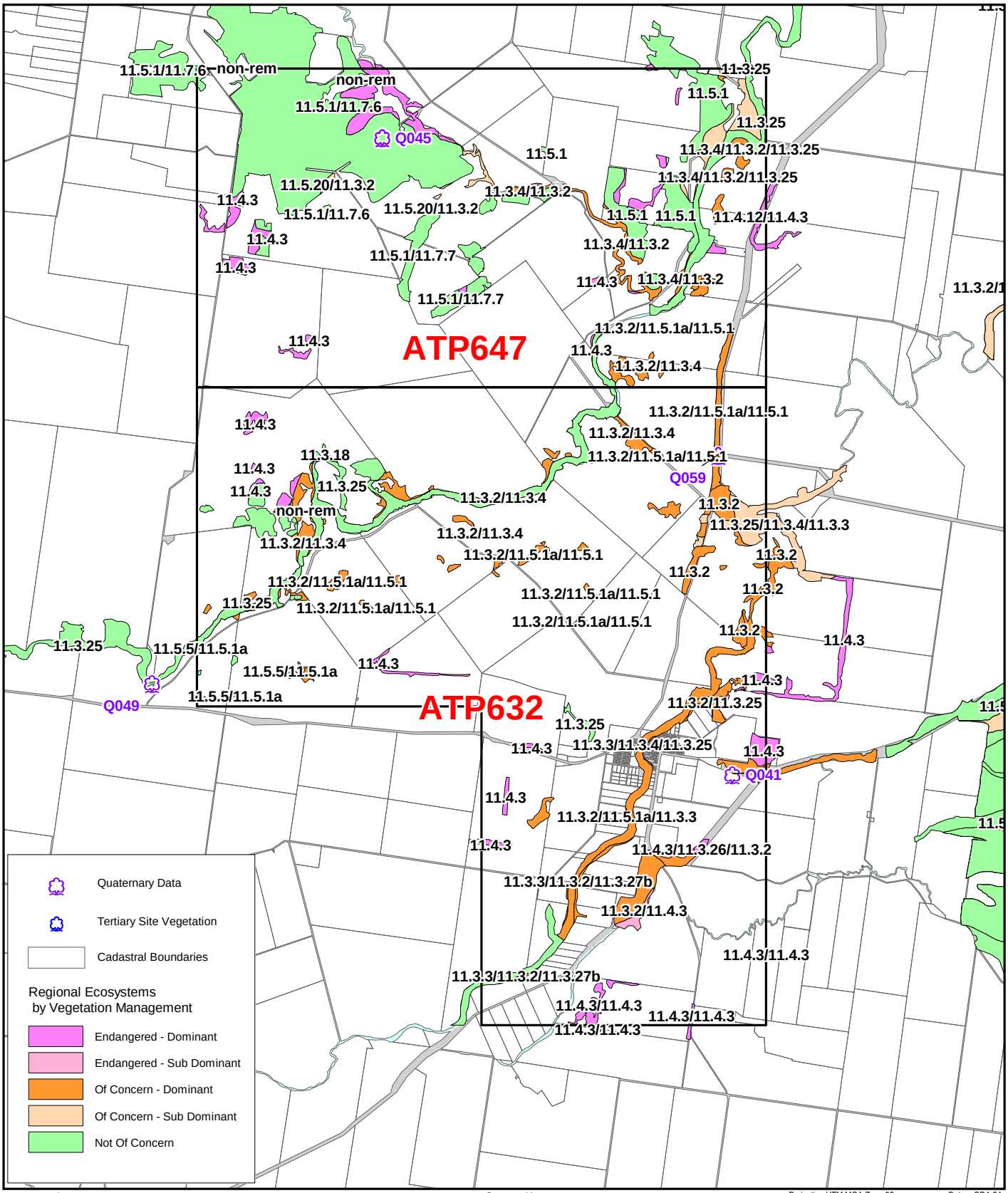

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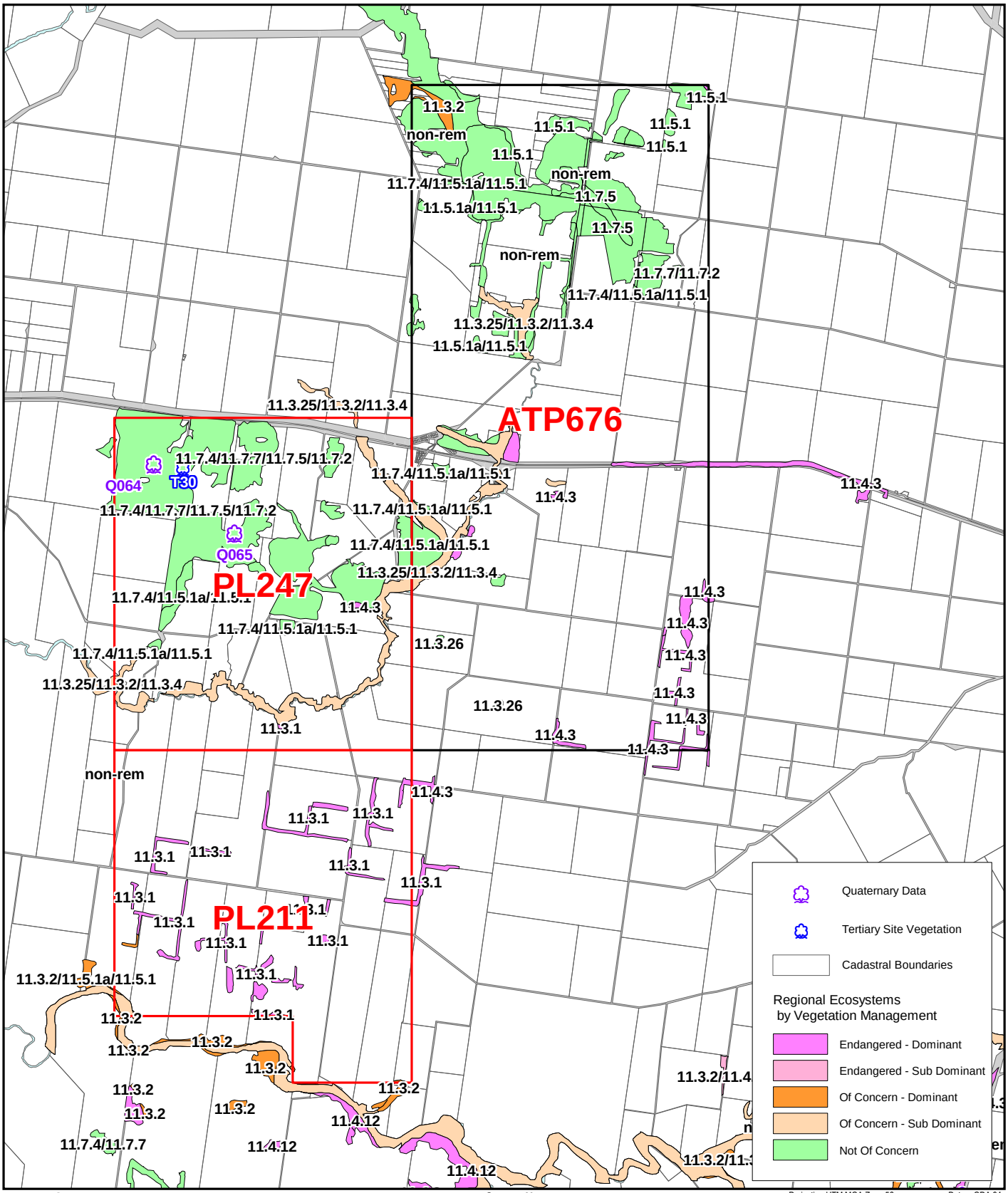

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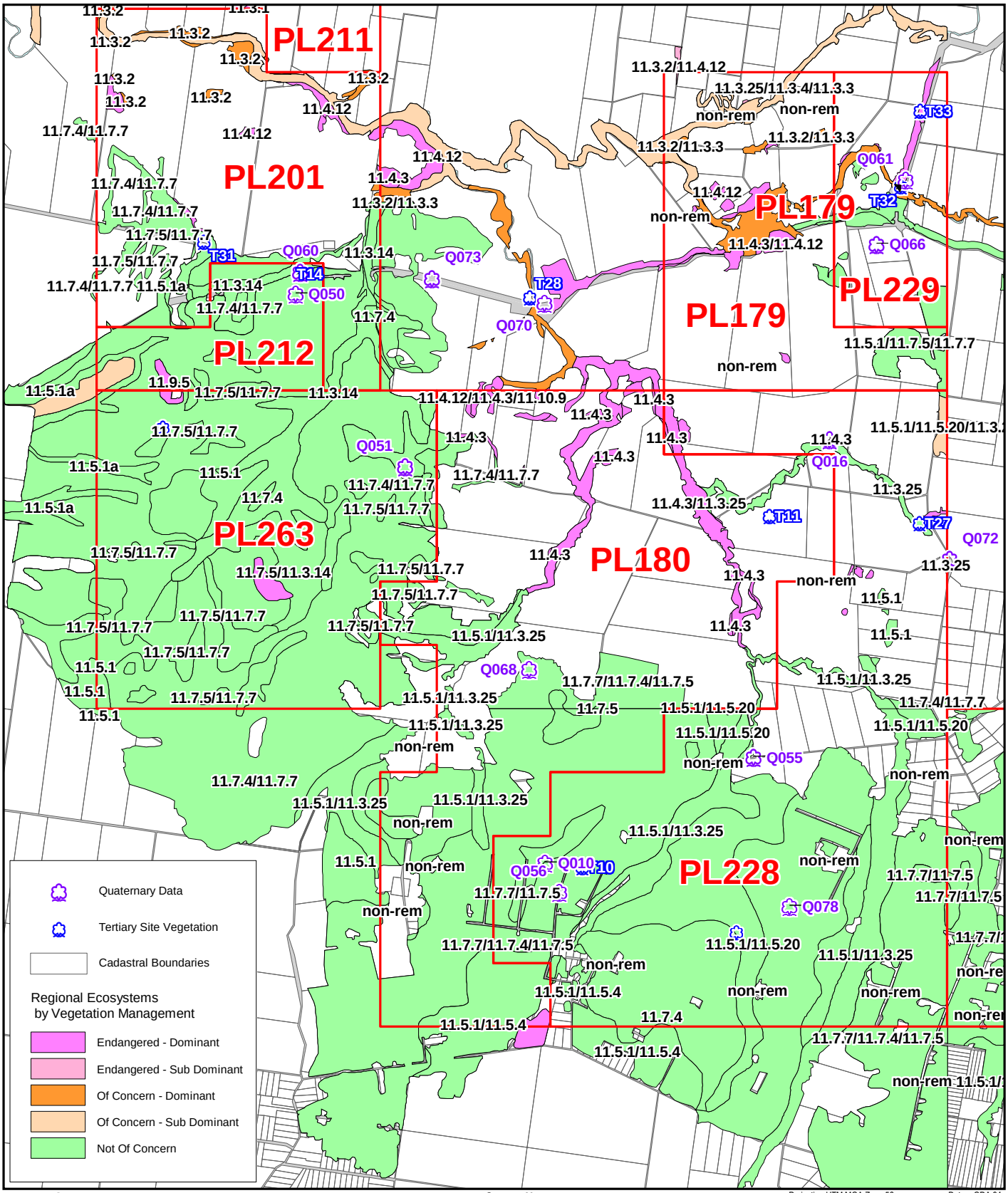

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Project	Queensland Curtis LNG Project	Title	Mapped RE's within Gas Fields - PL201, PL212, PL263, PL180, PL179, PL229 & PL228
Client	QGC - A BG Group business		
Drawn	Mipela	Annex 13.1	Figure 13.8
Approved	CDP	File No:	QC02-T-MA-00099
Date	17.07.09	Revision	A

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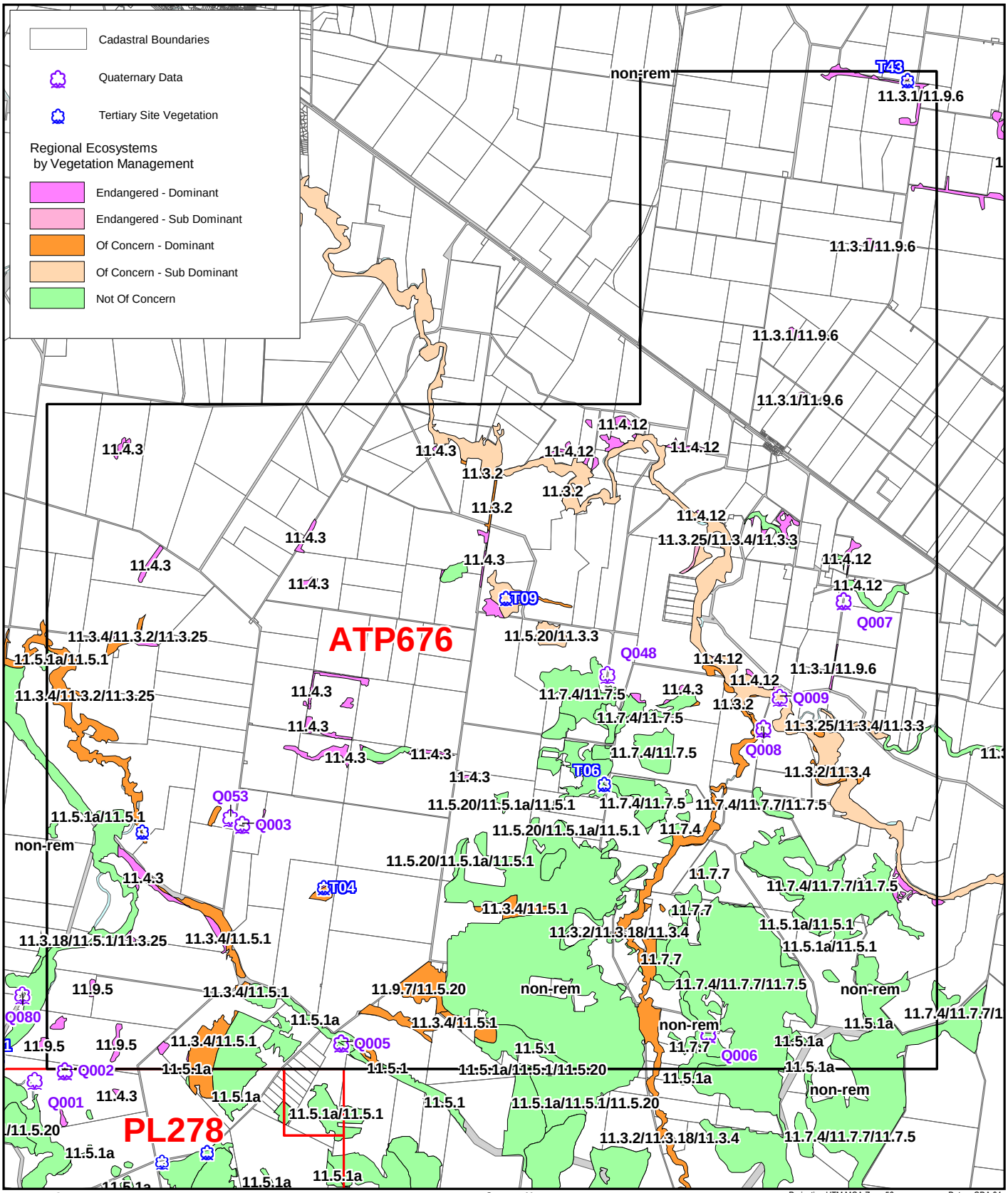

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QUEENSLAND CURTIS LNG A BG Group business	Project	Queensland Curtis LNG Project	Title Mapped RE's within Gas Fields - ATP676
	Client	QGC - A BG Group business	
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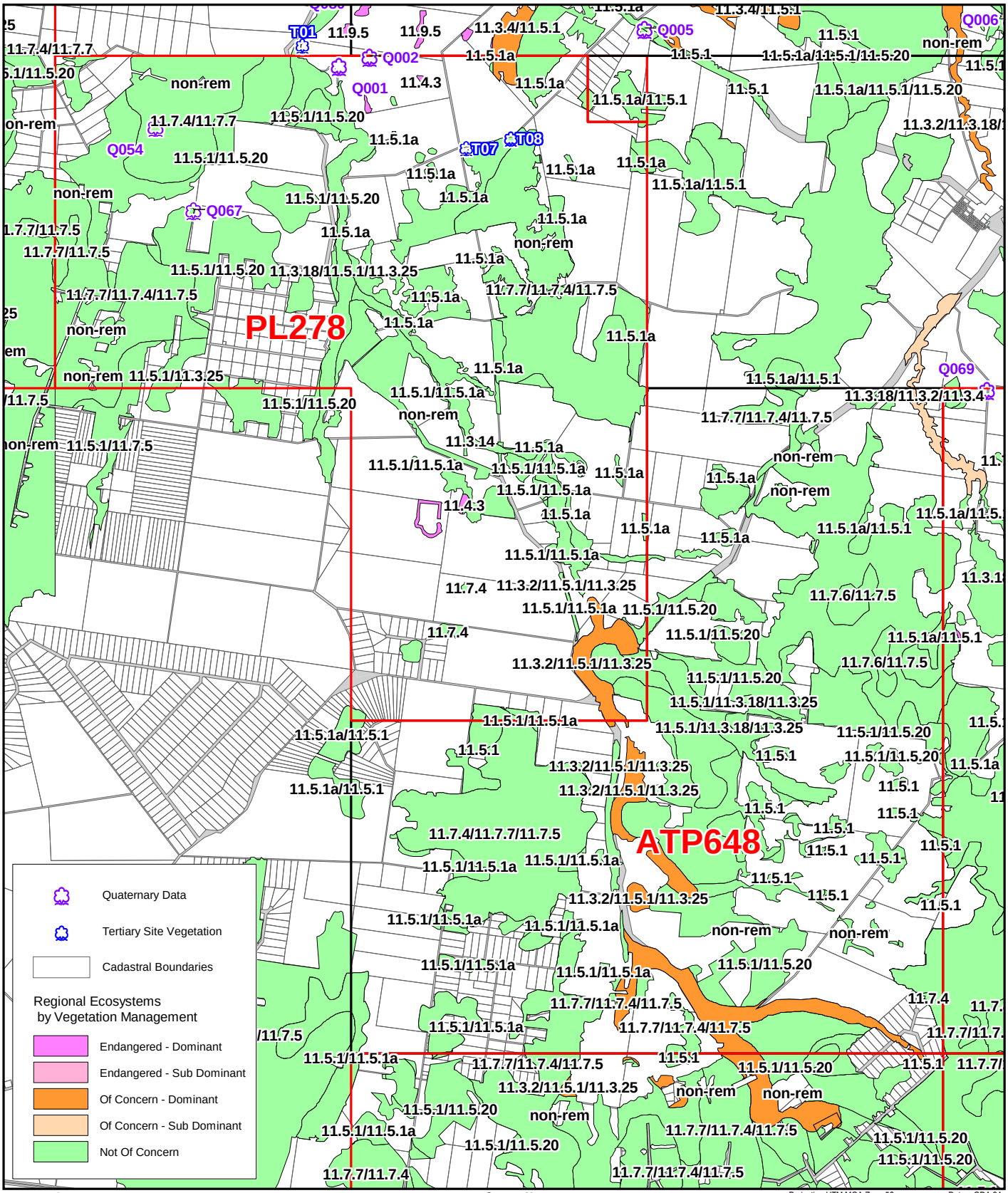

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Client	QGC - A BG Group business		
Drawn	Mipela	Annex 13.1	Figure 13.10
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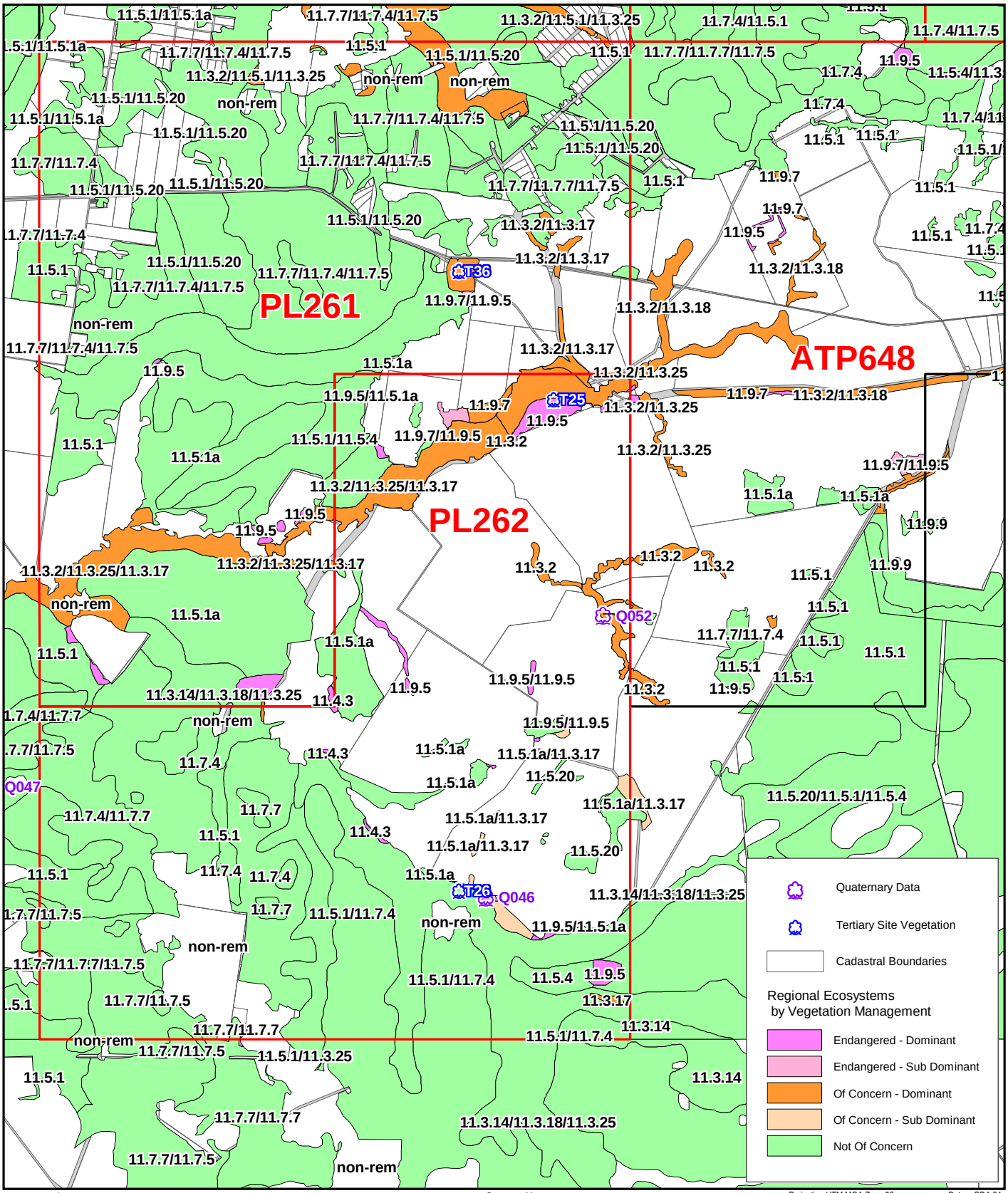

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	Client: QGC - A BG Group business		
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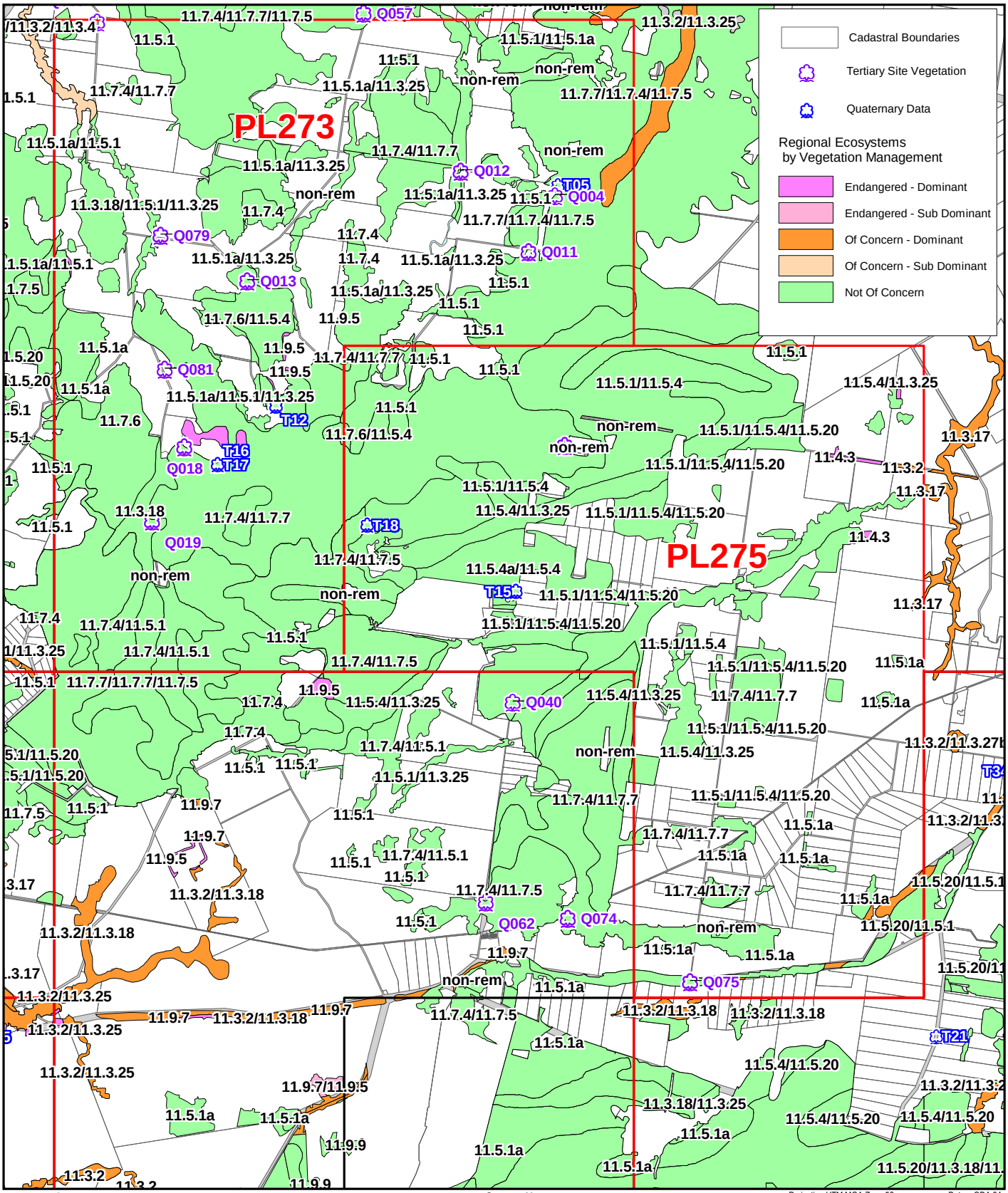

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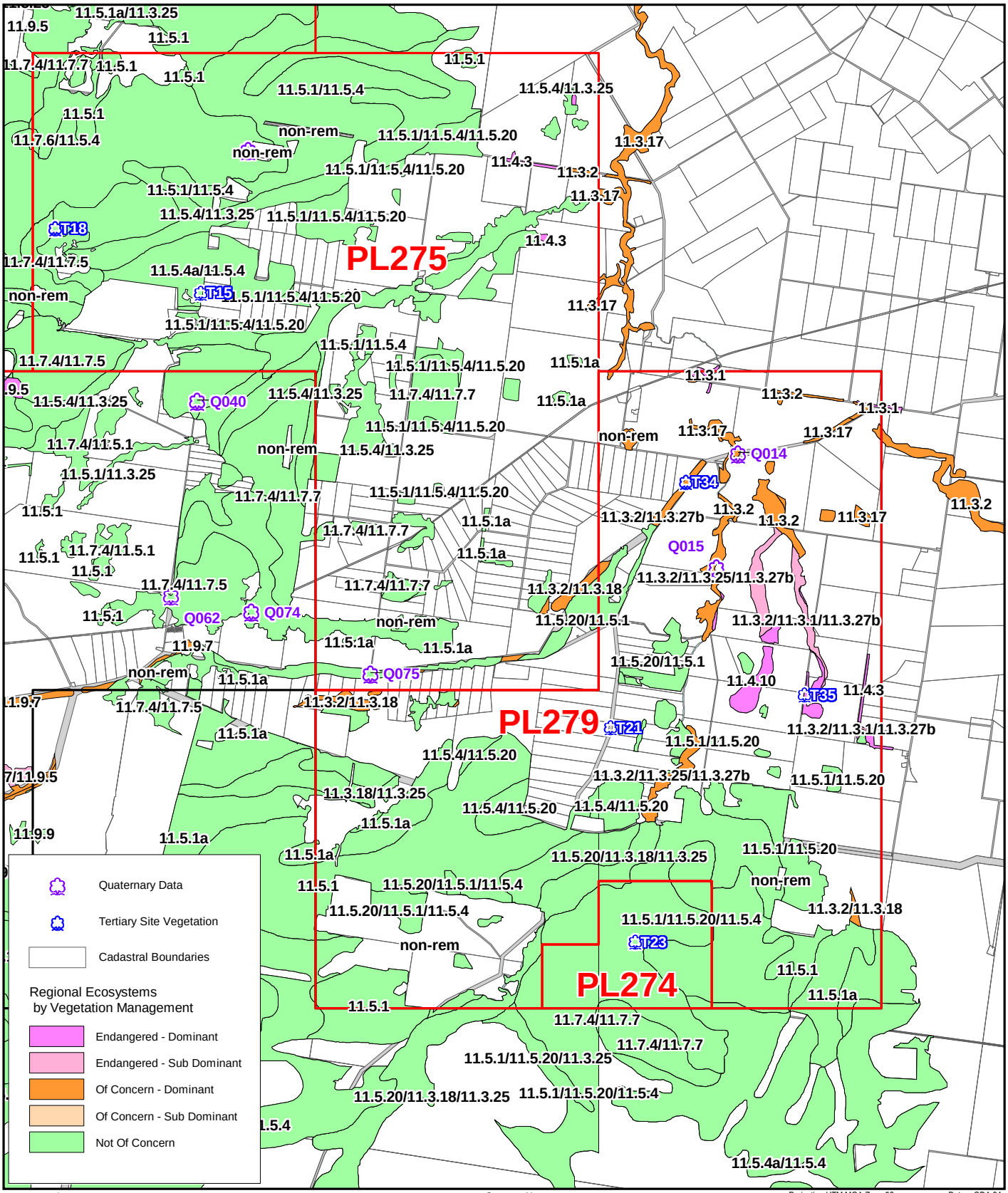

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GPS coordinates were taken using hand held GPS (accuracy +/- 10-20 m) to identify survey site locations and to assist in validating the existing Queensland Herbarium RE mapping. The general distributions of declared and other significant pest plants within the CSG Field were also noted.

4.3 Fauna Assessment

4.3.1 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 a matter of National Environmental Significance (NES) (DEWHA 2009a).

Threatened or non-listed Migratory and / or Marine species listed under international conventions or agreements that Commonwealth of Australia has ratified 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).

4.3.2 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 for the area - 25.8227° S to -27.435833 S and 149.4602° E to 151.1796° E
- Review of the Brigalow Belt 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: Baker *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).

4.3.3 Fauna Habitat Mapping

All REs identified as present within the project area were stratified into broad Faunal Habitats, based on the classification of Major Vegetation Groups and Subgroups identified by the National Vegetation Information System (NVIS) framework, developed for the National Land and Water Resources Audit (NLWRA 2001). Information used to categorise REs into Habitats was drawn from the RE descriptions (including landforms) in Sattler and Williams (1999) and in version five of the *Regional Ecosystem Description Database* (EPA 2007), along with data from the *Australian Terrestrial Biodiversity Assessment 2002* (NLWRA 2002).

4.3.4 Fauna Field Assessment

Initial rapid assessments to appraise fauna habitat were conducted in conjunction with the Quaternary flora assessments as described above. As for the flora, these surveys covered a range of landforms, land tenures and vegetation RE classifications.

Detailed fauna surveys were then carried out in the CSG Field from 27 October to 2 November, 12-18 November and 3-9 December 2008. In addition, surveys in other locations within the CSG Field were conducted during the week of the 24-28 October 2008.

The sites chosen for detailed fauna surveys were based on the analysis of the Quaternary assessments with the aim of surveying representative areas of intact native vegetation, since it was assumed that such areas would provide the best indication of fauna abundance and diversity. Similar criteria have been used to identify survey sites elsewhere (Pennay *et al*. 2002). Sites were also selected to minimize disturbance to livestock and property management activities, and also to reduce the likelihood of damage to survey equipment.

Three sites were selected for the detailed fauna survey. These were located in Braemar State Forest, Condamine State Forest and Gurulmundi State Forest near Miles. In addition to the quaternary assessments, rural lands were also further assessed by day surveys from the 24-28 October 2008.

Fauna surveys were conducted using pit fall traps, bat traps, ultrasonic bat recording, remote cameras, observational bird transects and night spotlighting. Details of this trapping/observation effort are summarized in **Table 2** below.

Pit fall traps consisted of pvc tubes of approximately 25 cm in diameter and 45 cm deep. Two pit falls were placed in each sampling site along a plastic fence line 10 to 12 m long.

Ultrasonic bat recording was undertaken using a time expanded recording system from Binary Acoustic Technology (http://binaryacoustictech.com/) and was used as an adjunct to bat trapping with 3 bank harp traps supplied by FaunaTech (PO Box 1655, Bairnsdale, Victoria 3875).

Remote cameras were small Sony S600 digital cameras, activated by PIR sensors. The cameras were set to automatic and recorded fauna 24hrs a day.

Playback of Powerful Owl and Barking Owl calls was used during spotlight surveys in order to enhance detection of these species.

Fauna surveys were carried out under Ethics Approval CA 2008/08/294 and EPA Scientific Purposes Permit WISP05501608.

Table 2: Trapping/observation effort

Trapping/Observational Technique	Number of Traps/Observations per day	Total Trapping/Observational effort
Pit fall traps	16	288 pit fall days
Bat traps	3	63 bat trap nights
Bird transects	4 hrs	280 hrs
Spotlighting	2 hrs	42 hrs
Ultrasonic bat recording	0.5 hr	10.5 hrs
Camera Traps	6	216 trap days*

*Camera traps were set for a period longer than the duration of the main survey period.

4.4 Mapping of Environmentally Sensitive Areas

In order to evaluate the conservation significance of areas in the CSG Field the following data were overlaid using GIS layers:

- BAMM methodology (the GIS product referred to as a Bioregional Planning Assessment)
- EPA's Environmentally Sensitive Areas
- Threatened Species and Ecological Communities (EPBC Act)
- Endangered REs (VM Act) (incorporated within BAMM Methodology)
- Of Concern REs (VM Act)
- Woodlands fringing drainage lines (RE 11.3.25)
- Wetlands (RE 11.3.27).

Numerical values were assigned to the criteria in order to allow the summation of an overall score (**Table 3**). In some cases where several BAMM criteria evaluated a number of co-dependant attributes, only one of these was used in the analysis in order to prevent double or triple scoring of essentially the same attribute. In the case of threatened species status, both Commonwealth and State values were used,

since they are appraised through separate processes and thus may differ markedly. A table of attributes and the values used in the analysis is presented below.

The mapping derived from this process was used to identify Environmentally Sensitive Areas and formed the basis for the development of the constraints mapping presented in **Section 7**.

Table 3 Attributes and values used in the assessment of Environmentally Sensitive Areas

Attribute	Category	Value	Comments
EPA's Environmentally Sensitive Areas Mapping	A	2	
	B	1	
Threatened Ecological Communities		2	Identified through RE mapping units.
Threatened Species (EPBC Act)	Extinct	0	Extrapolated to the underlying RE polygon.
	Extinct in the wild	0	
	Crit. Endangered	4	
	Endangered	4	
	Vulnerable	3	
	Cons. Depend.	1	
	Not listed	0	
EPBC Act Listed Taxa (NC Act)	Extinct	0	
	Endangered	4	
	Vulnerable	4	
	Rare	1	
	Common	0	
BAMM Crit.A Habitat for EPBC Act Listed Taxa		4	
BAMM Crit.B Ecosystem Value (State)	Endangered	3	
	Of Concern	2	
	Not of concern	1	
	Non-remnant	0	
BAMM Crit.C Tract Size	Very High	4	
	High	3	
	Medium	2	
	Low	1	
	0	0	
BAMM Crit.D Rel. Size of RE (State)	Very High	4	
	High	3	
	Medium	2	
	Low	1	

BAMM Crit.E Condition		-	Not used.
BAMM Crit.F Ecosystem Diversity	Very High	4	
	High	3	
	Medium	2	
	Low	1	
BAMM Crit.G Context & Connection	Very High	4	
	High	3	
	Medium	2	
	Low	1	
	0	0	
BAMM Crit.H Habitat for Priority Taxa		2	Extrapolated to the underlying RE polygon.
BAMM Crit.I Special Biodiversity Values		2	
BAMM Crit.J Corridors		-	Represented in the values by Crit. C and G.
BAMM Crit.K Threatening Processes		-	Not used.

5.0 EXISTING ENVIRONMENT

5.1 Floral environment

The CSG Field encompasses vegetated and cleared grazing lands, cropping lands, roadside and travelling stock reserves, Council lands, State Forests and Resource Reserves.

Based on the Queensland Herbarium RE mapping, approximately 297,445 ha of the total 468,700 ha CSG Field area is cleared. The remnant vegetation in the CSG Field equates to 171,255 ha and consists of approximately:

- 149,414 ha of Eucalypt woodlands
- 975 ha of Acacia woodlands
- 3,617 ha of Brigalow / Belah woodland
- 621 ha of Semi-evergreen Vine Thicket
- 6,693 ha of riparian Eucalypt woodland
- 9,824 ha of shrubland on scalds, and
- 111 ha of wetlands.

Table 4 indicates the EPBC-listed communities that were identified in the CSG Field, the sites where field assessments were carried out and an estimate of the extent of these communities within a 200km x 200km region of the CSG Field and within the overall Bioregion.

The Tertiary flora assessment data sheets are included in **Attachment 7** of **Appendix 3.2**. A complete flora list for the CSG Field is provided in **Attachment 9** of **Appendix 3.2**.

Table 4 Threatened Ecological Communities within the CSG Field

Ecological Communities / RE		Status (EPBC)	Area within CSG Field (ha)	Sites	Area within 200*200km sq (ha)	% within 200*200km sq	Area within Bioregion (ha)	% within Bioregion
RE	Description							
RE 11.3.1	*Acacia harpophylla* and / or *Casuarina cristata* open forest on alluvial plains	E	461	T8,T9,T11,T25,T26	3,668	12.6	77,207	0.6
RE 11.3.2	*Eucalyptus populnea* woodland on alluvial plains	E (in part)	4,322	T3,T13, T28,Q19, Q49,Q70,Q73,Q82, Q85	32,494	13.26	3,141,616	0.1
RE 11.4.3	*Acacia harpophylla* and/or *Casuarina cristata* shrubby open forest on Cainozoic clay plains	E	1,570	T33, T43, Q2, Q3, Q16, Q41	28,822	5.4	76,888	2.0
RE 11.4.7	Open forest to woodland of *Eucalyptus populnea* with *Acacia harpophylla* and/or *Casuarina cristata* on Cainozoic clay plains	E	11	Not accessible	3,576	0.3	20,847	0.1
RE 11.4.10	*Eucalyptus populnea* or *E. pilligaensis*, *Acacia harpophylla*, *Casuarina cristata* open forest to woodland on margins of Cainozoic clay plains	E	193	T35	955	20.16	44,249	0.4
RE 11.8.3	Semi-evergreen vine thicket on Cainozoic igneous rocks. Steep hillsides	E	8	Not accessible **	526	1.5	26,482	0.0
RE 11.9.4	Semi-evergreen vine thicket or *Acacia harpophylla* with a semi-evergreen vine thicket understorey on fine grained sedimentary rocks	E	613	T44, Q18	5,127	12.0	56,888	1.1
RE 11.9.5	*Acacia harpophylla* and/or *Casuarina cristata* open forest on fine-grained sedimentary rocks	E	1,175	T17, T39, T45, Q1, Q37, Q42	15,205	7.7	145,844	0.8
RE	*Acacia melvillei* ± *A.*	E	9	Not accessible **	279	3.1	378	2.3

Ecological Communities / RE		Status (EPBC)	Area within CSG Field (ha)	Sites	Area within 200*200km sq (ha)	% within 200*200km sq	Area within Bioregion (ha)	% within Bioregion
RE	Description							
11.9.6	*harpophylla* open forest on fine-grained sedimentary rocks							

* E = Endangered ** Not accessible and recommended “Very High Constraint” areas based on values and sensitivities.

5.1.1 EPBC Act Listed Ecological Communities

The CSG Field is known to contain two EPBC Act Listed Ecological Communities listed as Endangered under the EPBC Act (**Table 4**). These are represented by eight Queensland Regional Ecosystems, namely:

- Brigalow woodland / open forest communities –, REs 11.3.1, 11.4.3, 11.4.7, 11.4.10, 11.9.5, and 11.9.6, and
- Semi-evergreen vine thicket communities –RE 11.8.3 and 11.9.4.

The six Brigalow communities occur on fertile soil areas within areas predominantly cleared of remnant vegetation throughout the CSG Field. The Brigalow remnants are almost always small and narrow fragments which have been left along fencelines, creeks and roadsides. Two slightly larger patches occur in north-western areas of the CSG Field in Cherwondah State Forest (i.e., PL171; **Figure A.14 [QC02-T-MA-0032]**). The small patches were generally found to be degraded due to edge effects including weed invasion and fire damage Small patches of Brigalow, of relatively high quality were observed in Braemar and Condamine State Forests.

According to Queensland Herbarium mapping the REs 11.4.3 and 11.9.6 have an area within the CSG Field that equates to at least 2% of that type of RE found within the Bioregion.

Field surveys verified the occurrence of a mapped RE 11.4.3 remnant (T33). It was found to be in a degraded condition due to edge effects such as weed invasion. The total area of RE 11.4.3 found within the CSG Field is approximately 1,570ha. This equates to approximately 2% of this type of RE found within the Bioregion.

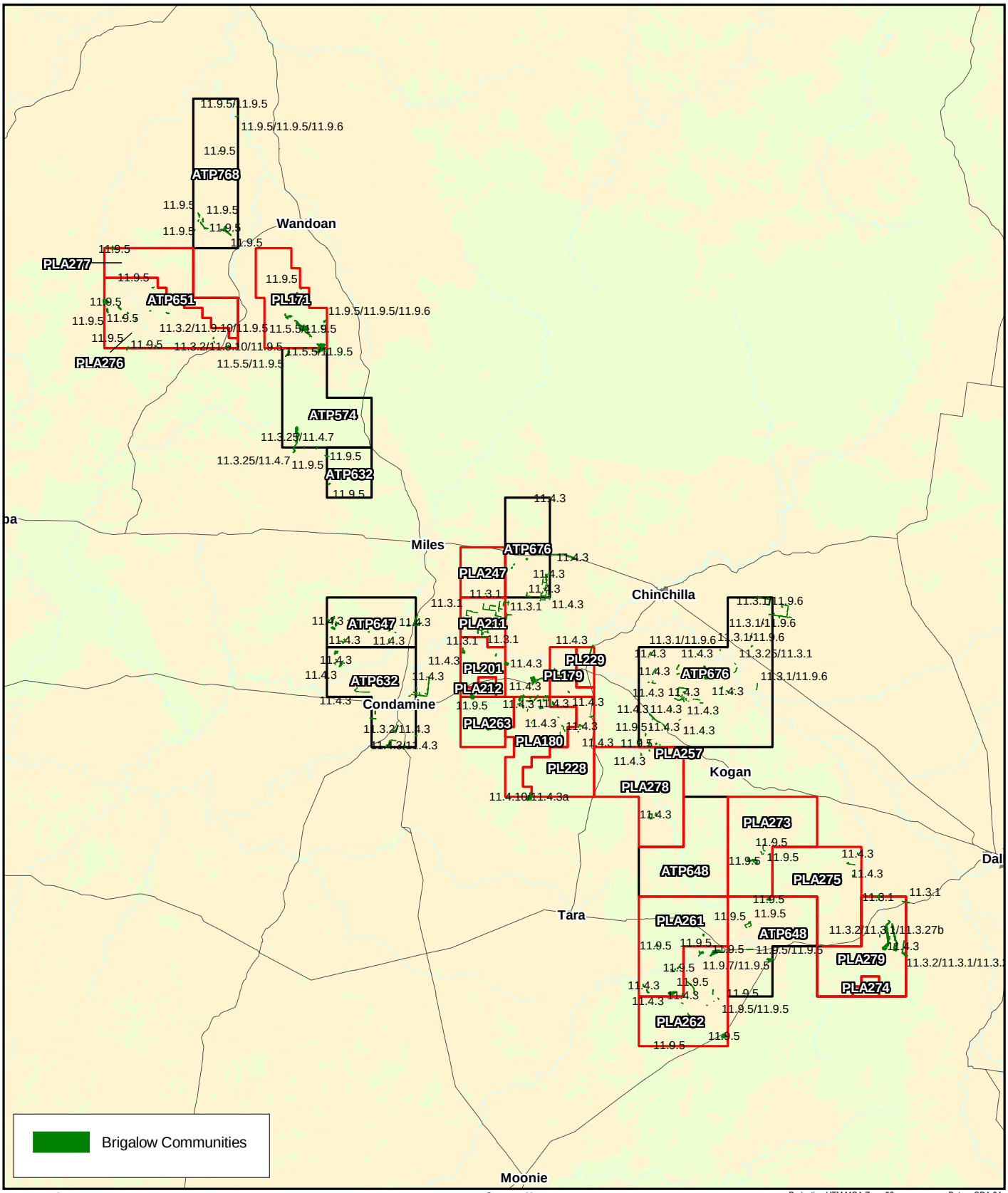
The total area of RE 11.9.6 located within the CSG Field is mapped as approximately 9 ha which equates to 2.2% of this type of RE found within the Bioregion.

According to existing maps the areas of REs 11.3.1, 11.4.1, 11.4.7, 11.4.10, 11.9.5 found within the CSG Field equate to less than 1% of that which occurs in the Bioregion. With the exception of RE 11.4.7, the presence of these REs were verified during the field surveys (T8, T9, T11, T17, T25, T26, T35, T39, T45). The condition of these areas was found to vary from degraded to very good. Two sites deemed to be in very good condition were roadside remnants of RE 11.3.1 (T25 and T26). These remnants contained low numbers of weed species. Two remnants of RE 11.9.5 (T39 and T45) were surveyed and found to be degraded due to past land practices such as grazing and logging.

The SEVT communities occur on deep red soils with clay subsoil and are confined to the northern part of the CSG Field. The SEVT remnants are typically small fragmented patches, although two larger ones occur in the northwest as illustrated in **Figure A.15 [QC02-T-MA-0033]**. The small patches are degraded by edge effects including weed invasion and fire damage.

Due to access constraints no areas of the RE 11.8.3 (8 ha in total) were assessed during the field surveys. In this case the Herbarium mapping is assumed to be correct. The area of RE 11.8.3 mapped as occurring with the CSG Field is estimated to be 1.1% of that which occurs within the Bioregion.

Field surveys of a mapped remnant of RE 11.9.4 found the area to be highly degraded due to habitat fragmentation and the presence of environmental weeds



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Kilometres

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Project	Queensland Curtis LNG Project	Title	Brigalow Woodland / Open Forest Communities
Client	QGC - A BG Group business		
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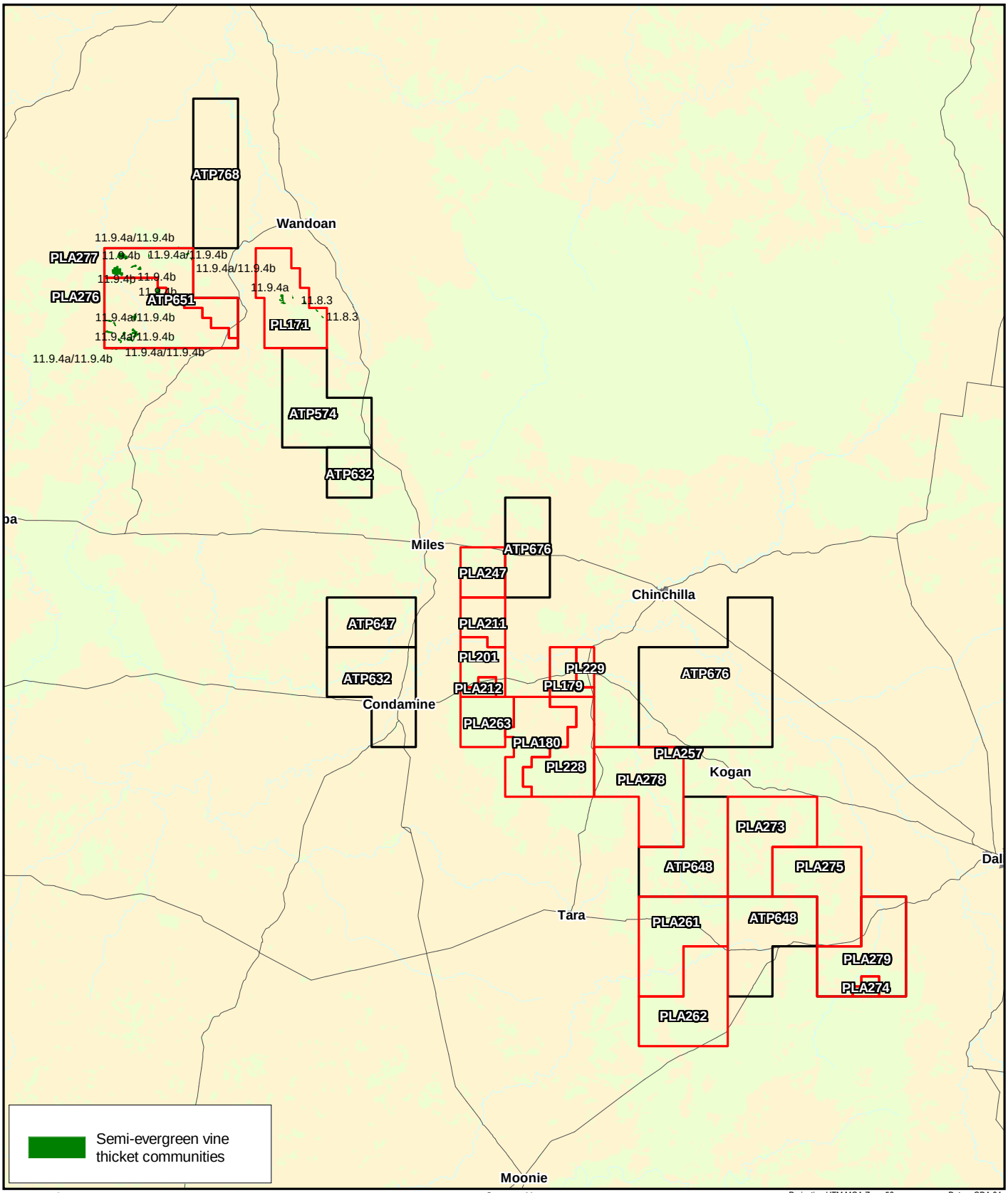

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Project	Queensland Curtis LNG Project	Title	Semi-evergreen Vine Thicket Communities
Client	QGC - A BG Group business		
Drawn	Mipela	Annex 13.1	Figure 13.15
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such as Buffel Grass (*Cenchrus ciliaris*). The total area of RE 11.9.4 estimated within the CSG Field is approximately 613 ha. This equates to approximately 1.1% of this type of RE found within the Bioregion.

An additional Threatened Ecological Community which may occur within the CSG Field 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 by DEWHA (2008ads) 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 within the CSG Field.

Other EPBC Act Listed communities identified as potentially present by the EPBC database includes Endangered Bluegrass (*Dichanthium* spp.) dominant grasslands of the Brigalow Belt Bioregion (North and South). The existing Queensland Herbarium RE mapping indicates that no remnant of this Ecological Community occurs within the CSG Field. Likewise, the field survey did not locate this community in the CSG Field.

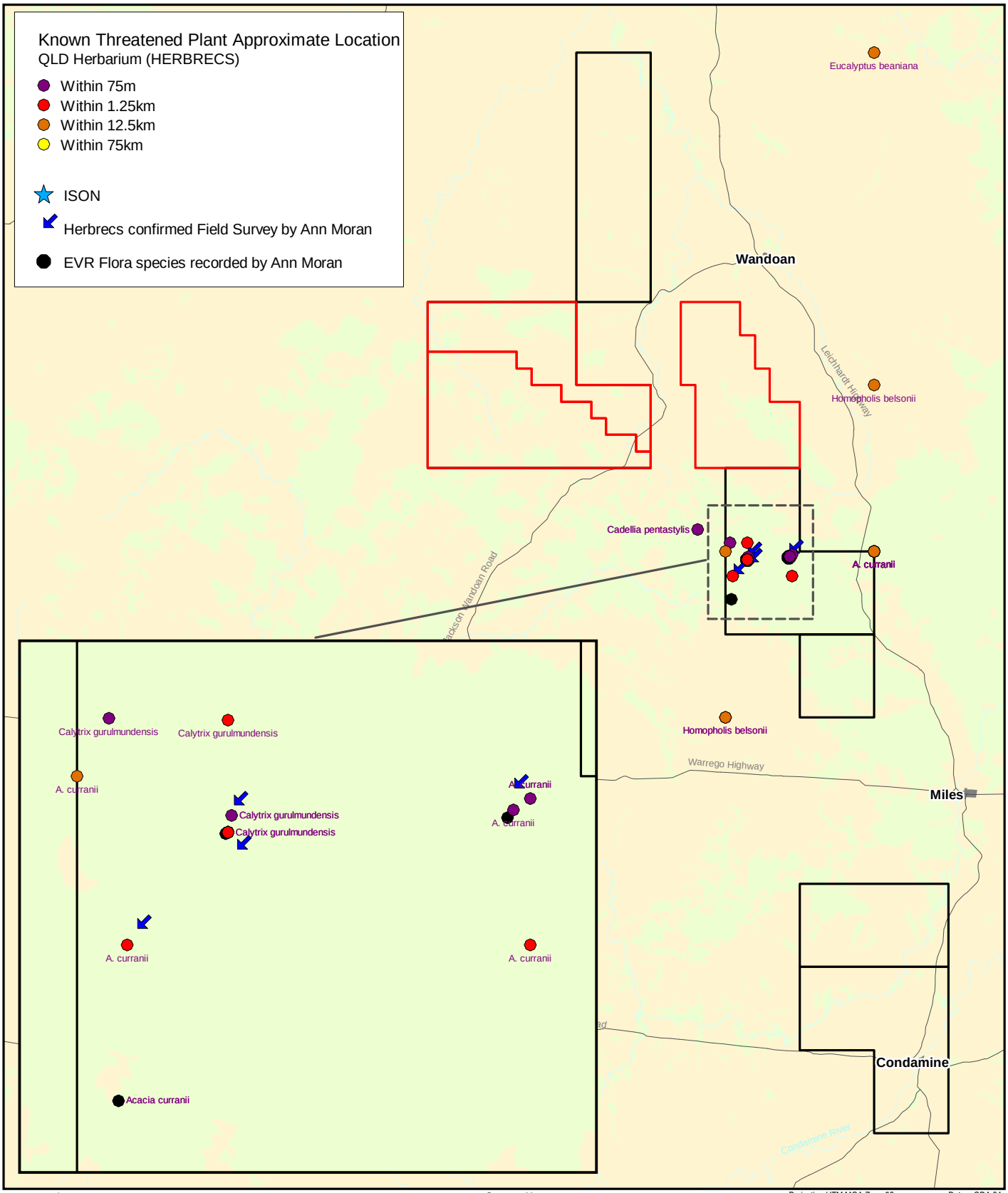
The proportion of each of the Brigalow and SEVT REs which occur within the CSG Field is less than 13% of that found in a 200 km x 200 km area centred on the CSG Field and less than 2.4% of that found in the Bioregion. An exception to this is RE 11.4.10 for which the area contained in the CSG Field represents approximately 20% of that which occurs in the broader 200 km x 200 km buffer and 0.4% of that which occurs in the Bioregion.

5.1.2 EPBC Act Listed Flora Species

Review of the Queensland Herbarium HERBRECS, WildNet and the EPBC Act Protected Matters databases, for the study area identified 24 species listed under the provisions of the EPBC Act, including 3 Endangered, and 21 Vulnerable. The CSG Field contains the preferred habitat of 14 of these species (**Table 5**).

These species and their preferred habitats were targeted during the field survey work.

The known locations of EPBC Act Listed flora are presented in **Figures A.16-A.17** Note that as it is not possible to undertake detailed flora surveys for the entire CSG Field, and therefore EPBC Act Listed flora species will be found in many additional locations to those shown in **Figures A.16-A.17.** EPBC Act Listed flora species occur in a range of RE habitat types. Of particular note is the high incidence of EPBC Act Listed flora occurring in remnant vegetation on gravelly hilltops (i.e. Landzone 7) (**Figure A.18 [QC02-T-MA-0003]**).



Legend:

Gas Fields - Petroleum Lease/Petroleum Lease Application

Gas Fields - Authority to Prospect

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Projection UTM MGA Zone 56 Datum GDA 94

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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 1 of 2
ERM Environmental Resources Management Australia Pty Ltd	Drawn Mipela	Annex 13.1 Figure 13.16	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.
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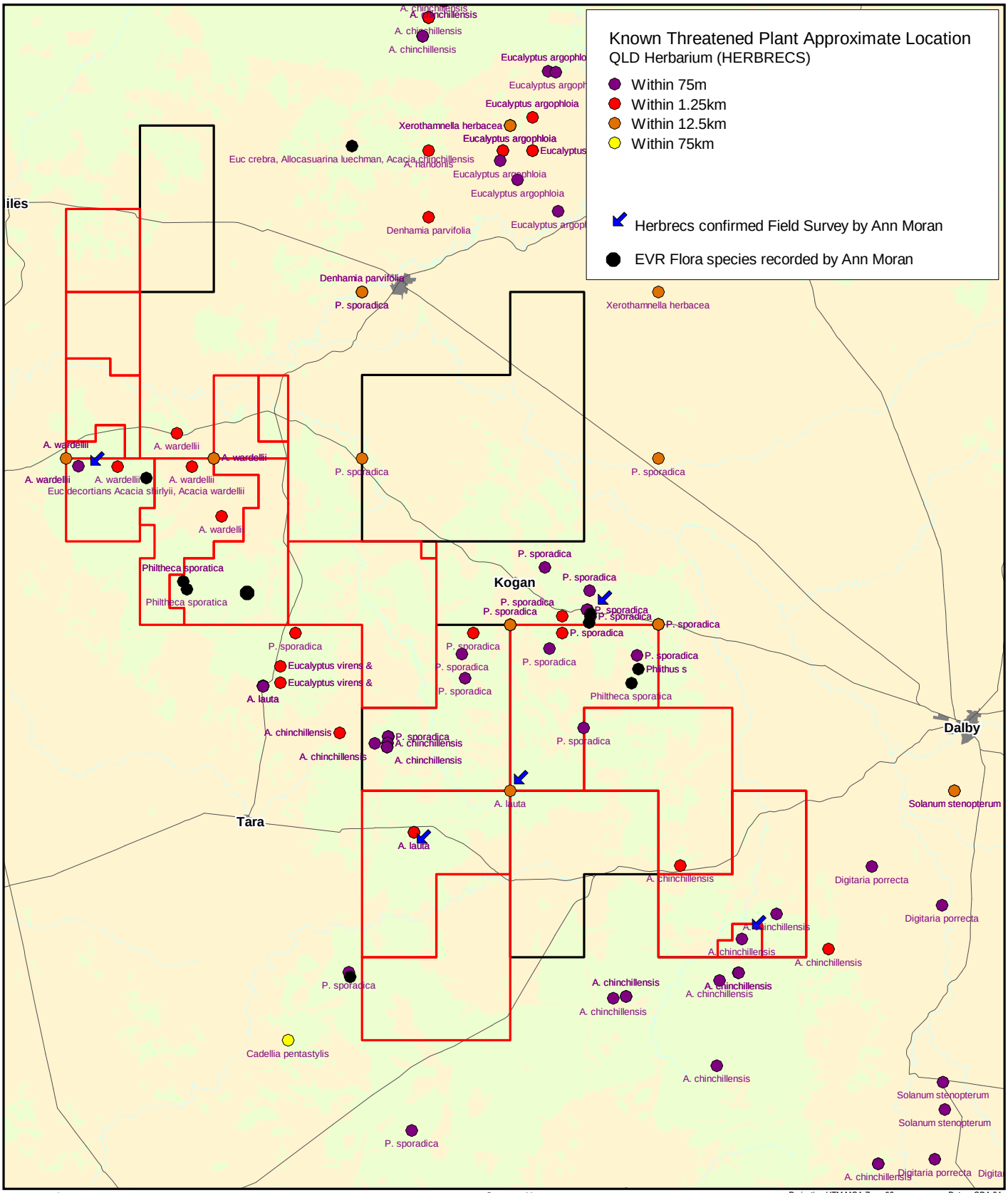

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Project	Queensland Curtis LNG Project	Title	Known EPBC Listed Flora Species Locations
Client	QGC - A BG Group business		Map 2 of 2
Drawn	Mipela	Annex 13.1	Figure 13.17
Approved	CDP	File No:	QC02-T-MA-00092
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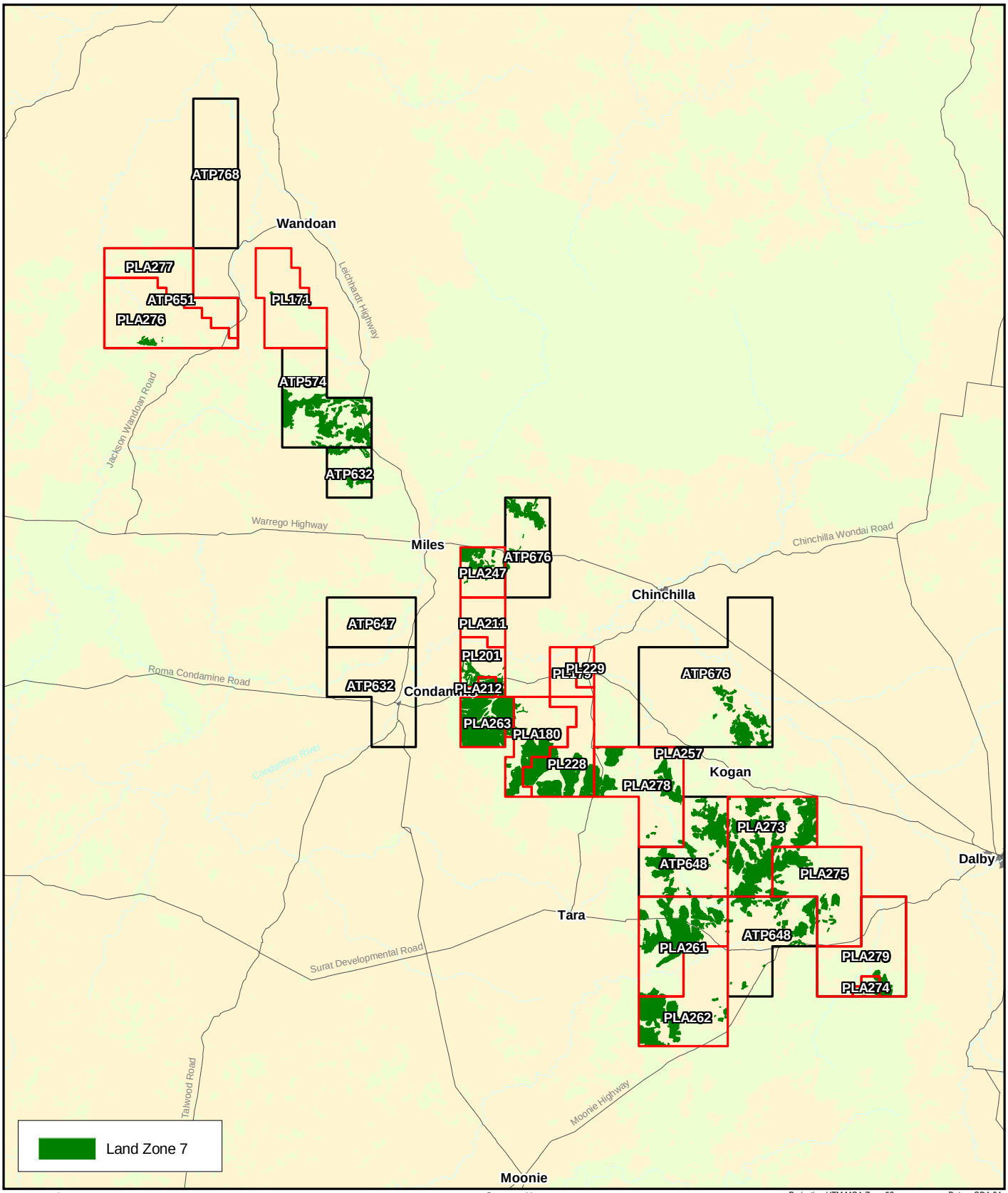

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Projection UTM MGA Zone 56 Datum GDA 94

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Kilometres

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QUEENSLAND CURTIS LNG A BG Group business	Project	Queensland Curtis LNG Project	Title **Regional Ecosystem Land Zone 7**
	Client	QGC - A BG Group business	
ERM Environmental Resources Management Australia Pty Ltd	Drawn Mipela	Annex 13.1 Figure 13.18	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.
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	Date 17.07.09	Revision A	

Table 5 EPBC Act Listed Flora Species Recorded or With Preferred Habitat Within the CSG Field.

Common Name	Scientific Name	EPBC	Preferred Habitat	Preferred habitat present	Source ^	Herbrecs Site # / Field Survey Site #	Comments
None known	*Acacia chinchillensis*	VU	Sandy soils. Widespread but uncommon.	Yes	1,2,3,4	6/3	All sites were in RE 11.5.1 across the southern parts CSG Field. Confirmed Herbarium known site where the population consisted of twenty plants scattered over 1 ha. Also recorded at an additional location consisting of five individuals on a graded 10 m x 10 m area adjacent to an access track. Appears tolerant of disturbance.
Curly-bark Wattle	*Acacia curranii*	VU	Only known from Gurulmundi wildflower area in Gurulmundi State Forest.	Yes	1,2,3,4	6/2	Gurulmundi State Forest only. The majority within RE 11.7.5. Herbarium sites confirmed. Additionally an extra population recorded further from roads. Populations large, consisting of 100's of individual plants and spread across areas in excess of 1 km^2. Populations dense and in association with other EPBC Act Listed flora species (especially *Micromyrtus carinata*). Dense populations present in avoidable patches within RE 11.7.5. Affected by varying fire regimes through the State Forest but apparently fire tolerant/ loving.
Tara Wattle	*Acacia lauta*	VU	Found from Tara to Inglewood 1) Property "Marron Glen", 2) 15km nth of Tara and	Yes	1,2,3	1/0	Searched for the one known Herbarium site within the vicinity of the CSG Field north of Tara along Chinchilla-Tara Rd. Not able to be located. An inability to locate likely to be due to the scale of

Common Name	Scientific Name	EPBC	Preferred Habitat	Preferred habitat present	Source ^	Herbrecs Site # / Field Survey Site #	Comments
			3) 16km east of Tara.				accuracy, possibly due to the scale of Herbarium accuracy (+/- 12.5km).
None known	*Acacia wardellii*	VU	Ridge crests with loamy or gravely soil. Coloniser of disturbed areas – Thomby Range and a few ridges east of the Condamine.	Yes	1,2,3,4	6/2	Populations recorded east of Condamine. Verified Herbarium record and found one other very large population which spread for 1 km along a pipeline easement. The population consisted of two trees with large numbers of young spreading along the pipeline by construction activities. Tolerant of disturbance.
Ooline	*Cadellia pentastylis*	VU	Clay plains, sandstone and residual ridges in association with vine thickets, brigalow, belah and red bauhinia.	Yes	1,2,3,4	1**/1***	Observed in north-easternmost CSG Fields. Single trees scattered through grazing paddocks. Also likely in SEVT patches (not visited due to access constraints). Possible elsewhere in CSG Field but none observed.
None known	*Calytrix gurulmundensis*	VU	Found on lateritic sandstone ridges. Localised and patchy distribution.	Yes	1,2,3,4	4/1	Gurulmundi State Forest only. Found within RE 11.7.5 Verified Herbarium site and found additional small isolated patches spreading along access tracks. Appears that grader activities have spread plants along access tracks radiating out from a main population which is spread over an area of several square kilometres. Plants dense in sunlight exposed locations and sparse in shaded areas. Appears tolerant of disturbance.
None	*Commersonia*	VU	Stony ridges,	Yes	1	0/0	Neither Herbarium records nor field

Common Name	Scientific Name	EPBC	Preferred Habitat	Preferred habitat present	Source ^	Herbrecs Site # / Field Survey Site #	Comments
Known	*argentea*		north of Chinchilla				surveys recorded this species within or in the vicinity of the CSG Field.
Small-leaved Denhamia	*Denhamia parvifolia*	VU	Found in semi-evergreen vine thickets. Brown loam or clay loam soils.		1,3	0/0	Neither Herbarium records nor field surveys recorded any sighting of this species within the CSG Field.
None Known	*Diuris tricolor (sheaffiana)*	VU	Sandy soils, often in Callitris woodlands. Primarily a NSW species with scattered records in Qld.	Yes	1,2	0/0	Neither Herbarium records nor field surveys recorded this species within or in the vicinity of the CSG Field.
Shiny-leaved Ironbark	*Eucalyptus virens*	VU	Sandstone ridges. Four populations – 1) Coolmunda Conservation Park 2) Tara, 3) NE of Eidsvold and 4) Maranoa River near Mt Moffatt.		1,2,3	0/0	Herbarium records indicate one sighting of this species approximately 3km from the central areas of the CSG Field. Field surveys did not record this species anywhere within the CSG Field.
None known	*Homopholis belsonii*	VU	Erect or ascending perennial to 40cm tall with panicles up to 25cm x 20cm. Known from near		1,3	0/0	Herbarium records show one tentative sighting on the outskirts of the northern eastern areas of the CSG Field, north east of Miles. Field surveys did not record this species anywhere within the CSG Field.

Common Name	Scientific Name	EPBC	Preferred Habitat	Preferred habitat present	Source ^	Herbrecs Site # / Field Survey Site #	Comments
			Gurulmundi, 30km north of Miles in the Darling Downs district (Stanley and Ross, 1989).				
None known	*Homoranthus decumbens*	VU	Found in two separate locations 1) Blackdown Tablelands and 2) State Forest 302, north of Chinchilla.	Yes	3	0/0	Neither Herbarium records nor field surveys recorded this species within or in the vicinity of the CSG Field.
None known	*Philotheca sporadica*	VU	On residual lateritic rises: 1) north of Tara and 2) 12km east of Kogan.	Yes	1,2,3,4	9/10	Dominant in patches on laterized scalds through central parts of the CSG Field (e.g. in the vicinity of Graham's Road, Mary's Roads, Kogan and Braemar State Forest).Generally recorded within ironstone jump-ups (lateric duricrusts). Could also potentially be present in nearby nearby areas where suitable habitat occurs (e.g. RE 11.7.5).
None known	*Rhaphidospora bonneyana*	VU	Not known in CSG Field. Grows in gullies or on rocky mesas in ranges	Yes	1	0/0	Neither Herbarium records nor field surveys recorded this species within or in the vicinity of the CSG Field.

*Status EPBC: Australian Government listed: E = Endangered; V = Vulnerable
**: Known records outside of CSG Field
***: Field survey site same as Herbrecs

^: Source: 1 = EPBC Protected Matters search; 2 = WildNet; 3 = Herbrecs; 4 = Field survey for this study

5.1.3 Significant Weed Species

In 1999 the Commonwealth, State and Territory Governments finalised a list of 20 weed species to be classified as Weeds of National Significance (WONS). The main criteria for this listing were:

- The invasiveness of the weed
- The potential impact of the weed
- The potential for the weed to spread, and
- The socio-economic and environmental values. (DEWHA 2009)

Field surveys detected no WONS within or in the vicinity of the CGS Field.

Numerous environmental weeds were also recorded during field surveys. Species that may impede rehabilitation works following construction include:

- Maynes Pest (*Verbena tenuisecta)*
- Mimosa Bush (*Acacia farnesiana*); and
- Exotic pasture and roadside grasses, such as:
  - African Love Grass (*Eragrostis curvula*);
  - Buffel grass (*Cenchrus ciliaris*); and
  - Guinea Grass (*Megathyrsus maximus* - syn. *Panicum maximum*).

Many REs 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

5.2 Fauna Environment

5.2.1 Fauna Habitats

The CSG Field encompasses vegetated and cleared grazing land and cropping land, roadside and travelling stock reserves, Council lands, State Forests and Resource Reserves.

As described in the flora description the CSG Field is approximately 468,700 ha in size. Of this, 297,445 ha is cleared. The remnant vegetation in the CSG Field equates to 171,255 ha and consists of approximately:

- 149,414 ha of Eucalypt woodlands
- 975 ha of Acacia woodlands
- 3,617 ha of Brigalow / Belah woodland
- 621 ha of Semi-evergreen Vine Thicket
- 6,693 ha of riparian Eucalypt woodland
- 9,824 ha of shrubland on scalds, and
- 111 ha of wetlands.

Fauna habitats on most rural lands and roadside verges in the CSG Field are fragmented and substantially degraded. Most areas have a long history of grazing, timber removal and invasion by environmental weeds. Nevertheless, some areas, particularly riparian zones, have significant fauna habitat values with a relatively high percentage of hollow-bearing trees and moderate to high levels of understorey vegetation and leaf litter. The relatively moist riparian environments support more regular and heavy flowering eucalypt communities which are important food sources for many bird species. Two Little Red Flying Fox (*Pteropus scapulatus*) colonies were also found in the area at the time of the study and were observed to be feeding principally along these riparian areas.

The majority of Brigalow (*Acacia harpophylla*) woodlands and tall shrublands occur as narrow wind breaks between cultivated or grazed paddocks or along roadside verges. They are usually heavily infested with introduced grasses and their overall quality as fauna habitats is marginal in these areas.

All habitats (even cleared and degraded land), provide habitat for a range of common native fauna species. Remnant vegetation provides higher habitat values and thus will have a larger range of more common and abundant species.

From observations made during the surveys it seems likely that several factors have combined over a period of time to reduce biodiversity in the area. These factors vary in their influence across the region and also between habitat types. They include:

- Frequent cool winter fires that have removed ground cover in many habitats. These fires are likely to have removed food resources and exposed fauna to elevated predation risks (Garden *et al*. 2007b; Letnic 2007; Priddel *et al.* 2007)
- In the southern areas of the CSG Field, foxes are particularly abundant and these highly efficient predators are well known to pose a serious risk to

terrestrial fauna, particularly were ground cover is scant (Briggs et al. 2007; Gentle *et al*. 2007; McKenzie *et al.* 2007; Priddel *et al*. 2007; Salo *et al*. 2007)

- Grazing and the establishment of environmental weeds, particularly Buffel Grass (Cenchrus ciliaris) are a serious threat to the integrity of many fauna habitats. Buffel Grass is now becoming widely recognized as a serious environmental weed in natural habitats but is also an important pasture grass for graziers (Best 1998; Clarke *et al.* 2005; Greenfield 2007), and
- Grazing has also exerted significant pressure on many natural habitats and has substantially degraded understorey vegetation structure in some areas (Munro *et al*. 2007).

The survey found no bandicoots, bettongs or other terrestrial mammals in this size range in the CSG Field south of the Warrego Highway. Also notably absent were leaf litter dependent species such as Death Adders (*Acanthopis antarcticus*) and the Brigalow Scaly-foot (*Paradelma orientalis*).

A complete list of the fauna observed in the field is set out in **Attachment 10** of **Appendix 3.2**.

5.2.2 EPBC Act Listed Fauna Species

Database searches identified 29 fauna species listed under the EPBC Act and of these 24 were considered to potentially occur in the area. They include 1 Extinct, 4 Endangered, 12 Vulnerable, 11 Migratory and 6 Marine species.

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**.

EPBC Act Listed species identified by the EPBC MNES Database as potentially occurring within the region include the Murray Cod (*Maccullochella peelii peelii*) and the Fitzroy River Turtle (*Rheodytes leukops*). The study area is located in the Condamine River catchment which is part of the Murray-Darling system and Murray Cod have been recorded in the area. The Fitzroy River Turtle is however, confined to the Fitzroy River catchment to the north and does not occur in the project area. It has therefore been excluded from further consideration.

Table 6: EPBC Act Listed Fauna of the CSG Fields

Common Name	Scientific Name	STATUS	Habitat	Probability of occurrence	Field Survey Record
Fish					
Murray Cod	*Maccullochella peelii peelii*	VU	Freshwater rivers: Murray-Darling System. Introduced to the Mary River, Fairbairn Dam and Cooper Creek.	Potential	No
Reptiles					
Brigalow Scaly-foot	*Paradelma orientalis*	VU	Dry sclerophyll and open woodlands in a wide variety of habitats.	Potential	No
Dunmall's Snake	*Furina dunmalli*	VU	In a wide variety of forest and woodland types on heavy clay soils and occasionally in adjoining sandy areas.	Potential	No
Yakka Skink	*Egernia rugosa*	VU	Widespread but uncommon, dry sclerophyll forest and woodlands, fallen logs, rock outcrops.	Potential	No
Five-clawed Worm Skink	*Anomalopus mackayi*	VU	Recorded in open woodlands with grassy understorey. Rare and poorly known.	Potential	No
Grassland Earless Dragon	*Tympanocryptus pinguicolla*	EN	Grasslands of black soil plains of the Darling Downs. Often found in cultivated paddocks with nearby grass cover.	Potential	No
Birds					
Swift Parrot	*Lathamus discolour*	EN	Occasional visitor to Qld when feeding on Eucalypt forests in winter. Breeds in Tasmania.	Potential occasional	No
Star Finch	*Neochima ruficauda ruficauda*	EN	Riverine habitats in tall grass. Not recorded from the region in the 1998-2002 Birds Australia Atlas.	Unlikely	No
Regent Honeyeater	*Anthochaera Phrygia*	EN, Mi	Dry Ironbark woodland associations. Irregular winter visitor to Qld.	Potential occasional	No
Paradise Parrot	*Psephotus pulcherrimus*	EX	Open grassy ironbark woodlands. Last reported 1927.	Unlikely	No
Australian Painted Snipe	*Rostratula australis*	VU	Marshes and swamps in tall grass.	Potential	No
Black-breasted Button-quail	*Turnix melanogaster*	VU	Dry rainforest and vine forest. Marginal in adjoining farmlands.	Potential	No

Common Name	Scientific Name	STATUS	Habitat	Probability of occurrence	Field Survey Record
Plains-wanderer	*Pedionomus torquatus*	VU	Known only from Diamantina Shire, to the west of the project area.	Unlikely	No
Red Goshawk	*Erythrotriorchis radiatus*	VU	Patchy distribution in relatively large expanses of forest and woodland.	Potential	No
Squatter Pigeon (southern)	*Geophaps scripta scripta*	VU	Patchy distribution in dry eucalypt forest, often near water. Not recorded from the QGC fields – occurs further north.	Unlikely	No
White-bellied Sea Eagle	*Haliaeetus leucogaster*	Mi, Ma	Inland locations – permanent and often extensive freshwater lagoons and aquatic systems.	Unlikely	No
White-throated Needletail	*Hirundapus caudacutus*	Mi	Aerial forager, thought to sleep on the wing. A widespread, seasonal visitor to Australia. Unlikely to land in the project area.	Potential	Yes
Rainbow Bee-eater	*Merops ornatus*	Mi	Summer migrant, breeding in sand ridges and creek banks in many habitat types. Common.	Potential	No
Rufous Fantail	*Rhipidura rufifrons*	Mi	A common and widespread bird in a variety of habitat types but often preferring dense vegetation.	Potential	No
Great Egret	*Ardea alba*	Mi, Ma	Widespread in wetland habitats.	Potential	No
Cattle Egret	*Ardea ibis*	Mi, Ma	Common and widespread over much of Australia. Nomadic in arid areas.	Potential	No
Lathams Snipe	*Gallinago hardwickii*	Mi, Ma	Widespread in eastern Australia. Wetlands.	Potential	No
Australian Cotton Pygmy-goose	*Nettapus coromandelianus albipennis*	Mi	Widespread in eastern Australia. Aquatic; permanent freshwater lagoons, swamps and rivers. Often with dense aquatic vegetation.	Potential	No
Painted Snipe	*Rostratula benghalensis*	Mi	Marshes and wetlands	Potential	No
Fork-tailed Swift	*Apus pacificus*	Mi, Ma	Aerial insectivore, widespread distribution.	Potential	Yes
Magpie Goose	*Anseranus semipalmata*	Ma	Marshes and swamps	Potential	No, (seen at Lake Broadwater on the eastern margin of the CSG Field)

Common Name	Scientific Name	STATUS	Habitat	Probability of occurrence	Field Survey Record
Mammals					
Eastern Long-eared Bat	*Nyctophilus timoriensis*	VU	Widespread but uncommon in dry forests and woodlands from Vic to central south Qld.	Potential	Yes
Large-eared Pied Bat	*Chalinolobus dwyeri*	VU	Patchily distributed in association with sandstone escarpments but also occurs in eucalypt forests and woodlands.	Potential	Tentative Record at Gurulmundi SF

***Status:** Commonwealth (EPBC) listed: **EX** = Extinct; **CE** = Critically Endangered; **EN** = Endangered; **VU** = Vulnerable; **Mi** = Migratory Species, **Ma** = Marine Species.

Field studies identified four EPBC Act Listed fauna species within the CSG Field. 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 (Tentative Record at Gurulmundi SF).

Field surveys also recorded one additional threatened fauna species at Lake Broadwater, just outside the south-east corner of the CSG Field:

- Magpie Goose (*Anseranus semipalmata*) – Marine species.

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 throughout the CSG Field, 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 CSG Field 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 CSG Field area, but it is highly unlikely that they would be affected in any way by the proposed development.

Overall distributional range is restricted to the Brigalow Belt Bioregion.

5.2.3 Aquatic Fauna

Queensland Museum and WildNet records list 18 species of fish from the catchment in the QGC Field, two of which are introduced.

One species, the Murray Cod, is listed as vulnerable under the EPBC Act.

5.2.4 Introduced Fauna

Eleven introduced species have been recorded within the wider area, including one amphibian, three birds, seven mammals and two fish. These species are included in **Attachment 10** of **Appendix 3.2**, where they are denoted as introduced species by an asterisk.

5.3 Wetlands

The Condamine and Balonne Rivers drain the region of the CSG Fields towards the southwest. Outside of the CSG Field, there are several nationally significant wetlands located on the lower Balonne River system including the Ramsar-listed Narran Lake Nature Reserve (which includes Back and Clear lakes) which is part of large terminal wetlands of the Narran River at the end of the Condamine system flowing out of Queensland. The Narran Lake Nature Reserve is approximately 450 km southwest of the QGC CSG Fields, in New South Wales.

In addition to the Narran Lake Nature Reserve there are two major wetlands within the Condamine catchment: Lake Broadwater Conservation Park and Resources Reserve 25km southwest of Dalby on the eastern boundary of PL269 and The Gums Lagoon 26km southwest of Tara outside the western boundary of EPP632 (**Figure A.19 [QC02-T-MA-0020]**). Lake Broadwater is classified as a Palustrine system with Lacustrine wetlands on the outskirts and supports four wetland communities: (i) open water communities (ii) lake edge communities (iii) marsh communities and (iv) riparian communities. The Gums Lagoon is classified as a Palustrine system with a relatively undisturbed wooded swamp in a small reserve of similarly undisturbed woodlands and open forest (QNPWS 2005). The Gums Lagoon supports 79 identified species of birds some of which are afforded special status under JAMBA and CAMBA. These bilateral agreements between Japan (JAMBA) and China (CAMBA) provide for the conservation of terrestrial, water and shorebird species that migrate between Australia and the respective countries.

5.4 Environmentally Sensitive Areas

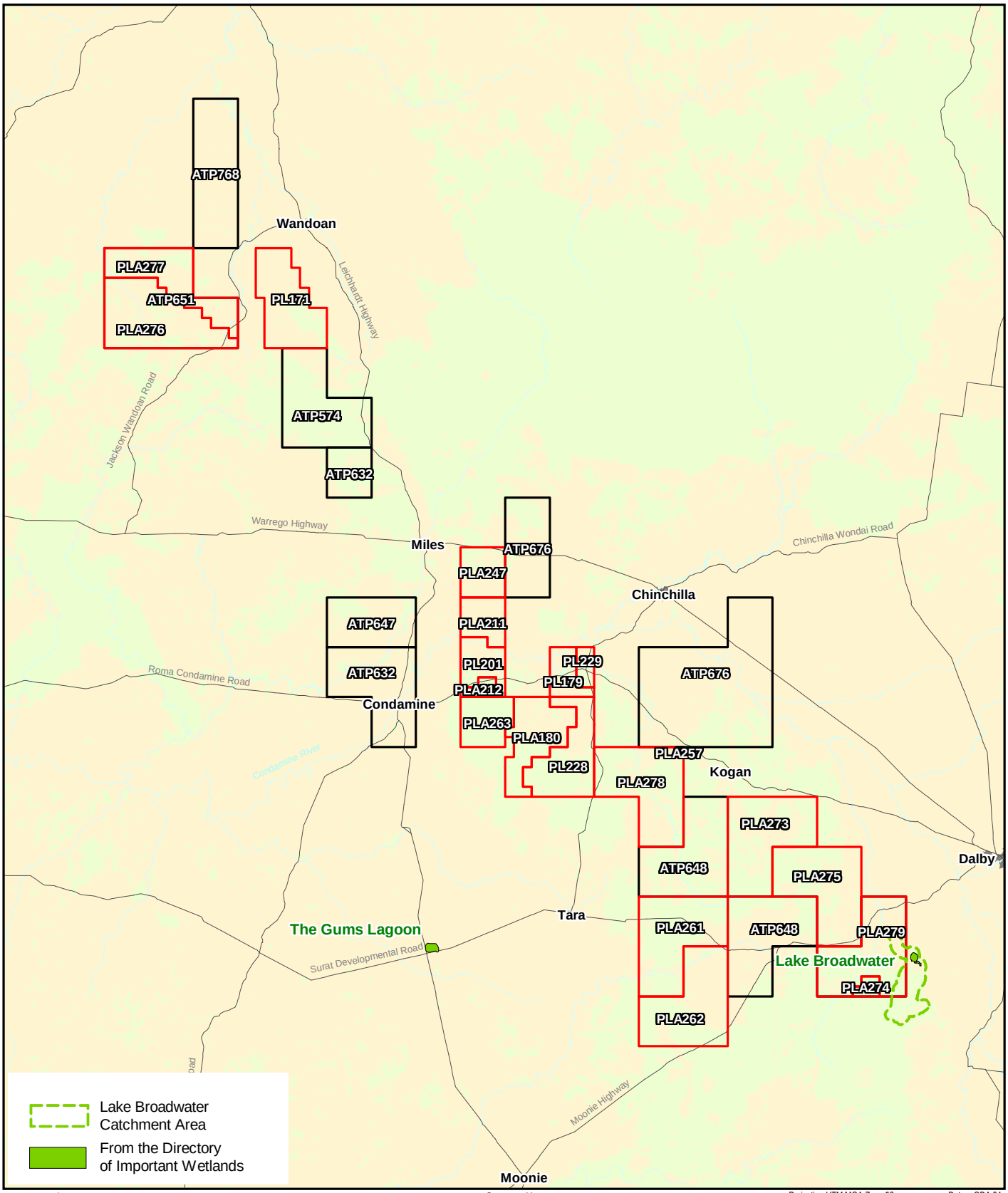
5.4.1 Bioregional Planning Assessment Values

Conservation values across the CSG Fields vary markedly as a result of past and present land uses and the intensity of current rural residential, cropping and grazing regimes. Conservation values have been appraised in accordance with the EPA's Biodiversity Assessment and Mapping Methodology (BAMM) and also taking into account Environmentally Sensitive Areas as defined by the EPA in their Guideline "Assessment and Approval Process for Environmental Authorities for Petroleum Activities". Incorporated in the BAMM methodology, is specific appraisal of habitat for EPBC Act Listed taxa, ecosystem values, RE status (VM Act). For the purposes of this study, the status of threatened ecological communities (EPBC Act 1999) has been incorporated, based on their RE designations.

Summaries of EPBC Act Listed Taxa have been provided in previous sections. Other values appraised during the field work and added to the assessment of conservation values include the following.

5.4.2 Additional Flora Values

- Semi-evergreen Vine Thicket protected under EPBC Act and VM Act is exceedingly rare in the CSG Fields, occurring only in the Wooleebee Creek



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Kilometres

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QUEENSLAND CURTIS LNG A BG Group business	Project Queensland Curtis LNG Project		Title **Important Wetlands Areas**
	Client QGC - A BG Group business		
ERM Environmental Resources Management Australia Pty Ltd	Drawn Mipela	Annex 13.1 Figure 13.19	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.
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area and in northern parts of, and further north of, Gurulmundi State Forest. It is afforded additional status as it contains taxa at the southern geographical extent of their range

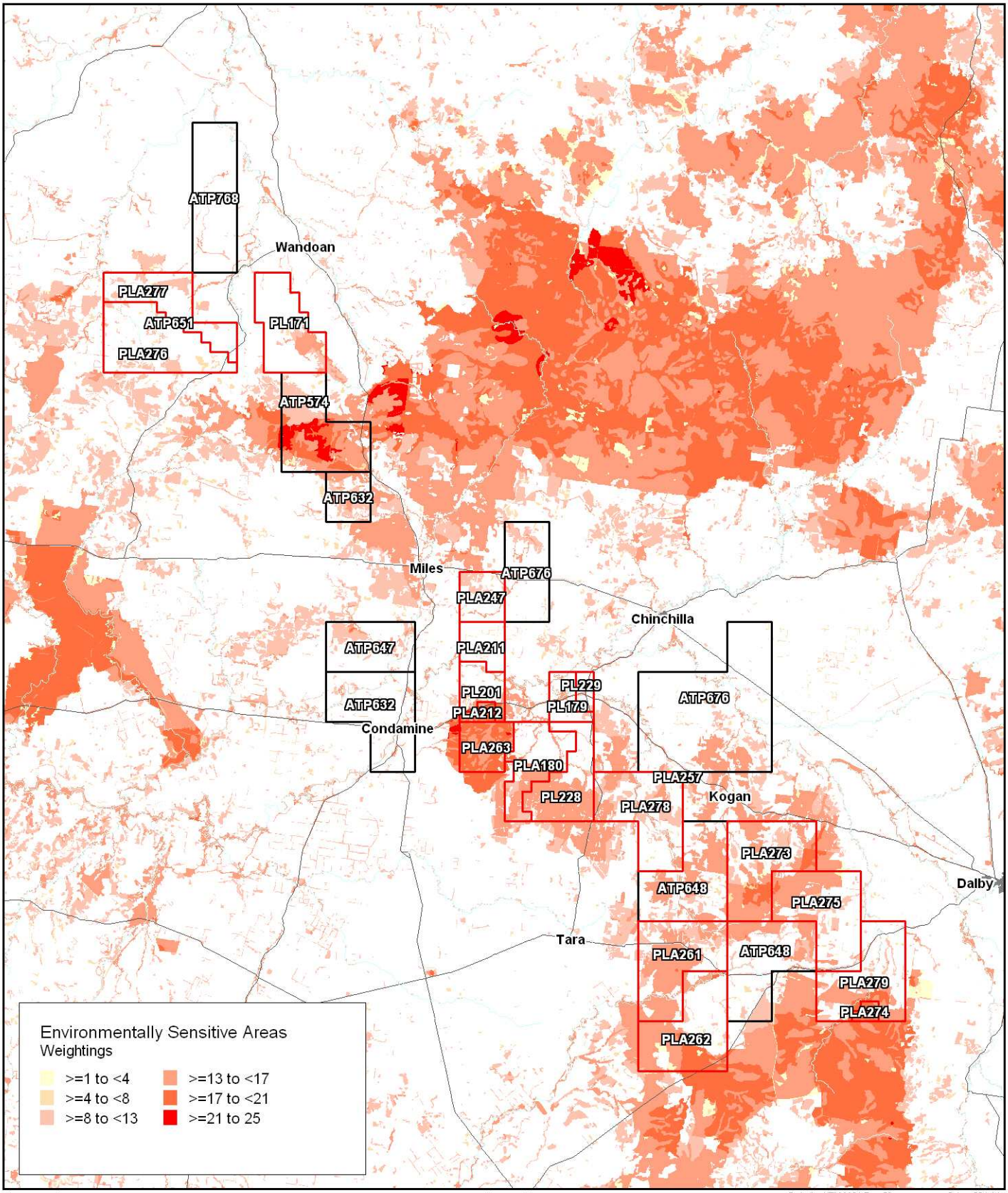
- Areas mapped as ephemeral wetlands (RE 11.3.27) on the assumption that these areas have extant values (not able to be assessed in the field due to landholder constraints), and
- All areas of remnant vegetation on gravelly hill tops (i.e. Land Zone 7) within the QGC Fields. This RE is of particular importance as it contains a significantly large number of EVR taxa in the Gurulmundi area and also in the southern areas of the CSG Fields where it supports *Philotheca sporadica* and other EVR plants. This Landzone comprises open gravelly hill tops (lateritic duricrust) and is frequently targeted for gravel extraction.

5.4.3 Additional Fauna Values

- Riparian corridors with native vegetation. Within the tenements there are many small creeks and floodout areas, some of these are still well vegetated. They include the environs of Wambo Creek, Wilkie Creek, Moramby Creek, Braemar Creek and the Condamine River. These areas contain a high proportion of hollow trees and are important dry season refuges and breeding areas.
- Gurulmundi area, in particular:
  - Topography over most of the CSG Field is relatively flat, however there are significant escarpments above steep boulder-strewn creeklines in the Gurulmundi State Forest area which are important refuges and also likely to provide habitat for uncommon species. This was the only area within the CSG Fields where the east-coast form of the Wallaroo (Macropus robustus robustus) was recorded
  - Bat calls recorded in this area may be those of the Large-eared Pied Bat (*Chalinolonbus dwyeri*) and footprints seen in the several caves may be those of a Northern Quoll (*Dasyusus hallucatus*). Further survey effort would be required to confirm these records, however, for the purposes of this assessment a precautionary approach will be taken and therefore it will be assumed that these species occur in the area, and
  - Based on all known values, the Gurulmundi area qualifies as an important fauna refuge and area of high species richness.

5.4.4 Environmentally Sensitive Areas Mapping

Based on the analysis of these criteria and the methodology described in **Section 4.4**, a map of Environmentally Sensitive Areas has been developed (**Figure A.20 [QC02-T-MA-0021]**).



Legend:

Gas Fields - Petroleum Lease/Petroleum Lease Application

Gas Fields - Authority to Prospect

Source Note:

Biodiversity Assessment data copyright of Queensland Environmental Protection Agency

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 **Environmentally Sensitive Areas (Weighted)**
	Client	QGC - A BG Group business	
ERM Environmental Resources Management Australia Pty Ltd	Drawn Mipela	Annex 13.1 Figure 13.20	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.
	Approved CDP	File No: QC02-T-MA-00108	
	Date 17.07.09	Revision A	

6.0 POTENTIAL IMPACTS

6.1 Reversible and Non-reversible Impacts

Once infrastructure has been developed, there is potential to allow vegetation to re-establish over a portion of the area originally cleared. Bore pads are 10 000m^2 (1 ha) in extent for construction but can be revegetated around the edges provided that 5000 m^2 around the established well remains vegetation free. Similarly road verges can be allowed to revegetate once wide clearance vehicles used in construction are withdrawn. Where flowlines are laid, a portion of the ground surface can be allowed to revegetate. Keeping a narrow strip of ground over the flowline, free of trees and shrubs may be all that is necessary to protect it from potential root damage and facilitate ongoing inspection and necessary maintenance.

With the typical well life being up to 25 years, wells and the associated flowlines and access roads will be progressively rehabilitated over the life of the Project. Rehabilitation activities will commence sequentially at ramp-down/cessation of commercial production for depleted wells.

As such, subject to landholder property management practises, it is expected that over the medium term (20 - 50 years) significant portions of the originally modified areas will be rehabilitated and allowed to naturally regenerate.

Longer-term, the CSG Field is likely to be decommissioned within several decades. Subject to the exception that landholders may choose to manage their properties in a manner that inhibits natural regrowth; the impacts associated with the clearing of vegetation for construction and maintenance are considered to be reversible in the long term.

6.2 Potential Impacts on EPBC Act Listed Ecological Communities

Regional Ecosystem mapping (EPA) indicates that approximately 50% of the CSG Field supports remnant vegetation. The majority of this consists of eucalypt woodlands and forests with very minor, fragmented stands of brigalow often occurring on roadside verges or as wind breaks along the margins of pasture or cropping paddocks. Some clearing of these remnant ecological communities will be required. Mostly, this will involve the clearing of relatively narrow, linear corridors and pad footprints in eucalypt communities.

The total known area of EPBC Act Listed Ecological Communities in the CSG Field is estimated to be 4,039 ha. The worst case clearing scenario would amount to the removal of approximately 117.1 ha, which equates to approximately 0.009% of the threatened communities found within the Bioregion. It should be emphasised, however, through existing and proposed avoidance / minimisation measures and the establishment of direct offsets this worst case clearing scenario will be reduced to zero.

6.2.1 Other Potential (non-clearing) Impacts on Threatened Ecological Communities

Other potential detrimental impacts include:

- The movement of machinery and vehicles between areas, which has the potential to spread weeds including a number of environmental and declared noxious species, such as Buffel grass, Parthenium Weed and Giant Rat's-tail Grass
- The introduction or proliferation of pest fauna species

- Changes to fire regimes, in particular increased fire regimes due to higher to weed biomass along cleared alignments
- The activities of machinery and construction operations may increase the likelihood of wildfires
- Initial drilling activities result in the production of associated water which is very mildly saline (generally 2,000-5,000 ppm), and so vegetation in the vicinity of the wells may be impacted if water tables are affected or if extracted water flows into nearby vegetation, and
- Accidental release of associated water with higher levels of salinity from evaporation ponds or other associated water infrastructure.

Due to the closed nature of Brigalow and SEVT communities, these areas are particularly sensitive to indirect impacts such as fragmentation, weed invasion and altered fire regimes. The invasion of these communities by exotic weed species (e.g. Buffel Grass) provides increased fuel loads which can lead to the increased occurance of wildfire and the subsequent damage to the lower tree layer.

6.3 Potential Impacts on EPBC Act Listed Flora Species

All EPBC Act Listed flora species identified in the CSG Field may be subject to some of the potential impacts described in the previous section, namely:

- Clearing for the construction of roads and pads for gas drilling and extraction
- The activities of machinery and construction operations may increase the likelihood of wildfires, and
- The project could potentially bring about beneficial affects through the establishment of environmental offsets and land management initiatives, aimed at protecting and improving knowledge of the distribution and threats to EVR flora species in the CSG Field.

There is higher potential for clearing activities within Landzone 7 to impact particular EPBC Act Listed flora species (i.e. *Acacia curranii, Calytrix gurulmundensis* and *Philotheca sporadica*).

The potential for weed species to significantly impact any EPBC Act Listed flora species within the CSG Field is considered to be low due to the fact that either:

- The niches in which they occur are generally not suitable for the establishment of significant populations of exotic species, or
- Where this is not the case, the preferred habitats are generally already dominated by Buffel Grass, Green Panic or other pasture grasses.

Table 7 summarises the potential for each EPBC Act Listed flora species to be impacted by the proposed activities with and without mitigation measures. Mitigation measures to address these potential impacts are detailed in **Section 7**.

Table 7 Potential for EPBC Act Listed Flora Species to be Impacted

Common Name	Scientific Name	Status	Habitat	Potential to be Adversely Impacted Without Mitigation Measures	Mitigation Measures	Potential to be Significantly Adversely Impacted with Mitigation Measures
None known	*Acacia chinchillensis*	VU	Sandy soils. Widespread but uncommon.	High	Planning Survey and Clearance Surveys, Fire Management	Low (easily avoidable)
Curly-bark Wattle	*Acacia curranii*	VU	Only known from Gurulmundi wildflower area north of Miles. The majority within RE 11.7.5.	Very high (restricted species)	Planning and Clearance Surveys (potentially widespread restrictions in Gurulmundi SF and wildflower area) , Fire Management	Potentially High in Landzone 7 within Gurulmundi area, low elsewhere
Tara Wattle	*Acacia lauta*	VU	Found from Tara to Inglewood 1) Property "Marron Glen", 2) 15km north of Tara and 3) 16km east of Tara. Recorded within and in the vicinity of the south-eastern areas of the CSG Field, just north of Tara.	High	Clearance Survey, Fire Management	Low (easily avoidable)
None known	*Acacia wardellii*	VU	Ridge crests with loamy or gravely soil. Coloniser of disturbed areas – Thomby Range and a few ridges east of the Condamine.	High	Clearance Survey, Fire Management	Low (restricted habitat type, easily avoidable in most cases)
Ooline	*Cadellia pentastylis*	VU	Clay plains, sandstone ridges. Localised and patchy distribution in Gurulmundi and Barakula areas.	High	Clearance Survey, Fire Management	Low (low numbers anticipated, easily avoided)
None known	*Calytrix gurulmundensis*	VU	Found on lateritic sandstone ridges. Localised and patchy distribution.	Very high (restricted species)	Exclusion areas at Gurulmundi. Clearance Surveys, Fire Management	Potentially High in Landzone 7 within Gurulmundi State Forest, low elsewhere
None known	*Commersonia*	VU	Stony ridges, north of	Low (not known in	Clearance Surveys	Low (easily avoided)

Common Name	Scientific Name	Status	Habitat	Potential to be Adversely Impacted Without Mitigation Measures	Mitigation Measures	Potential to be Significantly Adversely Impacted with Mitigation Measures
	argentea		Chinchilla	the CSG Field)		
None known	*Denhamia parvifolia*	VU	Not known in CSG Field.Found in semi-evergreen vine thickets. Brown loam or clay loam soils.	High	Clearance Survey, Fire Management	Low (low numbers anticipated, restricted habitat type, easily avoided)
None known	*Diuris tricolor (sheaffiana)*	VU	Sandy soils, often in Callitris woodlands. Primarily a NSW species with scattered records in Qld.	Low (not known in the CSG Field)	Clearance Surveys	Low (easily avoided)
Shiny-leaved Ironbark	*Eucalyptus virens*	VU	Type collected from Gurulmundi SF. Restricted to Landzone 7.	High	Clearance Survey, Fire Management	Potentially High in Landzone 7 within State Forests, low elsewhere
None known	*Homopholis belsonii*	VU	Not known in CSG Field.Dry woodland on sandy soils.	High	Clearance Survey, Fire Management	Low (easily avoidable for well sites, offsets required)
None known	*Homoranthus decumbens*	VU	Found in two separate locations 1) Blackdown Tablelands and 2) State Forest 302, north of Chinchilla.	Low (not known in the CSG Field)	Clearance Surveys	Low (easily avoided)
None known	*Philotheca sporadica*	VU	On residual lateritic rises: 1) north of Tara and 2) 12km east of Kogan.	Very High	Clearance Survey, Fire Management	Potentially high in Landzone 7 within the central parts of the CSG Field (e.g. in the vicinity of Graham's Road, Mary's Roads, Kogan and Braemar State Forest).
None known	*Rhaphidospora bonneyana*	VU	Not known in CSG Field. Grows in gullies or on rocky mesas in ranges	High	Clearance Survey, Fire Management	Low (low numbers anticipated, restricted habitat type, easily avoided)

***Status:** Commonwealth (EPBC) listed: **VU** = Vulnerable

As detailed in **Table 7**, the unmitigated potential for the Project to impact on EPBC Act Listed flora is:

- Very high for three species,
- High for eight species and
- Low for three species

Table 7 also describes how the use of the mitigation measures detailed in **Section 7** would enable the Project to avoid significantly impacts to all EPBC Act Listed flora. However, this assumes that non-linear CSG activities will not be conducted within Gurulmundi State Forest. Prior to separate government endorsement of plans to undertake CSG activities within this area based on detailed ecological evidence that such activities would be conducted without risk of significant impact on MNES. If this is not the case, there would be potential for significant impacts on three EPBC Act Listed flora species.

6.4 Potential Impacts Associated with Weeds of National Significance (WONS) and Environmental Weeds

Construction and maintenance of the wells and associated infrastructure has the potential to introduce new weeds and spread existing ones.

Of particular significance to landholders will be the potential to introduce WONS to areas within and in the vicinity of the CSG Field including those already present. Introduction and spread of these weed species can render land less productive and in some cases have serious health impacts on livestock and people. The weed species Parthenium (*Parthenium hysterophorus*) is of particular interest to landholders and the community due to its potential impacts on agricultural productivity and human health. Parthenium is not currently known within the CSG Field nevertheless it is believed to occur in nearby areas.

Construction and maintenance activities in the CSG Field also have the potential to spread environmental weeds into ecosystems that are currently in a natural condition. Of particular concern is Buffel Grass (*Cenchrus ciliaris*). This species is an introduced and highly valued pasture grass in many areas but also has the potential spread into native communities and conservation areas where it out-competes native species. It often causes an increase in biomass which drastically biases fire regimes towards much more intense and frequent fire events which can destroy natural ecosystems. The grass itself also provides very little nutritive or forage value for wildlife and so, areas dominated by the Buffel grass can quickly become biological deserts.

Other environmental weeds of significance are Castor Oil (*Ricinus communis*), Mexican Poppy (*Argemone ochroleuca*), Mimosa Bush (*Acacia farnesiana*) and Guinea Grass (*Megathyrsus maximus*).

Good weed hygiene practices should be adopted to minimise the introduction or spread of WONS and environmental weeds in the QGC Field. Recommendations aimed at controlling the introduction and spread of weed species are provided in **Section 7**.

6.5 Potential Adverse Impacts on EPBC Act Listed Fauna

Clearance of native vegetation will be required for the construction of roads, pipelines, well site pads and other infrastructure. It is expected that these impacts will be reduced over time as cleared areas partially revegetate post construction of CSG field infrastructure.

Overall levels of vegetation disturbance are considered to be low with the total anticipated amount of clearing likely to cause a reduction in extent of vegetation of approximately 3%, spread relatively evenly across the CSG Field.

As detailed in **Section 7**, the project infrastructure locations will be selected to avoid areas identified as having highest significant conservation values as derived from the constraints mapping. Nevertheless, some potential impacts would remain and these include the following:

- 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 flow line and access road construction. These features may act as movement barriers, particularly to fossorial[1] species, and alter movement patterns. They may also limit access to dry season fauna refuges associated with riverine environments
- Access for predators – dingoes and to a lesser extent, foxes and cats are known to follow roads and tracks as they provide easy access paths. This may open up new habitats and expose fauna to elevated predation risks
- The establishment of environmental weeds, particularly Buffel grass, have the potential to 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 and limit access to food or other resources
- The potential for road kills along access tracks will elevate mortality risks for some species
- Sedimentation and nitrification of aquatic habitats, and
- Accidental release of associated water with higher levels of salinity from evaporation ponds or other associated water infrastructure.

Discussion of each of these potential impacts follows.

6.5.1 Removal of Tree Hollows and Vegetation

Removal of mature vegetation reduces feeding resources and shelter for native fauna species. While it is recognised that the proposed loss of mature vegetation would not be significant, some parts of the CSG Field have been heavily cleared and are now severely fragmented.

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 and Lindenmayer, 2002). Mature trees with hollows are a limited

[1] burrowing

resource in this region and are largely confined to riparian corridors and areas of mature, intact forest. During the initial tertiary surveys birds such as galahs were observed nesting in degraded fragments of roadside vegetation where large hollows existed. Thus all forest and woodland fragments with large trees should be considered as potentially important fauna habitat. The formation of hollows suitable for use by fauna does not occur until eucalypts are at least 120 years. Therefore, the replacement of lost hollows may not occur for very long periods.

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. For example, during the detailed fauna surveys, Rufous Bettongs were only recorded in association with dense understorey vegetation. The loss or removal of fallen timber and understorey vegetation severely reduces the abundance and diversity of small ground-dwelling fauna. Impacts from removal of dead timber and understorey vegetation will reverse over time as affected areas revegetate but reduction in abundance of some species is likely to occur in the short to medium term.

6.5.2 Habitat Fragmentation

The CSG Field includes riparian Eucalypt woodlands and forests which have 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 because much of the wider environment of the study corridor is fragmented due to clearing for agriculture. Additionally these watercourses are often the only source of water during the dry season and therefore enable populations to persist in a dry and largely cleared landscape. Fragmentation and disturbance or these habitats may be reversible in the medium to long term by natural revegetation and habitat rehabilitation or specific programs aimed at restoring habitat.

Whilst it is recognised that the vast majority of vegetated areas are already extensively criss-crossed with fire-breaks, fencelines and roads, the clearing for proposed project infrastructure will increase the degree of existing habitat fragmentation. This impact is somewhat reduced by the fact that the proposed clearing will generally consist of narrow, linear strips (as access tracks and flowlines are developed). This impact will be more significant in relatively intact vegetation areas (particularly in State Forests) and less significant where ground and shrub layers have been degraded by existing land uses, such as grazing, and fire and weed impacts.

Fragmentation and disturbance of these habitats may be reversible in the medium to long term by revegetation and habitat rehabilitation programs.

6.5.3 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 unrestricted 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 provide refugia for fauna.

6.5.4 Environmental Weeds

The movement of machinery and vehicles may facilitate the spread of weeds species, some of which are highly invasive once established are very difficult and costly to eradicate. Of particular concern in relation to potential impacts on native fauna is the environmental weed Buffel Grass (*Cenchrus ciliaris*). This grass has the potential to spread and out-compete native species in a variety of habitat types. Its increased biomass may also predispose infested habitats to more intense and frequent fire events. It is also of very little nutritive value to fauna and seeds are inedible to many grainivorous birds. Areas that are heavily infested with Buffel Grass often become 'biological deserts' where few native fauna can survive. Buffel Grass can be poisoned; however seeds remain viable for many years and can germinate quickly after rainfall events, with young plants flowering and setting seed in little more than a week. Thus once established in native plant communities, it can be extremely difficult to eradicate.

A somewhat different situation exists in pastoral areas where Buffel Grass is highly valued as a pasture grass.

Areas currently free of Buffel Grass include the floodplain communities in the southern parts of Gurulmundi and other parts of the State Forest where grazing pressure has been minimal.

Many Brigalow communities are already significantly degraded by Buffel Grass and Green Panic. As such, there is an opportunity for this project to improve management of these areas to reduce the abundance and biomass of these grasses and thus to improve fauna and flora habitat values within these areas.

6.5.5 Noise and Human Activity during Construction

Construction activities involve high levels of human activity and noise. This may disrupt some fauna, particularly if these activities occur near important roosting or breeding sites. Often such sites are used by a particular species because the site has significant microclimatic attributes, freedom from predators and/or proximity to food resources. As such, disturbance to these sites can seriously jeopardise species survival in some instances. The disturbance however, is anticipated to be temporary and so impacts will be short-term. It will be necessary to include fauna habitat assessments in site clearance procedures to check for nesting birds, important roosts (e.g. Barking Owl, microbat and flying fox daytime roosts) and key habitats such as rock outcrops and cliff faces/gorges.

6.5.6 Increased Levels of Fauna Road Kill

The construction of roads and general increase in human activity in the CSG Field will increase levels of fauna road kill. Road kills are often most frequent at night, in the very early morning and evening when many species are most active. Most human activity along roads will likely occur during the day and unsealed roads are negotiated at low speed, thus road kill impacts are anticipated to be limited, however, monitoring of road kills in areas of high conservation value and response strategies (e.g. reduced speed zones) are recommended in **Section 7**.

6.5.7 Sedimentation, Nutrification and Accidental release of saline water to watercourses and wetlands

The potential for the Project to impact on aquatic habitats through sedimentation, nutrification and accidental release of saline water is described in **Section 6.7**. Any such impacts would affect wetland fauna species.

6.5.8 Potential Beneficial Impacts on Habitat for EPBC Act Listed Fauna

The overall condition of much of the CSG Field is relatively poor in terms of fauna habitat, with evidence of frequent and hot fires, environmental weeds and grazing pressure in many areas. As such, the project may be able to contribute to better environmental outcomes via a number of means. These include:

- The development of a better road network will provide enhanced opportunities for fire control, particularly if prescribed fuel reduction burns are conducted along these roads to widen the fire barrier. The development of fire barriers also provides a safe haven for vehicles and personnel in the event of wildfires. The formulation of a fire management plan will also be important in order to provide for the protection of infrastructure.
- A reduction in fire frequency will allow the regeneration of ground storey vegetation and accumulation of leaf litter. This will supply vital habitats for many fauna species and provide protection from introduced predators.
- **Section 7** recommends offset initiatives where impacts to native vegetation and fauna habitats are unavoidable. These areas will be managed with a strong conservation focus and 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.
- Conservation focussed land management on QCG owned land including development of Conservation Plans and assessment of ecological implications of reducing grazing intensities and/or livestock exclusion.

6.5.9 *Summary of Potential Impacts on EPBC Act Listed Fauna*

Table 8 lists the EPBC listed fauna species that may potentially be impacted by the project and provides an assessment of the potential for significant impacts in accordance with the EPBC Significant Impact Guidelines, Policy Statement 1.1 (DEWHA 2006).

The potential impacts on EPBC Act Listed fauna is projected to be low, for with the application of the ecological constraints zoning model which is set out in Section 7, only small areas of vegetation are likely to be affected by the proposed CSG Field activities.

It is considered that the project could bring potential benefits to EPBC Act Listed fauna species. These have been discussed in **Section 6.5.8** above. The mapping of areas of high conservation value areas may be used to target key EPBC Act Listed fauna habitats with conservation management initiatives.

6.5.10 Impacts on Migratory and Marine Species

In addition to threatened species, the EPBC Act lists Migratory and Marine fauna, of which 12 species were identified by desktop studies. Of these species, during the field surveys the White-throated Needletail and the Fork-tailed Swift were observed within the CSG Field and the Magpie Goose was observed just outside the CSG at Lake Broadwater. These bird species occur fleetingly in the CSG Field or utilise the airspace above (swifts). For these species, an assessment was made as to whether the project was likely to:

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

As discussed in the previous assessment, 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. Many of the migratory/marine species are water birds and as outlined in **Section 7**, riparian and wetland habitats are afforded special protection in this project with most of these habitats precluded from any development.

Table 7 Potential for EPBC Act Listed Fauna Species to be Impacted

Common Name	Scientific Name	EPBC	Assessment	Potential to be Impacted Without Mitigation Measures	Mitigation Measures	Potential to be Significantly Impacted with Mitigation Measures
Fish						
Murray Cod	*Maccullochella peelii peelii*	VU	May occur in the Condamine River. Current environmental practices ensure that the river and its environs are fully protected.	Low	Condamine River environs excluded from development apart from some necessary easements placed with minimal disturbance	Low
Reptiles						
Five-clawed Worm Skink	*Anomalopus mackayi*	VU	Poorly known species in the area. Known from roadside grassy verges in disturbed habitats in the Dalby region. Not recorded in field surveys.	Low	Minimal clearing in native grasslands and grassy woodlands where species is likely to occur. Site clearances.	Low
Grassland Earless Dragon	*Tympanocryptus pinguicolla*	EN	Restricted to the black soil grasslands found primarily to the east of the CSG Field. Has demonstrated a capacity to adapt to high levels of disturbance in cultivated areas and pastures.	Low	Minimal clearing in native grasslands and grassy woodlands where species is likely to occur. Site clearances.	Low
Brigalow Scaly-foot	*Paradelma orientalis*	VU	The species distribution and habitat preferences are poorly known. It may occur in the northern portion of the CSG Field area. Not recorded in field surveys.	Low	Planning and Pre-clearance Surveys in areas of native vegetation	Low
Dunmall's Snake	*Furina dunmalli*	VU	No baseline data on populations in the area. Normally found in seasonal swampy areas in black soil.	Low	Planning and Clearance Surveys in areas of native vegetation. Primary habitat excluded from development.	Low
Yakka Skink	*Egernia rugosa*	VU	Distributed patchily from near Cairns to the Gold Coast. Often in dry	Low	Planning and Clearance Surveys	Low

Common Name	Scientific Name	EPBC	Assessment	Potential to be Impacted Without Mitigation Measures	Mitigation Measures	Potential to be Significantly Impacted with Mitigation Measures
			sclerophyll forest. Occurrence in the CSG Field unknown. Not recorded in field surveys.			
Birds						
Red Goshawk	*Erythrotriorchis radiatus*	VU	This species requires extensive areas of intact forest habitat and in such areas, only occurs in low numbers. Not known from the QGC Fields. Records from the Dalby area are doubtful.	Low	Retention of existing large tracts of native vegetation.	Low
Squatter Pigeon (southern)	*Geophaps scripta scripta*	VU	The project area is in the southern part of the species' distributional range. Not recorded during field surveys. It is found in sandy areas adjacent permanent water.	Low	Planning and minimal clearing in forested habitats including riparian areas as per constraints mapping.	Low
White-bellied Sea Eagle	*Haliaeetus leucogaster*	Mi, Ma	In inland areas, this species is associated with extensive bodies of permanent water, none of which exist in the CSG Field. A possible vagrant along the Condamine River.	Low	Protection of riparian areas, swamps and marshes, including the immediate environs of the Condamine River. Primary habitat excluded from development.	Low
White-throated Needletail	*Hirundapus caudacutus*	Mi	A seasonal vagrant that forages well above the tree canopy in the CSG Field areas. Not known to roost or breed in Australia.	Low	Planning and minimal clearing in forested habitats including riparian areas.	Low
Rainbow Bee-eater	*Merops ornatus*	Mi	Seasonal visitor to the CSG Field area and possibly breeds in sandy creek banks and riparian dunes.	Low	Protection of riparian habitats.	Low
Rufous Fantail	*Rhipidura rufifrons*	Mi	Common species in more densely vegetated habitats. Broad distribution.	Low	Planning and minimal clearing in vine forest and forest habitats.	Low

Common Name	Scientific Name	EPBC	Assessment	Potential to be Impacted Without Mitigation Measures	Mitigation Measures	Potential to be Significantly Impacted with Mitigation Measures
Great Egret	*Ardea alba*	Mi, Ma	Widespread species over much of the continent. No breeding records exist from the CSG Field area and it may possibly use ephemeral pondages and marshes in the area including the environs of the Condamine River.	Low	Protection of riparian habitats.	Low
Cattle Egret	*Ardea ibis*	Mi, Ma	Widespread and recorded from grasslands in the CSG Field although not known to breed there. Often feeds in association with domestic stock.	Low	Planning and minimal clearance of vegetation.	Low
Lathams Snipe	*Gallinago hardwickii*	Mi, Ma	Winter visitor to southern Australia where it is not known to breed. Commonly found in wetlands and adjacent grasslands.	Low	Protection of riparian areas, swamps and marshes, including the immediate environs of the Condamine River.	Low
Australian Cotton Pygmy-goose	*Nettapus coromandelianus albipennis*	Mi	Found in coastal central Queensland. The CSG Field are in the extreme south west of the species distributional range. Often found on water bodies with floating vegetation.	Low	Protection of riparian areas, swamps and marshes, including the immediate environs of the Condamine River.	Low
Painted Snipe	*Rostratula benghalensis*	Mi	Possibly a visitor to the CSG Field area in winter. Found in wetland areas.	Low	Protection of riparian areas, swamps and marshes, including the immediate environs of the Condamine River.	Low
Fork-tailed Swift	*Apus pacificus*	Mi, Ma	Summer migrant to Australia. Aerial forager and not strongly associated with any specific habitat type in the CSG Field.	Low	Planning and minimal clearance of vegetation.	Low
Magpie Goose	*Anseranus semipalmata*	Ma	A northern Australian species with very occasional representation as far south as Brisbane. Not recorded from	Low	Protection of riparian areas, swamps and marshes, including the	Low

Common Name	Scientific Name	EPBC	Assessment	Potential to be Impacted Without Mitigation Measures	Mitigation Measures	Potential to be Significantly Impacted with Mitigation Measures
			the CSG Field area but likely to be a vagrant in wetland areas		immediate environs of the Condamine River.	
Swift Parrot	*Lathamus discolour*	EN	Impact restricted to feeding habitat, and this would be exceedingly minor, due to the very small percentage of native woodland or forest that might be altered.	Low	Minimal clearance of woodlands and forest areas where possible.	Low
Star Finch	*Neochima ruficauda ruficauda*	EN	Since 1900, few records have come from south of Townsville. If present in the area, it is most likely to be found in Eucalypt riparian areas along rivers.	Low	Protection of riparian areas, swamps and marshes, including the immediate environs of the Condamine River.	Low
Regent Honeyeater	*Anthochaera Phrygia*	EN, Mi	As for Swift Parrot. Not recorded from the CSG Field areas. In 2008, breeding was recorded in Durakai SF near Warwick.	Low	Minimal clearing in forested habitats including riparian areas	Low
Paradise Parrot	*Psephotus pulcherrimus*	EX	No records. No longer considered to occur in the area.	Nil	N/A	Nil
Australian Painted Snipe	*Rostratula australis*	VU	Widespread in eastern Australia. Not recorded in the CSG Field although it may occur in seasonal wetlands.	Moderate	Protection of riparian areas, swamps and marshes, including the immediate environs of the Condamine River.	Low
Plains-wanderer	*Pedionomus torquatus*	VU	Not recorded in the area.	Nil	N/A	Nil
Black-breasted Button-quail	*Turnix melanogaster*	VU	Dry vine forest is a primary habitat for this species and is exceedingly scarce in CSG Field.	Low	Planning and clearance surveys	Low
Mammals						
Eastern Long-eared Bat	*Nyctophilus timoriensis*	VU	Most commonly found in central western NSW and recorded in Qld in the Inglewood area. Occurs sparsely	Moderate	Minimal clearing in forested habitats including riparian areas	Low

Common Name	Scientific Name	EPBC	Assessment	Potential to be Impacted Without Mitigation Measures	Mitigation Measures	Potential to be Significantly Impacted with Mitigation Measures
			in a wide variety of habitats.			
Large-eared Pied Bat	*Chalinolobus dwyeri*	VU	Widely distributed but uncommon species known from mines and caves but is also a tree dweller. Major populations occur in proximity to sandstone and other rocky formations which presumably, are important roosts. Unlikely to occur in significant numbers in the CSG Field.	Low	Planning and minimal clearing in forested habitats including riparian areas	Low

***Status:** Commonwealth (EPBC) listed: **EX** = Extinct; **CE** = Critically Endangered; **EN** = Endangered; **VU** = Vulnerable; **Mi** = Migratory Species, **Ma** = Marine Species.

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6.6 Potential Impacts on Aquatic Fauna

Aquatic environments in the CSG Field are small in extent and will generally be excluded from any development. In some instances, linear features such as small creeks may need to be crossed in order to connect adjacent infrastructure. In these cases, the mitigation measures described in **Section 7** will substantially control the potential impacts associated with these construction activities.

As with other taxa groups, if the offsets recommendation is adopted, then aquatic habitats may benefit by extra protection through this process.

6.7 Potential Impacts on Wetlands

The internationally recognised wetland downstream of the CSG Field (via the Condamine River) is the Ramsar-listed Narran Lake Nature Reserve. As it is approximately 450 km southwest of the CSG Field, it is considered that there is a low potential that the proposed activities will impact this wetland.

No major wetlands occur within the CSG Field. Two occur immediately outside the CSG Field, Lake Broadwater Conservation Park and Resources Reserve and The Gums Lagoon. Lake Broadwater Conservation Park and Resources Reserve is downstream of Broadwater gully that is situated within the CSG Field (EPP 648). Consequently without appropriate mitigation measures, there would be potential for some impacts by nutrient and sediment flows and accidental releases of Associated Water. Gums Lagoon is not downstream of the CSG Field. Therefore, this wetland is not expected to be directly or indirectly impacted by the proposed developments.

6.8 Potential Impacts on Environmentally Sensitive Areas

Environmentally Sensitive Areas are described in **Section 5.4** and shown in **Figure A.20 [QC02-T-MA-0021]**.

The previous discussions on potential impacts to flora and fauna values apply equally to the Environmentally Sensitive Areas. To avoid repetition, these potential impacts are not repeated here.

In the absence of appropriate mitigation measures there could be potential for Environmentally Sensitive Areas within the CSG Field to be significantly impacted by the proposed developments. In order to mitigate these impacts, **Section 7** recommends a constraint based approach to development within the CSG Field which includes identification of constraints areas through the analysis and mapping of overall conservation values. This approach then facilitates the development of a zoning system so that more stringent environmental conditions can be applied to areas of high conservation value Through the use of this zoning system it is anticipated that potential impacts to key habitats and taxa will be minimal.

Assuming the successful adoption and implementation of the mitigation and rehabilitation recommendations outlined in **Section 7**, the potential for the Project to have significant impacts on Environmentally Sensitive Areas is low. There is potential for the project to contribute to protecting and improving environmental values in these areas through conservation focussed offsets and land management initiatives.

7.0 MITIGATION AND REHABILITATION RECOMMENDATIONS

7.1 Constraints Based Approach to Managing Impacts

The synthesis of all conservation values identified from EPA data, specific field survey work and other sources as identified previously in this report, has enabled the development of mapping that indicates the overall conservation values for areas across the QGC Field. This mapping is presented as the Environmentally Sensitive Areas shown in **Figure A.20 [QC02-T-MA-0021]**.

This Environmentally Sensitive Areas mapping has then been used as a basis to develop an Ecological Constraints zoning system which places more stringent environmental conditions on areas of high conservation value and less stringent conditions where conservation values are lower (**Figure A.21 [QC02-T-MA-0040]**).

The mapping is primarily based on RE polygons and tenure considerations. In order to translate this into workable constraints zones for field operations, the mapping has been simplified and four constraints zones have been recommended. They are:

- Zone 1 Minimal Ecological Constraints
- Zone 2 Medium Ecological Constraints
- Zone 3 High Ecological Constraints, and
- Zone 4 Very High Ecological Constraints.

The guidelines below are presented as:

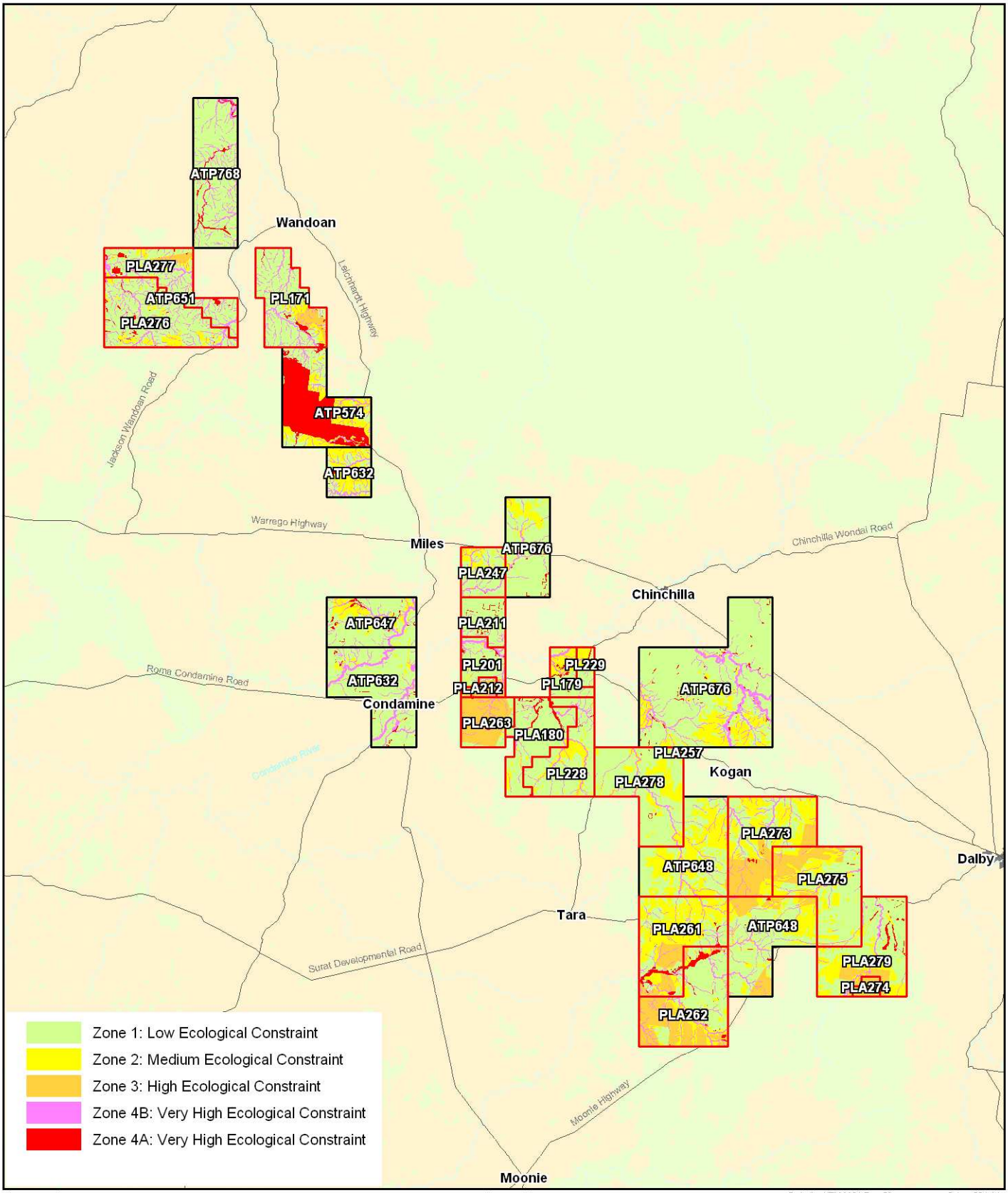
1. General recommendations that are applicable across the whole of the CSG Field, and
2. Special recommendations for each constraints zone.

In this way, it is anticipated that potential impacts to key habitats and taxa will be minimised.

7.2 General Recommendations

In addition to the protection measures which are already part of the existing Environmental Management Plan (e.g. weed washdowns, water disposal, audits) (**Attachment 3** of **Appendix 3.2**), the following mitigation measures are recommended to help ensure that significant impacts on biodiversity are avoided where possible and otherwise minimised:

- Infrastructure will be located away from remnant vegetation areas whenever possible. This includes roadside verges, travelling stock routes and similar areas that may have so far escaped clearing in otherwise cleared and developed areas
- The clearing or disturbance of all EPBC listed Ecological Communities will be avoided whenever possible
- An offset strategy which compensates for all unavoidable clearing will be developed and implemented (refer **Section 7.7**)
- Individual site pre-clearance surveys will be undertaken for each proposed road, well pad and pipeline (and other infrastructure), as is currently the practice, to enable detection and avoidance of flora and fauna values whenever possible, but should be expanded to include:



Legend:

Gas Fields - Petroleum Lease/Petroleum Lease Application

Gas Fields - Authority to Prospect

Source Note:

Regional Ecosystems v5.0 copyright QLD Herbarium
QLD Protected Areas copyright Environment Protection Agency
DCDB data copyright State of Queensland (2008)

Projection UTM MGA Zone 56 Datum GDA 94

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QUEENSLAND CURTIS LNG A BG Group business	Project	Queensland Curtis LNG Project	Title **Gas Fields - Ecological Constraints Zones**
	Client	QGC - A BG Group business	
ERM Environmental Resources Management Australia Pty Ltd	Drawn Mipela	Annex 13.1 Figure 13.21	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.
	Approved CDP	File No: QC02-T-MA-00109	
	Date 17.07.09	Revision A	

  - The presence or absence of EPBC Listed communities (including the Weeping Myall Open Woodland Community) and species
  - Identification of potential microhabitat for fauna (e.g. hollow-bearing trees) and fauna habitat which may require the presence of fauna handlers during clearing
  - Confirmation of results of the EVR flora field clearance searches and fauna microhabitat features
  - Compulsory answers/options providing a clear action path stemming from each answer
  - Identification of permitting requirements, and
  - Note the presence or absence of declared weed species in order to develop site-specific weed management options (control, vehicle and machinery washdowns).
- A clearing database will be maintained to record the areas of each RE cleared for CSG activities/infrastructure
- Good weed hygiene practices should be adopted to minimise the introduction or spread of declared, agricultural and environmental weeds in the CSG Field. These should include regular ongoing monitoring of areas disturbed by CSG activities
- Declared, agricultural and environmental weeds should be controlled throughout the construction, operational and decommissioning phases of the project. In relation to the construction footprint and areas of disturbance, it is recommended that environmental weeds, such as Buffel Grass (*Cenchrus ciliaris*), Castor Oil (*Ricinus communis*), Mexican Poppy (*Argemone ochroleuca*), Mimosa Bush (*Acacia farnesiana*) and Guinea Grass/Green Panic (*Megathyrsus maximus*) are also managed, particularly during the construction phase and subsequent rehabilitation works. Rehabilitation of disturbed areas may also benefit from control of other exotic grasses; however, landholders may request that these species are retained for grazing purposes
- A Weed Management Plan that addresses the construction, rehabilitation and operation phases of the project will be prepared prior to construction. This Plan will include hygiene protocols to minimise the likelihood of introduction and spread of environmental, agricultural and declared weeds
- Fauna handlers will be present to survey for, and as necessary relocate wildlife immediately prior to and during clearing activities in all locations identified as containing suitable fauna habitat during the pre-clearance surveys
- Fire fuel loads will be monitored and vehicle activities will be restricted to roads, access tracks and hardened surfaces to reduce the possibility of wildfire. Vehicles will be fitted with spark arrestors and fire fighting equipment will be available at construction sites
- Vegetated creeklines, fencelines and road reserves will be crossed at approximately 90 degrees whenever possible to limit the extent of clearing
- Measures will be taken to avoid placing water storage facilities in the Lake Broadwater catchment area (Broadwater Gully) which occurs in the south eastern corner of EPP 648. This may help reduce the potential for nutrient,

sediment and Associated Water (accidently released) flows entering Lake Broadwater Conservation Park.

- The EMP will include appropriate requirements in relation to management of waste and potential contaminants, and
- Conservation Plans will be developed and implemented. These plans will set out conservation focussed land management initiatives to be taken on QGC owned land.

7.3 Recommendations for Zone 1 Minimal Ecological Constraints

These areas are substantially altered habitats with existing pastures of predominantly non-native species, cropping lands, intensively grazed and rural-residential areas. Some unmapped remnant vegetation may occur along the margins of paddocks or in roadside reserves and may be of moderate to high conservation value but are relatively small in extent and managed in the overall context of the predominant land use of the area.

Since the majority of this zone is privately owned and managed for primary production, the wishes of the landholder will be a primary factor in determining the placement and management of infrastructure, subject to the general guidelines above (**Section 7.2**) as they relate to least concern flora and fauna, EPBC Act Listed species, Ecological Communities / REs and weeds.

Final rehabilitation requirements for sites in this zone will be negotiated with the landowner. In most cases they would provide for the return of areas to productive agricultural land.

7.4 Recommendations for Zone 2 Medium Ecological Constraints

Zone 2 areas include all mapped remnant vegetation (with the exception of Zone 3 and 4 areas). In addition to the General Guidelines, the following mitigation measures have been adopted for Zone 2 areas. :

- Infrastructure and access lines will be located along existing easements where possible
- Fauna handlers will be present to survey for, and as necessary relocate wildlife immediately prior to and during clearing activities in all locations identified as containing suitable fauna habitat during the pre-clearance surveys
- Vegetative waste as a result of clearing will be mulched or distributed across adjacent areas where it may provide refuge for terrestrial species. It will not be burnt, and
- Linear features such as roads and pipelines will be built to a standard sufficient to allow for their intended purpose but should be allowed to revegetate as much as possible in order to minimise their impact on terrestrial fauna movements.

7.4.1 Rehabilitation Requirements

Rehabilitation will be negotiated with the landholder where applicable. Unless roads and pads are to be retained for other use, 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.

A re-seeding plan will be developed based on soil types, existing local vegetation characteristics and landholder preferences along the alignment. If available (and subject to landholder preferences), local provenance native seed will be used for

regeneration seeding following construction in all disturbed areas. If local provenance seed cannot be collected or purchased, native grass seed from other parts of central Queensland will be purchased from commercial operators and re-spread in these locations.

Monitoring and control of weeds will be conducted on an ongoing basis during the life of the Project. A Weed Management Plan that addresses the construction, rehabilitation and operation phases of the project will be prepared prior to construction. This Plan will include hygiene protocols to minimise the likelihood of introduction and spread of environmental, agricultural and declared weeds.

Rehabilitation should be monitored on a monthly basis for six months after works are completed and then bi-annually for two years.

7.5 Recommendations for Zone 3 High Ecological Constraints

Zone 3 areas are all the State Forests within the CSG Field, with the exception of Gurulmundi State Forest, namely:

- Hinchley State Forest
- Mount Organ State Forest
- Cherwondah State Forest
- Condamine State Forest
- Braemer State Forest
- Vickery State Forest
- Daandine State Forest
- Weranga State Forest, and
- Kumbarilla State Forest.

State Forests were selected as High Ecological Constraints areas because they contain the vast majority of the mapped REs of high conservation value including areas of significant value to EVR flora and fauna, refugial areas and areas critically important to the maintenance of existing biodiversity values.

For High Ecological Constraints areas, the following recommendations are made in addition to those identified in **Sections 7.2-7.4**:

- All CSG Activities to be planned and undertaken in close liaison with EPA State Forest Management staff
- Where possible, site access to be only along existing cleared tracks, fire trails and easements. Where this is not possible, access is to be negotiated with EPA State Forest management staff.
- EPA and/or independent flora and fauna consultants to be involved in detailed pre-clearance surveys as part of early planning for infrastructure locations
- In order to minimise fragmentation effects pads for gas extraction will be of minimum safe area and placed against the edge of existing easements where possible
- Use of “Best Available Technology” to minimise clearing requirements.
- Access tracks will be incorporated into pad clearance areas where possible to minimise total clearing requirements.

- Extraction methodologies that minimise the density of well pads in these areas (e.g. horizontal drilling) will be investigated and used where practicable
- Vehicles and machinery will require washdown before entering State Forest, if they have come from Zone 1 areas or known weed areas. The control of Buffel grass is a key consideration in this zone, and
- Access tracks will be regularly inspected for weeds and control measures employed where serious environmental or declared weeds are identified. It is recognised that some weed species may have established in areas pre-project commencement, and so less emphasis will be placed on these. The primary object of the guideline is to control weed spread that may occur as a direct result of the project.

7.5.1 Rehabilitation Requirements

Rehabilitation will be managed in close liaison with the landholder (EPA) and involve the restoration of sites to a level that is mutually acceptable to the parties, the overall goal being the maintenance of biological processes and conservation of natural systems.

7.6 Recommendations for Zone 4 Very High Ecological Constraints

Zone 4a and 4b included areas with the highest ecological values. These values could potentially be significantly impacted by the CSG activities. It is therefore recommended that all non-linear CSG infrastructure be excluded from these Zones. The construction of gathering systems and access tracks should follow the criteria in Zone 3 throughout the areas, with avoidance of new disturbance being the primary objective.

Zone 4a areas are considered to have higher conservation values than Zone 4b. They are distinguished from each other only for the purpose of enabling planning of linear infrastructure to avoid Zone 4a areas in preference to Zone 4b areas in locations where such areas are unavoidable.

Areas within Zone 4a include:

- Gurulmundi State Forest and the Environmentally Sensitive area immediately north west of the State Forest. The location of linear infrastructure (e.g. pipelines and access tracks) through this area will be determined by ecologist field studies at the detailed design stage to follow existing tracks and previously disturbed areas where possible and to avoid or minimise disturbance of highest value areas (e.g. EVR plant populations, high quality fauna habitats, steep terrain). QGC will not undertake drilling or development of non-linear infrastructure in this area prior to government endorsement of detailed development plans showing proposed production techniques and infrastructure locations. Such a plan would be based on detailed ecological investigations within this area and would aim at ensuring that any such development would be undertaken in an ecologically sustainable and acceptable manner.

- EPBC Act listed Ecological Communities, and
- The EPA defined Category B Environmentally Sensitive Areas which, in the CSG Field, include:
  - VM Act Endangered Res, and

- Additional REs classified as Endangered under the EPA's Biodiversity Status.

Areas within Zone 4b include:

- RE 11.3.27 (ephemeral wetlands), and
- Buffer zones adjacent to watercourses in accordance with the Environmental Authority conditions for QGC's existing operations, namely:
  - 50m from Stream Order 1 and 2 watercourses
  - 100m from Stream Order 3 and 4 watercourses, and
  - 200m from Stream Order 5-8 watercourses.

It is recognised that in a small number of instances linear infrastructure (e.g. collection lines, pipelines and access tracks) will be unable to avoid transecting linear remnants and watercourses of very high ecological value (i.e. Zone 4 a and b areas). Provided such unavoidable impacts are minimised and compensated for by offset initiatives the proposed activities will not have a significant impact on the conservation values of these areas.

7.7 Environmental Offsets and Conservation Focused Land Management

An environmental offsets strategy is expected to be developed prior to the commencement of the Project. That strategy will identify the environmental offset activities which will be established to compensate for all ecological impacts (e.g. loss of vegetation, fragmentation of fauna habitat and movement corridors, disturbance of EVR flora) where clearing and CSG extraction activities within areas of remnant vegetation areas are unavoidable. It is envisaged that there will be opportunities to undertake most offset activities within the Gas Field (as opposed to removed locations).

To the greatest practicable extent the offset activities will address both Commonwealth and Queensland Governments' offsets legislation and policy, including Part 9 of the EPBC Act (in particular s. 134 and 136), and the Queensland Government's Environmental Offsets Policy (QGEOP) (EPA 2008). As such, the 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.

According to the QGEOP, an environmental offset is taken to be legally secured if protected by some form of legally binding mechanism. These can include:

- Designation as a protected area under the *Nature Conservation Act*
- Designation as an area of high nature conservation value under the *Vegetation Management Act*, and
- The purchase of land or the establishment of a covenant under the Land Title Act 1994 (EPA 2008d).

It is preferable that offsets are protected for the long term by purchasing land or establishing covenants on title (e.g. VM Act covenants). As such, selection of offset sites will also depend on a number of non-environmental factors including:

- land tenure – tenure needs to enable purchase or covenants on title
- landholder preferences – it will be necessary to find willing landholders to sell or covenant land
- land use – (e.g. alienation of GQAL constraints and possible synergies and constraints relating to CSG activities and other land uses)

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

Current government policy stipulates that a 'package' of offset actions is likely to lead to the better conservation outcomes. QC LNG should be in keeping with this best practice by considering a broad range of direct and indirect actions throughout the initial development stage of its Offsets Strategy.

Priority offset areas from an environmental perspective would include:

- Matters of National Environmental Significance
- EREs
- OC REs
- Any REs where clearing may be considered as a significant impact.
- Particular EVR fauna habitats
- EVR flora rich areas
- Connections/Corridors
- Riparian areas
- Areas containing wetlands and Marine Plant areas (REs 11.1.2, 11.1.4, 11.3.27)
- Areas linking/adjoining any of the above areas.

Flora assessments and detailed fauna surveys have noted the relatively degraded state of many environments in the Gas Field. The impacts identified include inappropriate fire regimes, environmental and declared weed invasions, feral animals and grazing pressure from stock.

Through its investment in the region, QGC will provide opportunities to manage some of these environmental issues and thus realise local environmental benefits. QGC has invested significantly in fencing and gates to control stock movements,

improved access tracks and increased personnel in the region, all of which assists in fire prevention and limits weed propagation. Areas dedicated as environmental offsets, would provide further opportunities for enhanced environmental management through the dedication of special purpose conservation areas and may improve the connectivity between these environments.

It is recommended that where offset areas are established, management and monitoring plans 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 should 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.

8.0 CONCLUSION

Provided that the recommended mitigation and rehabilitation measures are adopted and successfully implemented, the proposed CSG extraction activities will be unlikely to have a significant impact on any EPBC Act MNES.

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