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6.1 INTRODUCTION

This chapter provides a summary of the environmental values, potential impacts and mitigation measures for terrestrial ecology within the proposed rail corridor.

Desktop and field studies were used to identify, describe and assess key flora and fauna values of the study area and potential impacts associated with both the construction and operation of the rail infrastructure.

The Project environmental objective for the terrestrial ecology is to undertake Project activities such that impacts on terrestrial flora, fauna and ecological communities are minimised.

The detailed rail assessment report addressing flora and fauna matters is provided in Volume 5, Appendix 12.

6.2 ASSESSMENT METHODS

The Project environmental objectives for this chapter are based on:

- the protection of flora and fauna diversity;
- ensuring significant species are protected through management and mitigation measures in developing; and
- ensuring any actions associated with the rail do not promote or introduce the establishment of pest species.

The impacts on fauna and flora have been assessed after reviewing publicly available databases, previously published information and studies and detailed field surveys including, but not limited to:

- Queensland Herbarium Regional Ecosystem (RE) mapping (Version 6.0, 2009) to identify mapped significant vegetation communities;
- Queensland Herbarium HERBRECS data and DERM Wildlife Online databases to identify all flora and fauna species of conservation significance known to occur within the wider study area;
- Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) Protected Matters Search Tool to identify all Matters of National Environmental Significance (MNES) known or potentially occurring within, or close to, the study area including Ramsar-listed wetlands, critical habitat areas, threatened ecological communities, fauna and flora species and other matters including conservation areas;
- DERM Property Maps of Assessable Vegetation (PMAV) to identify areas of high-value regrowth vegetation as listed under the *Vegetation Management Act 1999* (VM Act);
- DERM Queensland Essential Habitat Area (EHA) mapping to identify essential habitat areas for Threatened listed flora species;
- Review of records held by the QLD Museum;
- Review of Wildnet Database;
- Review of Birds Australia records;
- DERM Desert Uplands Biodiversity Planning Assessment (BPA) to identify areas of ecological significance at the state, regional and local level;
- DERM Environmentally Sensitive Area (ESA) map layers to identify key ecologically sensitive areas including, wetlands, Endangered REs (Biodiversity Status) and nature refuges;
- Directory of Important Wetlands (Blackman *et al.* 1999) database;
- DERM Queensland Wetlands mapping (WetlandInfo);
- Satellite imagery to gain an appreciation of the project's proximity to sensitive areas, assess vegetation patterns and identify target areas for field investigations;
- DERM Brigalow Belt and Desert Uplands Biodiversity Planning Assessments (BPAs) to identify areas of ecological significance at the state, regional and local level;
- DERM Wildlife Online;
- Queensland Museum data;
- Priority Taxa under the Biodiversity Assessment and Mapping Methodology (BAMM) Criteria H;
- Aerial observation of the entire length of the route; and
- On ground surveys for flora and fauna habitat at 57 survey sites.

As detailed in Volume 3, Chapter 1, Section 1.1.2, (changes in alignment since field assessments) the ecology assessment for the rail alignment was undertaken in July 2010. A corridor of 1.6. km (i.e. 800 m either side of the proposed rail alignment) was defined as the study area for the rail assessment. However, since July 2010 the proposed rail alignment has shifted (as depicted in Volume 3, Chapter 1, Figures 2 to 5) to accommodate design elements and

community concerns. The majority of the changes are within the 1.6 km corridor. The calculations of the amounts of ecological values to be impacted were based upon a corridor of 100 m around the alignment as it was proposed in July 2010. As a consequence of the subsequent changes in rail alignment, the specific amount of REs and other ecological values to be impacted will also have changed, and hence the results presented herein are indicative, not definitive, at this stage. However, given the relatively minor nature of the changes in alignment, the changes are not considered likely to be significant, and it is likely that the type and magnitude of impacts will be very similar to those presented herein. Waratah are committed to undertaking detailed surveys of all remnant vegetation to be cleared prior to finalisation of the alignment.

The assessments in this chapter describe the alignment as it was at the time of the field assessments (July, 2010), while the figures in this chapter depict the alignment as it currently stands. A comparison of the alignment as it was at the time of assessment and the alignment as it currently stands can be found in Figures 2 to 5 in Volume 3, Chapter 1. In addition, the subsequent changes to the rail alignment at the mine and port end (as described in Volume 3, Chapter 1, Section 1.1.2), are also shown.

6.3 EXISTING ENVIRONMENT

The proposed alignment is shown on Figure 1. This figure shows the location of survey sampling sites, kilometre points and observed and recorded occurrences of Threatened or Near Threatened flora and fauna. This data is overlain at a larger scale on the regional ecosystem maps at Figures 5 to 7.

6.3.1 FLORA

6.3.1.1 Terrestrial Flora Field Assessment

The terrestrial flora assessment of the proposed rail corridor was conducted over ten days in July 2010.

The assessment was conducted by helicopter (for all KPs except KP 0 - 20) and included:

- aerial observation of the entire length of the route; and
- detailed (on-ground) flora surveys at 57 sites shown in detail on Figures 5 to 7.

The aerial observations were conducted from between 30 - 250 m elevations and enabled obvious vegetation community characteristics to be recorded (e.g. confirmation of the presence / absence of Brigalow communities, Semi-evergreen Vine Thicket communities and Eucalypt forests and woodlands).

Survey sites S1 and S2, within KP 0 – 20, were accessed by vehicle and foot on 24 July 2010. The on-ground field surveys:

- targeted Threatened Ecological Communities (TECs) / REs as well as representative REs mapped within the Study Area;
- were assessed to the 'tertiary' level in accordance with the methodology outlined by the Queensland Herbarium (Nelder *et al*. 2005) and data collected was compatible with the Queensland Herbarium's CORVEG database;
- included investigation of the presence / absence or likely presence / absence of Threatened and Near Threatened flora species and Significant Ecological Communities within and in the vicinity of all tertiary survey sites;
- included investigation of the presence / absence or likely presence / absence of significant weed species; and
- included observations on the wider environment surrounding each tertiary survey site so that potential impacts could be considered in the Local, Regional and State contexts.

Data collected at the Tertiary flora survey sites included:

- confirmation of mapped REs;
- description of vegetation present;
- the presence and identification of significant flora species;
- the presence and identification of significant weeds; and
- general condition of the vegetation communities present.

6.3.1.2 Flora Environment

The proposed rail corridor is located within the Brigalow Belt North bioregion (from KP 0 to KP 376) and Desert Uplands bioregion (from KP 376 to 445).

The Brigalow Belt North bioregion encompasses an area of approximately 59,824 km^2 with landforms which vary from rugged ranges to alluvial plains. Vegetation communities are predominantly acacia open forests and eucalypt woodlands. Major population centres along the rail route in this bioregion include Bowen and Collinsville.

The Desert Uplands bioregion encompasses an area of about 70,300 km^2 and straddles the Great Dividing Range between Blackall and Pentland in central northern Queensland. The bioregion partly lies within the Galilee and Eromanga Basins. These Basins consist of Mesozoic to Tertiary (less than 251 million years ago) sediments including major coal and gas deposits (ANRA, 2009). The vegetation of this bioregion consists predominantly of eucalypt and acacia woodlands (often with an open spinifex understorey).

At the broad scale, the proposed rail corridor transects cleared pasture lands, eucalypt and acacia woodlands, narrow strips of riparian vegetation and small pockets of high value regrowth.

The dominant land use for the vast majority of the area transected by the proposed rail corridor is cattle grazing. A significant portion is cleared of standing timber for cattle pastures. These areas are dominated by buffel grass (*Pennisetum ciliare*), an introduced invasive pasture species which is well established in most areas throughout the proposed rail corridor.

The proposed alignment commences in an area of open eucalypt woodland, subject to cattle grazing, on the northern side of the Bruce Highway. It then travels to the west through a gap in the Great Dividing Range and crosses a number of creeks in undulating rocky country comprising of eucalypt woodlands with a sparse, grassy understorey. Where riparian zones are present in the area they are lined with gallery forest and dominated by *Melaleuca* spp. Most creeks are heavily infested with weeds, including dense stands of rubber vine (*Cryptostegia grandiflora*), Mexican poppy (*Argemone ochroleuca*) and noogoora burr (*Xanthium occidentale*), and are also subject to heavy grazing.

From Sites 10 to 13, the corridor runs through undulating hills that support open Eucalypt woodlands with degraded and severely grazed understorey dominated by Buffel grass. Patches of native grass (including *Dicanthium* sp. dominated grasslands) were observed. Creeklines in this area were smaller and fringed by open eucalypt woodlands or, in some more sheltered areas, Semi-evergreen vine thicket remnants in very poor condition.

From the Collinsville area (Site 13) to the south, the corridor moves into gently undulating plains supporting Eucalypt woodlands and scattered patches of Brigalow with grassy understorey. Most areas were heavily grazed and in poor condition.

As the corridor proceeds south from this area (from Site 16), it moves into slightly steeper terrain and the overall quality of vegetation improves (Sites 17 to 24).

South of the Bowen Developmental Road (nearest to Site 24) the corridor traverses an area of Sandstone range with bare, exposed rock and skeletal soils (Site 25). This area had been extensively burnt by a very severe fire; however, sufficient pockets of protected vegetation remain. In some areas, these rocky hills support lancewood thickets (Sites 26 and 34) with spinifex understorey. Site 28 is in an extensive area of remnant vegetation that is significant in terms of its size and quality with woodlands supporting grassy and shrubby understorey.

South of the Suttor Development Road (from Site 29), the corridor enters an extensive region of gently undulating plains, intersected by large, braided river systems. This includes the Suttor River, Mistake Creek and Belyando River. The vegetation throughout this region is comprised of open Eucalypt woodlands with interspersed patches of Brigalow. Larger trees and dense vegetation dominates in the areas subject to seasonal flooding. Overall condition of the vegetation varied from good to degraded, depending on the intensity of grazing pressure and extent of buffel grass establishment. This pattern continues south to the proposed mine site.

As detailed in the following sections, the main ecologically significant features of the proposed rail corridor include:

- Ecological Communities protected under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) including Brigalow communities and Natural Grasslands;
- Endangered Regional Ecosystems (ERE);
- Of Concern REs;
- a number of major watercourses including Suttor River, Mistake Creek and Belyando River;
- a number of watercourses which are preferred habitat for the threatened flora species black ironbox (*Eucalyptus raveretiana*); and
- areas containing high habitat values for fauna species.

6.3.1.3 DERM's Environmentally Sensitive Areas

Terrestrial ESAs as provided by DERM's online ESA mapping are shown in Figure 2 to Figure 4.

The Environmental Protection Regulation 1998 classifies environmentally sensitive areas according to the level of significance of each. There are no Category A and / or Category C ESAs occurring within or adjacent to the proposed rail corridor. The only ESAs occurring within the proposed rail corridor are Category B ESAs, being Regional Ecosystems listed as Endangered under DERM Biodiversity Status. The presence of Category B environmentally sensitive areas within the project area triggers the need for an environmental authority under the *Environmental Protection Act 1994* within the Category B areas. The balance of the site is exempt from this particular requirement.

The Category B ESAs recorded within the study area are predominantly Brigalow (*Acacia harpophylla*) dominant and co-dominant communities, but also include:

- Black gidgee (*Acacia argyrodendron*) woodlands (KP 205 - 207);
- Gidgee (*Acacia cambagei*) woodlands (KP 260 - 360); and
- False sandalwood (*Eremophila mitchellii*) open woodland on alluvial plains (KP 10 - 25).

The Brigalow communities are discussed in Section 6.4.1.1.4.

The black gidgee woodland survey site (Site 29) was found to be degraded by grazing activities. Harissa cactus (*Harrissia martini*) was identified as being present.

The Gidgee woodland survey sites (Sites 37, 39 and 51) were found to be in generally good condition; however, some areas have been degraded due to grazing and fire. The declared weeds (declared under the *Land Protection (Pest and Stock Route Management) Act 2002* (LP Act)) parthenium weed (*Parthenium hysterophorus*), velvet tree pear (*Opuntia tomentosa*) and harissa cactus were found to be present amongst these sites as well as buffel grass (which is not a declared weed but is significant ecologically as it has the potential to out-compete native groundcover species and increase biomass).

Figure 1. Overview Map

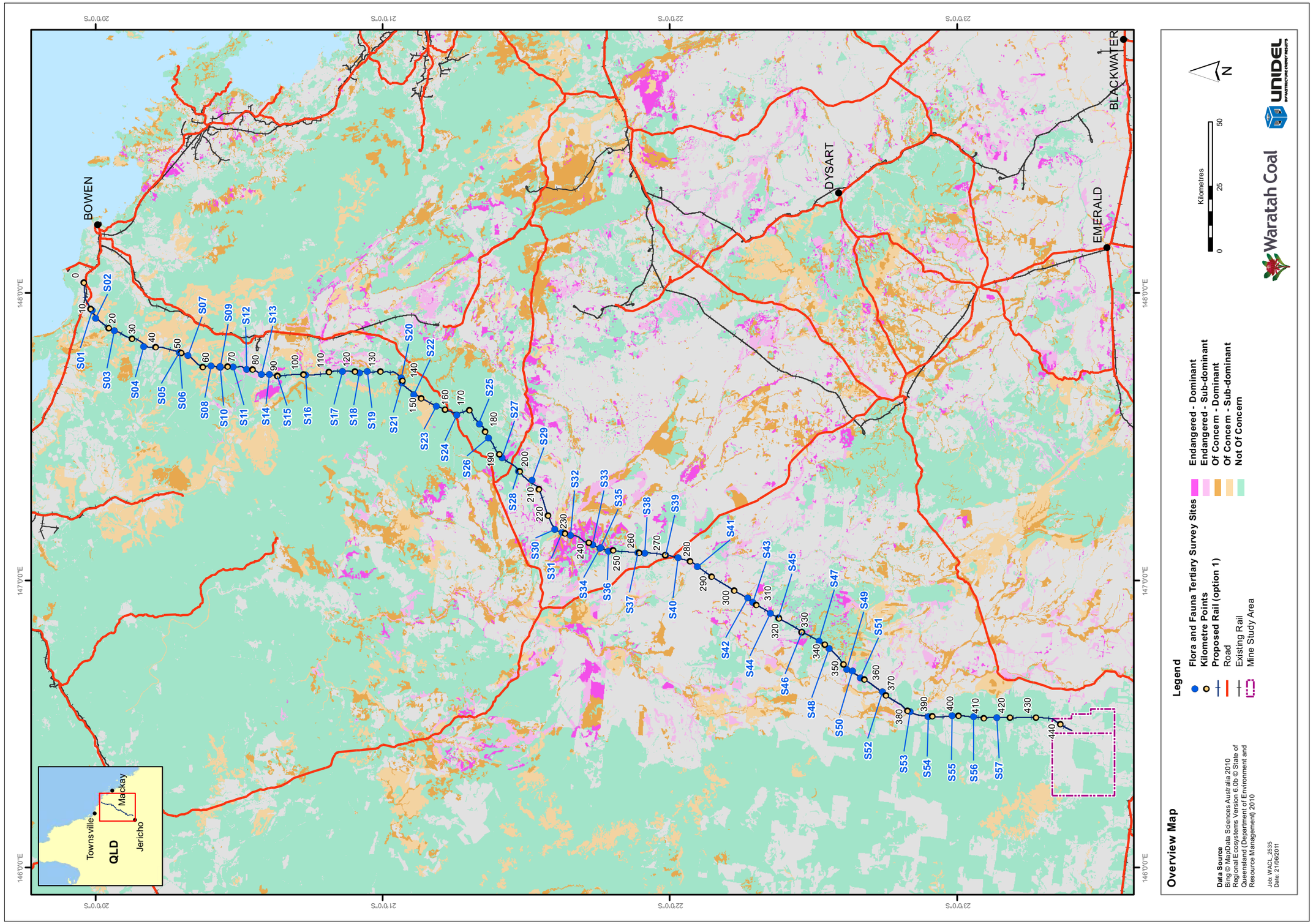


Figure 2. DERM Environmentally Sensitive Areas (Map 1 of 3)

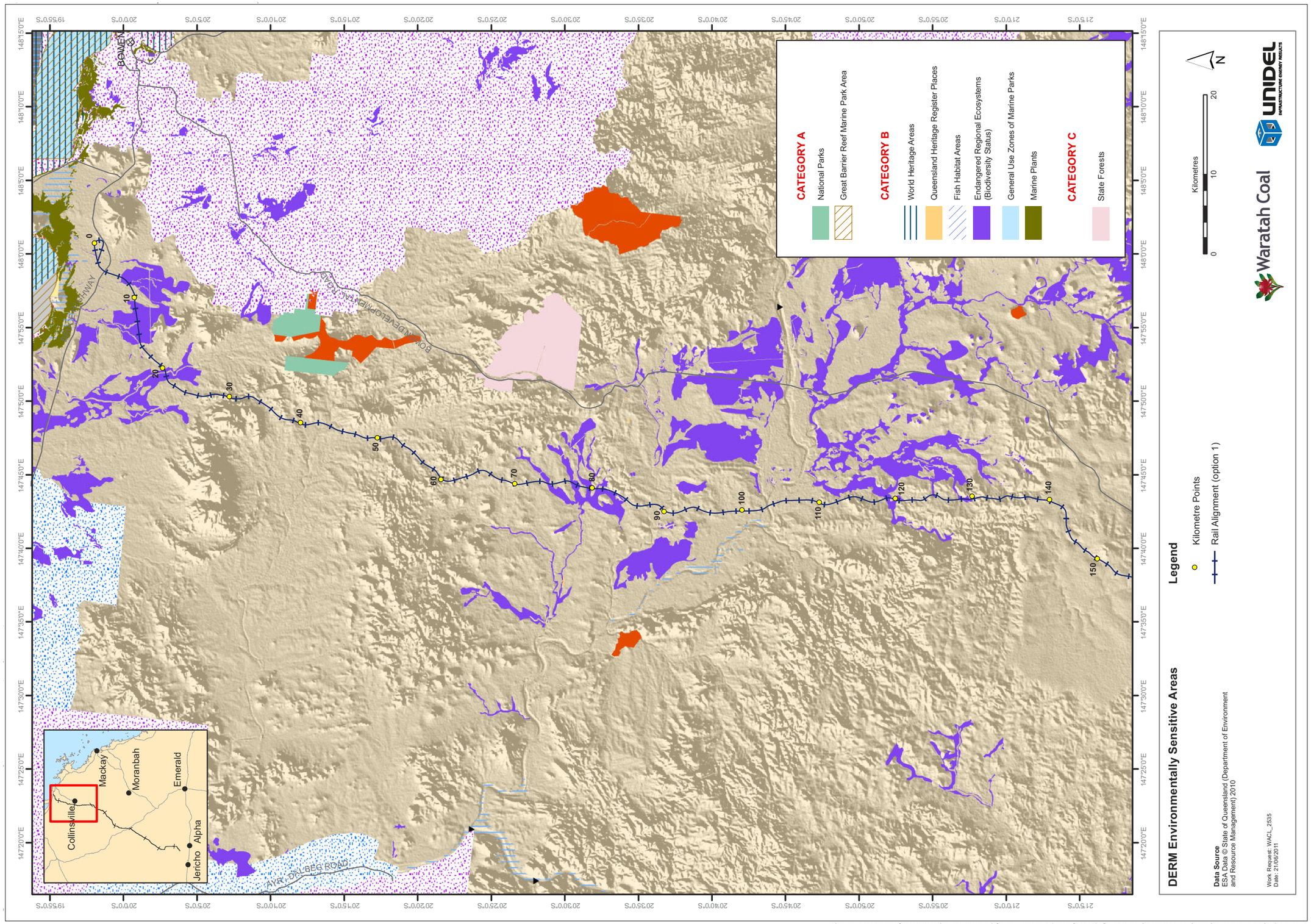
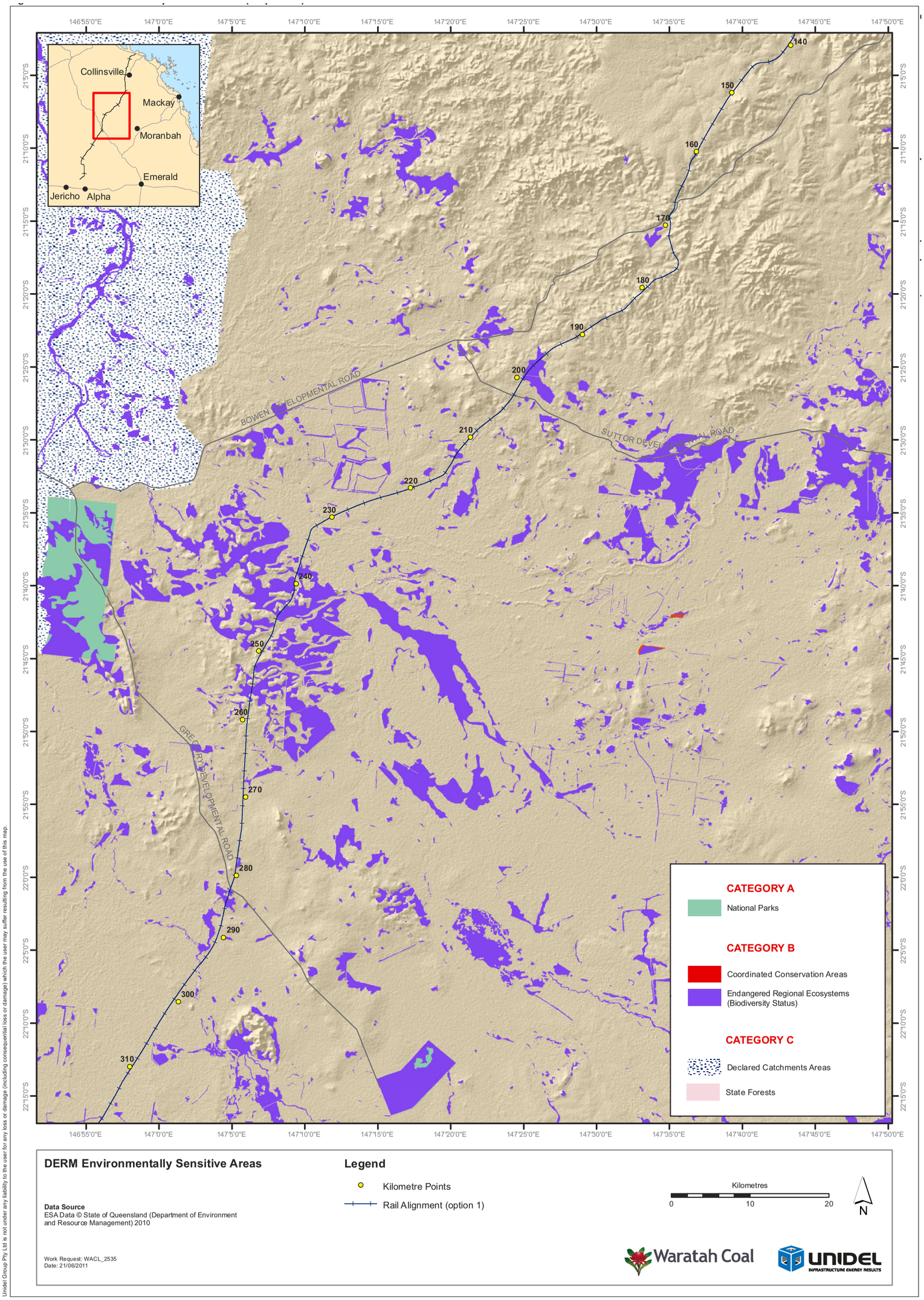


Figure 3. DERM Environmentally Sensitive Areas (Map 2 of 3)



DERM Environmentally Sensitive Areas

Data Source
ESA Data © State of Queensland (Department of Environment and Resource Management) 2010

Work Request: WACL_2535
Date: 21/06/2011

Legend

- Kilometre Points
- Rail Alignment (option 1)

Kilometres
0 10 20

N

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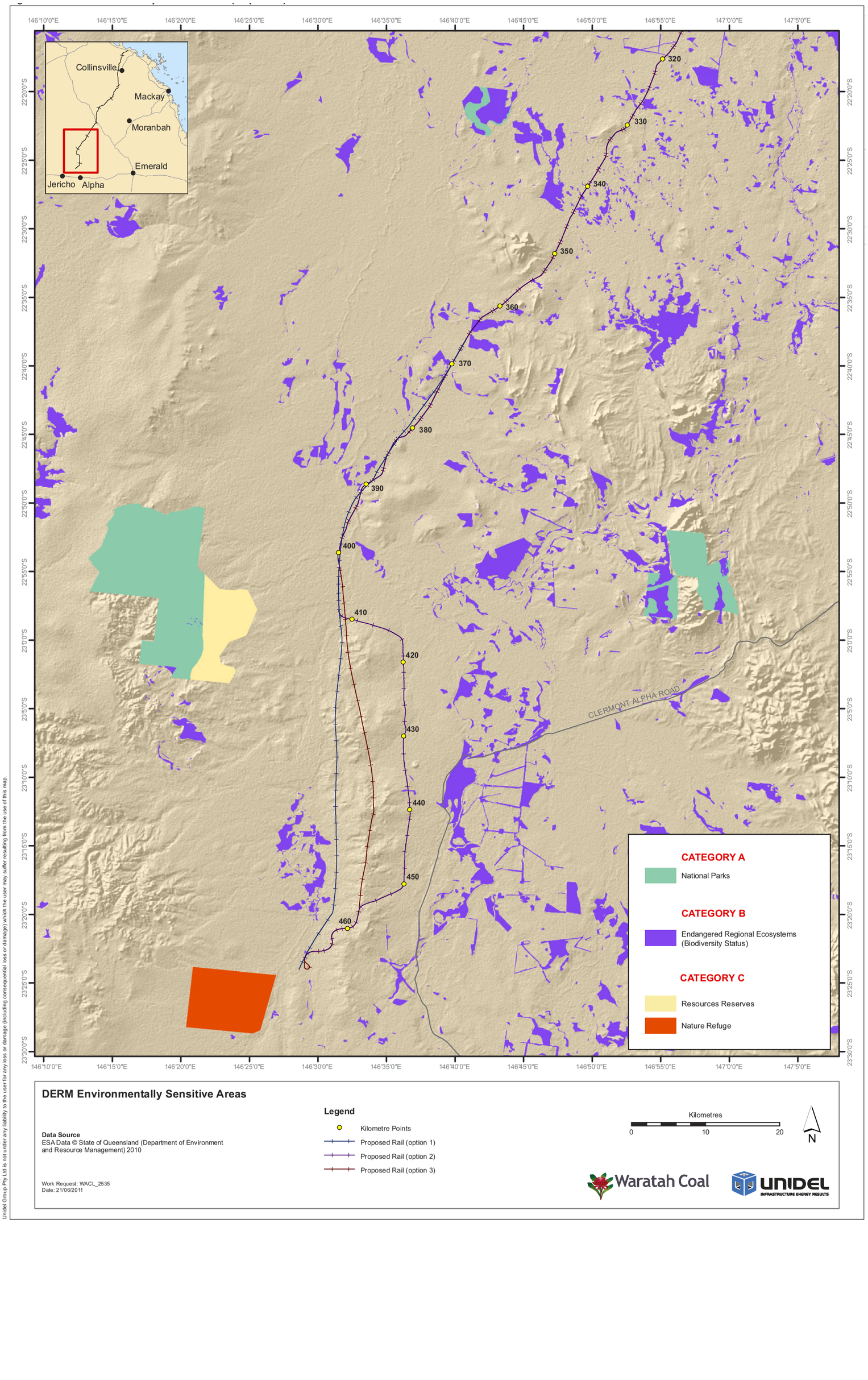
UNIDEL
INFRASTRUCTURE ENERGY RESULTS

Figure 4. DERM Environmentally Sensitive Areas (Map 3 of 3)



False sandalwood open woodland on alluvia plains is mapped as occurring within a mosaic between KP7 - KP25 (although this community was not present at any survey site, nor observed on the drive into Sites 1 and 2).

6.3.1.4 Ecological Communities / Regional Ecosystems

The EPBC Act Protected Matters Search Tool identified five Threatened Ecological Communities (TECs) potentially occurring within the broader study area. These are:

- Brigalow (*Acacia harpophylla* dominant and co-dominant);
- Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin;
- Weeping Myall Woodlands;
- Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions (SEVT); and
- the Community of native species dependent on natural discharge of groundwater from the Great Artesian Basin.

The field survey identified that one of these, Brigalow (*Acacia harpophylla* dominant and co-dominant), occurs as small intermittent patches throughout the length of the proposed rail corridor. Brigalow communities were generally observed to be in good condition.

Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin are mapped as occurring:

- as a pure stand at KP 273 (Site 38), however, the field survey found that this community had been removed by cultivation and no native grasslands occurred in the vicinity of this location;
- as 20 % of a mosaic RE at KP 192 (Site 27), however, the field survey found the Native Grassland does not occur along the proposed rail corridor at this location; and
- with patchy distribution around Collinsville (between KP 60 – 110) and the field survey confirmed that some Native Grasslands areas do occur within this portion of the proposed rail corridor.

The desktop study indicated that weeping myall woodlands could potentially occur in the southern portions of the proposed rail corridor although there is very limited suitable habitat (i.e. RE 11.3.2). No evidence of Weeping Myall Woodland was found during the field survey.

The desktop study indicated that the proposed rail corridor avoids any areas mapped as SEVT remnant vegetation; however the field survey observed a limited number of small areas of greatly degraded SEVT in sheltered pockets between KP 0 – 140.

The desktop study and field survey also concluded that the proposed rail corridor avoids any areas mapped as 'Communities of native species dependent on natural discharge of groundwater from the Great Artesian Basin'. Current RE mapping identifies 61 REs as occurring within the study footprint, including 45 Least Concern, 15 Of Concern and 3 Endangered (Figure 5 to Figure 7).

Table 1 shows each ecological community / RE mapped being transected by the proposed rail corridor and any tertiary survey sites which were conducted within each ecological community / RE or within areas mapped as containing each ecological community / RE. Table 2 shows the KPs where each TEC, Endangered RE and Of Concern RE is mapped as occurring or known to occur along the proposed rail corridor.

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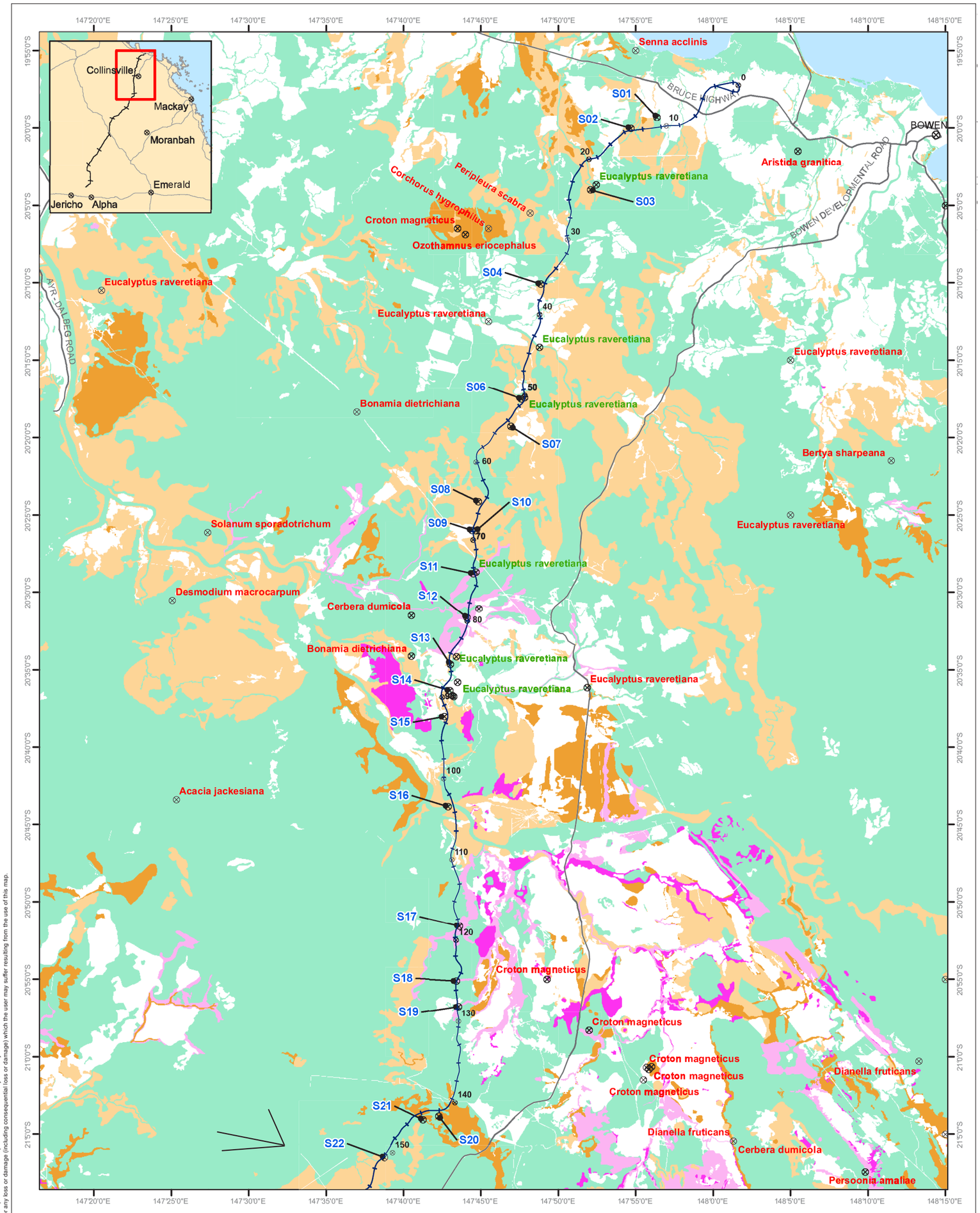
Figure 5. Regional Ecosystem Mapping (Map 1 of 3)



Regional Ecosystem Mapping and Location of Flora and Fauna Survey Sites

Legend

- Kilometre Points
- Flora and Fauna Tertiary Survey Sites
- Threatened and Near Threatened Flora Species Records (Unidel Data)
- Threatened and Near Threatened Flora Species Records (QLD Herbarium HERBRECS Data)
- Rail Alignment (option 1)
- Endangered - Dominant
- Endangered - Sub-dominant
- Of Concern - Dominant
- Of Concern - Sub-dominant
- Least Concern

Kilometres: 0 10 20

N

Data Source
Regional Ecosystem Data © State of Queensland (Department of Environment and Resource Management) 2010

Work Request: WACL_2535
Date: 21/06/2011

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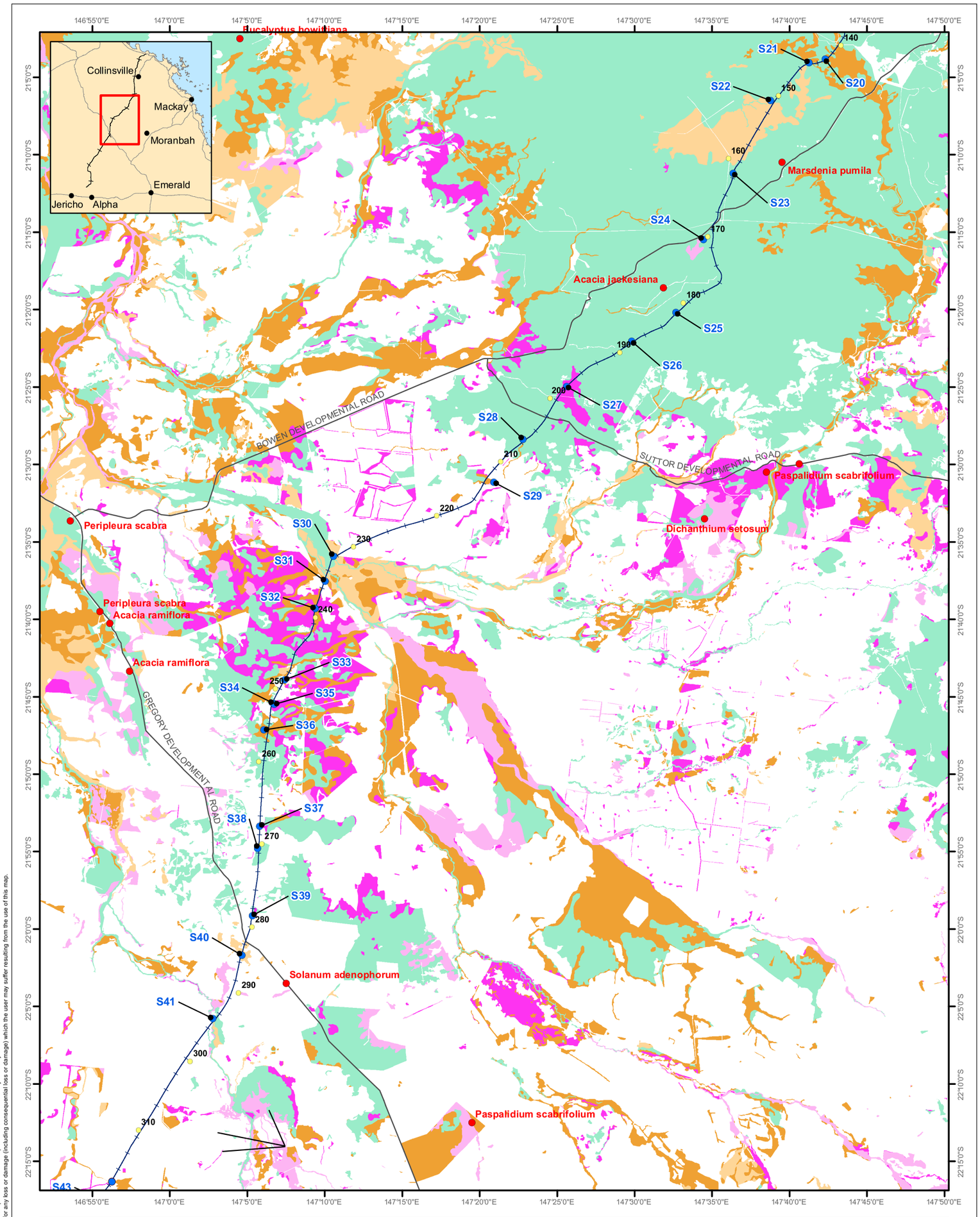
UNIDEL INFRASTRUCTURE ENERGY INSIGHTS

Figure 6. Regional Ecosystem Mapping (Map 2 of 3)



Regional Ecosystem Mapping and Location of Flora and Fauna Survey Sites

Legend

- Kilometre Points
- Flora and Fauna Tertiary Survey Sites
- Threatened and Near Threatened Flora Species Records (Unidel Data)
- Threatened and Near Threatened Flora Species Records (QLD Herbarium HERBRECS Data)
- Rail Alignment (option 1)
- Endangered - Dominant
- Endangered - Sub-dominant
- Of Concern - Dominant
- Of Concern - Sub-dominant
- Least Concern

Kilometres 0 10 20

N

Data Source
Regional Ecosystem Data © State of Queensland (Department of Environment and Resource Management) 2010

Work Request: WACL_2535
Date: 21/06/2011

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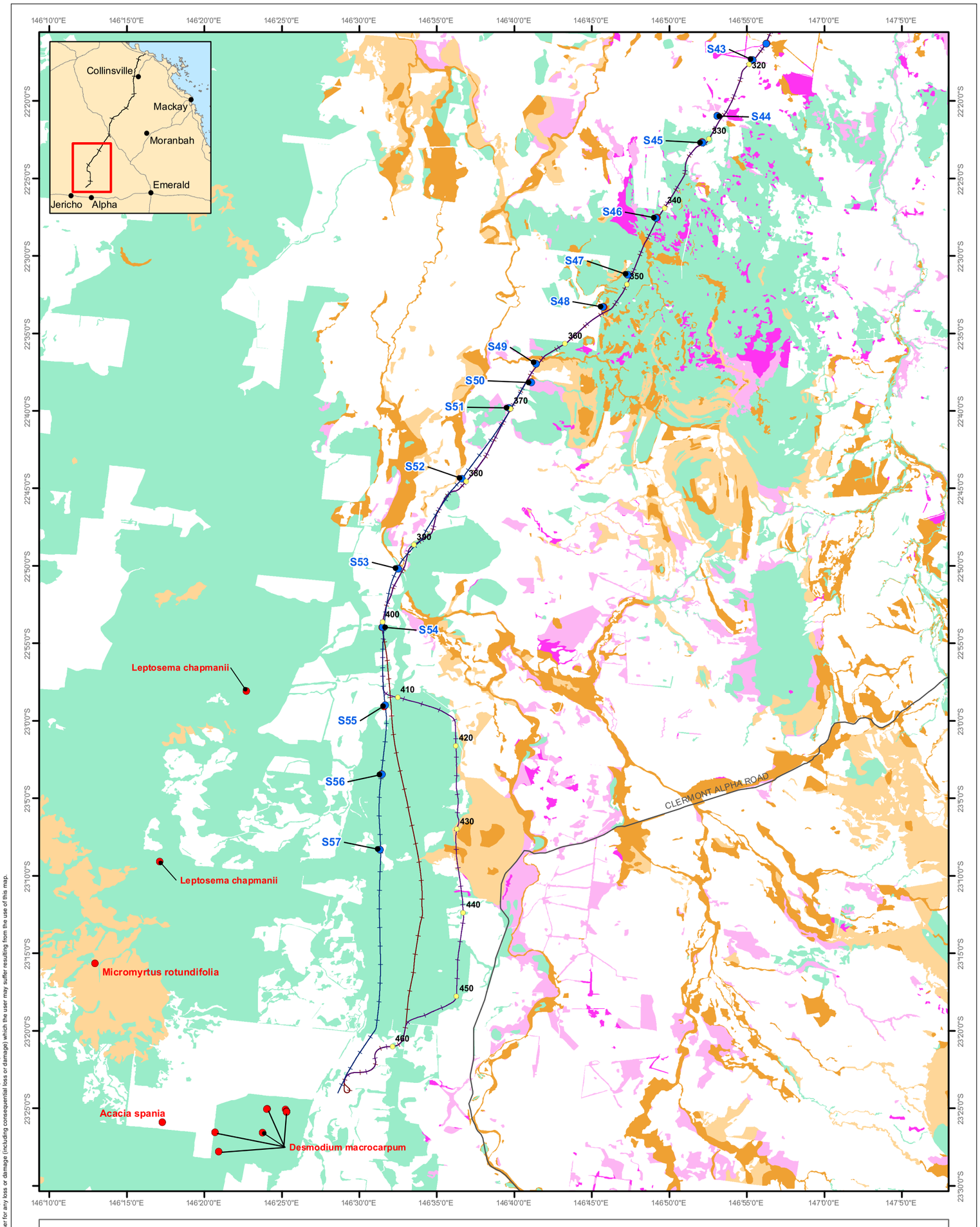
UNIDEL INFRASTRUCTURE ENERGY RESULTS

Figure 7. Regional Ecosystem Mapping (Map 3 of 3)



Regional Ecosystem Mapping and Location of Flora and Fauna Survey Sites

Data Source
Regional Ecosystem Data © State of Queensland (Department of Environment and Resource Management) 2010

Work Request: WACL_2535
Date: 21/06/2011

Legend

- Kilometre Points
- Flora and Fauna Tertiary Survey Sites
- Threatened and Near Threatened Flora Species Records (Unidel Data)
- Threatened and Near Threatened Flora Species Records (QLD Herbarium HERBRECS Data)
- Proposed Rail (option 1)
- Proposed Rail (option 2)
- Proposed Rail (option 3)
- Endangered - Dominant
- Endangered - Sub-dominant
- Of Concern - Dominant
- Of Concern - Sub-dominant
- Least Concern

Kilometres
0 10 20

N

Waratah Coal

UNIDEL INFRASTRUCTURE ENERGY RESULTS

Table 1. TECs and REs mapped as being transected by the rail corridor

ECOLOGICAL COMMUNITIES / RES		STATUS			SITE NUMBER		
RE NUMBER	DESCRIPTION	EPBC	VM ACT	BIODIVERSITY	TERTIARY SURVEY SITE NUMBER	MAPPED BY DERM BUT RE ABSENT AT SITE	MAPPED AS PART OF MOSAIC BY DERM BUT RE ABSENT AT SITE
10.3.4	*Acacia cambagei* low open woodland to low woodland on alluvial plains.	-	LC	OC			
10.3.3	*Acacia harpophylla* and / or *Eucalyptus cambageana* low open woodland to open woodland on alluvial plains.	-	LC	NOC			
10.3.12	*Corymbia dallachiana* and *C. plena* or *C. terminalis* open woodland on sandy alluvial terraces (eastern).	-	LC	NOC			54
10.3.13	*Melaleuca fluviatilis* and / or *Eucalyptus camaldulensis* woodland along watercourses.	-	LC	OC			53, 55, 57
10.3.14	*Eucalyptus camaldulensis* and / or *E. coolabah* open woodland along channels and on floodplains.	-	LC	OC	53, 55, 57		
10.3.27	*Eucalyptus populnea* open woodland on alluvial plains.	-	LC	OC	54		
10.3.28	*Eucalyptus melanophloia* or *E. crebra* open woodland on sandy alluvial fans.	-	LC	NOC			54
10.5.1	*Eucalyptus similis* and / or *Corymbia brachycarpa* and / or *Corymbia setosa* low open woodland to open woodland on sand plains.	-	LC	NOC			
10.5.2	*Corymbia plena* with or without *C. dallachiana* or *C. terminalis* open woodland on sand plains.	-	LC	NOC			
10.5.5	*Eucalyptus melanophloia* open woodland on sand plains.	-	LC	NOC	56		
10.5.12	*Eucalyptus populnea* open woodland on sand plains.	-	LC	NOC			56
10.7.3	*Acacia shirleyi* woodland or *A. catenulata* low woodland at margins of plateaus.	-	LC	NOC			
10.7.5	*Eucalyptus thozetiana* open woodland on scarps and on pediments below scarps.	-	LC	OC			
10.7.7	*Melaleuca* spp. and / or *Acacia leptostachya* shrubland on ferricrete (eastern).	-	LC	NOC			
10.10.4	*Eucalyptus exilipes* and / or *Corymbia leichhardtii* open woodland on sandstone ranges.	-	LC	NOC			
11.3.1	*Acacia harpophylla* and / or *Casuarina cristata* open forest on alluvial plains.	E	E	E	12, 31, 42, 52		11, 17, 18, 19, 44, 50
11.3.2	*Eucalyptus populnea* woodland on alluvial plains.	-	OC	OC			20, 51
11.3.3	*Eucalyptus coolabah* woodland on alluvial plains.	-	OC	OC	44	31	42
11.3.4	*Eucalyptus tereticornis* and / or Eucalyptus spp. Tall woodland on alluvial plains.	-	OC	OC			4, 6, 7, 8, 9, 10, 17, 18, 19

ECOLOGICAL COMMUNITIES / RES		STATUS			SITE NUMBER		
RE NUMBER	DESCRIPTION	EPBC	VM ACT	BIODIVERSITY	TERTIARY SURVEY SITE NUMBER	MAPPED BY DERM BUT RE ABSENT AT SITE	MAPPED AS PART OF MOSAIC BY DERM BUT RE ABSENT AT SITE
11.3.5	*Acacia cambagei* woodland on alluvial plains.	-	LC	OC			42, 43
11.3.7	*Corymbia* spp. woodland on alluvial plains.	-	LC	OC			
11.3.9	*Eucalyptus platyphylla, Corymbia* spp. Woodland on alluvial plains.	-	LC	NOC			
11.3.10	*Eucalyptus brownii* woodland on alluvial plains.	-	LC	NOC			11,, 12
11.3.25	*Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines.	-	LC	OC	2, 3, 5, 8, 9, 10, 11, 14, 16, 19, 21, 41		12, 17, 18
11.3.30	*Eucalyptus crebra, Corymbia dallachiana* woodland on alluvial plains.	-	LC	NOC			1
11.3.32	*Allocasuarina luehmannii* open woodland on alluvial plains.	-	LC	NOC	1		
11.3.33	*Eremophila mitchellii* open woodland on alluvial plains.	-	OC	E			1
11.3.35	*Eucalyptus platyphylla, Corymbia clarksoniana* woodland on alluvial plains.	-	LC	NOC	4, 17		
11.3.37	*Eucalyptus coolabah* fringing woodland on alluvial plains.	-	LC	NOC	30		
11.4.4	*Dichanthium* spp., *Astrebla* spp. Grassland on Cainozoic clay plains.	E	LC	OC		38	
11.4.5	*Acacia argyrodendron* woodland on Cainozoic clay plains.	-	OC	E	29		
11.4.6	*Acacia cambagei* woodland on Cainozoic clay plains.	-	OC	E	37, 39, 51		40, 50
11.4.8	*Eucalyptus cambageana* woodland to open forest with *Acacia harpophylla* or *A. argyrodendron* on Cainozoic clay plains.	E	E	E	27, 36, 43, 46, 50	39	37, 51
11.4.9	*Acacia harpophylla* shrubby open forest to woodland with *Terminalia oblongata* on Cainozoic clay plains.	E	E	E			35
11.4.11	*Dichanthium sericeum, Astrebla* spp. and patchy *Acacia harpophylla, Eucalyptus coolabah* on Cainozoic clay plains.	E	OC	OC			27
11.5.2	*Eucalyptus crebra, Corymbia* spp., with *E. moluccana* on lower slopes of Cainozoic sand plains/remnant surfaces.	-	LC	NOC			
11.5.3	*Eucalyptus populnea* + / - *E. melanophloia* + / - *Corymbia clarksoniana* on Cainozoic sand plains/remnant surfaces.	-	LC	NOC	28, 40, 47	29	20, 29,36, 37, 50
11.5.5	*Eucalyptus melanophloia, Callitris glaucophylla* woodland on Cainozoic sand plains/remnant surfaces. Deep red sands.	-	LC	NOC			
11.5.9	*Eucalyptus crebra* and other *Eucalyptus* spp. and *Corymbia* spp. woodland on Cainozoic sand plains / remnant surfaces.	-	LC	NOC	20, 23		22

ECOLOGICAL COMMUNITIES / RES		STATUS			SITE NUMBER		
RE NUMBER	DESCRIPTION	EPBC	VM ACT	BIODIVERSITY	TERTIARY SURVEY SITE NUMBER	MAPPED BY DERM BUT RE ABSENT AT SITE	MAPPED AS PART OF MOSAIC BY DERM BUT RE ABSENT AT SITE
11.5.10	*Melaleuca tamariscina* shrubland on Cainozoic sand plains / remnant surfaces.	-	OC	OC	22		
11.5.12	*Corymbia clarksoniana* woodland and other *Corymbia* spp. and *Eucalyptus* spp. on Cainozoic sand plains/remnant surfaces.	-	LC	NOC			40
11.7.2	*Acacia* spp. woodland on Cainozoic lateritic duricrust. Scarp retreat zone.	-	LC	NOC	34		33
11.7.3	*Eucalyptus persistens, Triodia mitchellii* open woodland on stripped margins of Cainozoic lateritic duricrust.	-	LC	NOC	33, 35		37
11.8.11	*Dichanthium sericeum* grassland on Cainozoic igneous rocks	-	OC	OC			
11.9.3	*Dichanthium* spp., *Astrebla* spp. grassland on fine-grained sedimentary rocks.	E	LC	NOC			
11.9.9	*Eucalyptus crebra* woodland on fine-grained sedimentary rocks.	-	LC	NOC			
11.9.10	*Eucalyptus populnea, Acacia harpophylla* open forest on fine-grained sedimentary rocks.	-	OC	E	36		
11.10.3	*Acacia catenulate* or *A. shirleyi* open forest on coarse-grained sedimentary rocks, crests and scarps.	-	LC	NOC			
11.10.7	*Eucalyptus crebra* woodland on coarse-grained sedimentary rocks.	-	LC	NOC			
11.10.12	*Eucalyptus populnea* on medium to coarse-grained sedimentary rocks. *Eucalyptus populnea* woodland on medium to coarse-grained sedimentary rocks	-	LC	NOC	18		
11.11.1	*Eucalyptus crebra* + / - *Acacia rhodoxylon* woodland on old sedimentary rocks with varying degrees of metamorphism and folding.	-	LC	NOC	13		15
11.11.8	*Eucalyptus shirleyi* woodland on deformed and metamorphosed sediments and interbedded volcanics.	-	LC	NOC			15
11.11.9	*Eucalyptus populnea* or *E. brownii* woodland on deformed and metamorphosed sediments and interbedded volcanics.	-	LC	NOC	7		13
11.11.10	E*ucalyptus meanophloia* woodland on deformed and metamorphosed sediments and interbedded volcanics.	-	OC	OC			
11.11.13	*Acacia harpophylla* or *A. argyrodendron, Terminalia oblongata* low open forest on deformed and metamorphosed sediments and interbedded volcanics.	-	OC	OC	15	48	33
11.11.15	*Eucalyptus crebra* woodland on deformed and metamorphosed sediments and interbedded volcanics.	-	LC	NOC	45		

ECOLOGICAL COMMUNITIES / RES		STATUS			SITE NUMBER		
RE NUMBER	DESCRIPTION	EPBC	VM ACT	BIODIVERSITY	TERTIARY SURVEY SITE NUMBER	MAPPED BY DERM BUT RE ABSENT AT SITE	MAPPED AS PART OF MOSAIC BY DERM BUT RE ABSENT AT SITE
11.11.19	*Eucalyptus thozetiana, Acacia harpophylla* woodland on old sedimentary rocks with varying degrees of metamorphism and folding.	-	OC	OC	48		15
11.12.1	*Eucalyptus crebra* woodland on igneous rocks.	-	LC	NOC	6, 26		4, 7, 8, 9, 10, 24, 25
11.12.2	*Eucalyptus melanophloia* woodland on igneous rocks.	-	LC	NOC	25		26
11.12.7	*Eucalyptus crebra* woodland with patches of Semi-evergreen vine thicket on igneous rocks (boulder-strewn hillsides).	-	LC	NOC		57.5 - 61.7	
11.12.9	*Eucalyptus platyphylla* woodland on igneous rocks.	-	LC	NOC			4
11.12.10	*Corymbia clarksonia* woodland on igneous rocks.	-	OC	OC			

E = Endangered; OC = Of Concern; LC = Least Concern under the VM Act; NOC = No Concern at Present under Biodiversity status classification

Table 2. KPs for TECs, REs and Of Concern REs

RE NUMBER	DESCRIPTION	EPBC	VM ACT	BIO-DIVERSITY	KPS WHERE RE IS MAPPED BY DERM	KPS WHERE RE IS MAPPED AS PART OF MOSAIC BY DERM	KP OF UNIDEL TERTIARY SURVEY SITE KP WHERE RE RECORDED
11.3.1	*Acacia harpophylla* and / or *Casuarina cristata* open forest on alluvial plains.	E	E	E		72.2 - 72.4, 75.2 - 75.4, 75.6 - 76.4,77.7 - 78.2, 78.6 - 79, 79.4 - 79.8, 80.8 - 81, 114.4 - 116, 121.6 - 122, 124.8 - 125, 125.8 - 126, 283.6 - 283.7, 283.8 - 283.9, 316.1 - 316.3, 352.4 - 352.5	78, 228, 306, 368
11.3.2	*Eucalyptus populnea* woodland on alluvial plains.	-	OC	OC		136.2 - 136.3, 136.4 - 137.2, 137.6 - 137.8, 138.2 - 139.2, 139.8 - 140, 140.3 - 140.4, 332.6 - 333.8, 351.1 - 351.5, 359.5 - 359.6	
11.3.3	*Eucalyptus coolabah* woodland on alluvial plains.	-	OC	OC	228.7 - 229, 230.4 - 232, 232.2 - 234.2, 235 - 235.2	3.7 - 3.8, 227.4 - 227.6, 228 - 228.2, 228.4 - 228.5, 228.6 - 228.7, 283.6 - 283.7, 283.8 - 283.9, 306 - 306.2, 316.1 - 316.3, 351.1 - 351.5, 379.8 - 379.9, 380.6 - 380.7	316
11.3.4	*Eucalyptus tereticornis* and / or *Eucalyptus* spp. tall woodland on alluvial plains.	-	OC	OC	199.6 - 199.8, 239.7 - 239.9, 240.3 - 240.4, 241.5 - 241.8, 242.1 - 242.2	31.9 - 32.5, 32.9 - 34, 34.8 - 36.6, 42.8 - 44.8, 48.8 - 50.8, 51 - 51.4, 51.6 - 52.2, 52.4 - 57.6, 61.6 - 66.4, 67.8 - 70, 70.2 - 70.4, 70.6 - 70.8, 84.4 - 84.6, 95 - 95.8, 97 - 97.2, 99.9 - 100.6, 100.9 - 102, 102.4 - 103.69, 114.4 - 116, 121.6 - 122, 124.8 - 125, 125.8 - 126, 225.4 - 225.8	

RE NUMBER	DESCRIPTION	EPBC	VM ACT	BIO-DIVERSITY	KPS WHERE RE IS MAPPED BY DERM	KPS WHERE RE IS MAPPED AS PART OF MOSAIC BY DERM	KP OF UNIDEL TERTIARY SURVEY SITE KP WHERE RE RECORDED
11.3.33	*Eremophila mitchellii* open woodland on alluvial plains.	-	OC	E		7.8 - 7.9, 11.4 - 13.4. 14 - 14.4, 14.6 - 14.8, 16.1 - 16.4, 22.1 - 22.4, 22.6 - 24.6	
11.4.4	*Dichanthium* spp., Astrebla spp. Grassland on Cainozoic clay plains.	E	LC	OC	70 - 71, 73.4 - 73.6, 262 - 264.2		
11.4.5	*Acacia argyrodendron* woodland on Cainozoic clay plains.	-	OC	E		205.8 - 206.6	205.5
11.4.6	*Acacia cambagei* woodland on Cainozoic clay plains.	-	OC	E		273.6 - 274, 274.5 - 275.6, 351.5 - 352.4, 352.6 - 353.3, 359.5 - 359.6	260, 270, 358.5
11.4.8	*Eucalyptus cambageana* woodland to open forest with *Acacia harpophylla* or *A. argyrodendron* on Cainozoic clay plains.	E	E	E	244.5 - 244.6	190 - 193.8, 229.8 - 230.4, 232 - 232.2, 234.2 - 234.4, 234.6 - 234.8, 235.6 - 235.7, 236.6 - 237, 237.4 - 238.2, 308.3 - 308.4, 314 - 314.2, 330.1 - 330.3, 359.5 - 359.6	192, 308.5, 330, 355
11.4.9	*Acacia harpophylla* shrubby open forest to woodland with Terminalia oblongata on Cainozoic clay plains.	E	E	E		234.2 - 234.4, 234.6 - 234.8	
11.4.11	*Dichanthium sericeum*, Astrebla spp. and patchy *Acacia harpophylla, Eucalyptus coolabah* on Cainozoic clay plains.	E	OC	OC		190 - 193.8	
11.5.10	*Melaleuca tamariscina* shrubland on Cainozoic sand plains/ remnant surfaces.	-	OC	OC		141.2 - 141.8, 143.8 - 144.1, 146.8 - 154.8	147
11.8.11	*Dichanthium sericeum* grassland on Cainozoic igneous rocks	-	OC	OC	New alignment	New alignment	New alignment
11.9.3	*Dichanthium* spp., *Astrebla* spp. grassland on fine-grained sedimentary rocks.	E	LC	NOC	97.2 - 100		

RE NUMBER	DESCRIPTION	EPBC	VM ACT	BIO-DIVERSITY	KPS WHERE RE IS MAPPED BY DERM	KPS WHERE RE IS MAPPED AS PART OF MOSAIC BY DERM	KP OF UNIDEL TERTIARY SURVEY SITE KP WHERE RE RECORDED
11.9.10	*Eucalyptus populnea, Acacia harpophylla* open forest on fine-grained sedimentary rocks.	-	OC	E		247.7 - 248.6, 249 - 249.5	248
11.11.10	*Eucalyptus melanophloia* woodland on deformed and metamorphosed sediments and interbedded volcanics.	-	OC	OC	339.9 - 340.1		
11.11.13	*Acacia harpophylla* or *A. argyrodendron, Terminalia oblongata* low open forest on deformed and metamorphosed sediments and interbedded volcanics.	-	OC	OC	342 - 342.5	82.4 - 83, 87.4 - 88.4, 86.6 - 89.2, 89.4 - 89.6, 89.8 - 90.8, 240.1 - 240.4	90
11.11.19	*Eucalyptus thozetiana, Acacia harpophylla* woodland on old sedimentary rocks with varying degrees of metamorphism and folding.	-	OC	OC			13
11.12.10	*Corymbia clarksonia* woodland on igneous rocks.	-	OC	OC		45.2 - 47, 47.2 - 47.6	

The field survey found the DERM RE mapping to be generally accurate and 27 REs were observed during the ground-truthing surveys including:

- 17 LCREs;
- 7 OCREs; and
- 2 EREs (Table 1 and Table 2).

The communities were generally found to be in good to excellent condition within the large contiguous stands of vegetation between KP 10 - 202, KP 225 - 255 and KP 323 - 343. The new preferred alignment at the mine end of the corridor (south of KP 386) is now proposed to the east of the surveyed area but appears to traverse part of the same contiguous vegetation (mapped in Figure 7 predominantly as Least Concern). In other areas the communities tended to be impacted to a greater degree by grazing and / or altered fire regimes associated with buffel grass.

6.3.1.5 High Value Regrowth Vegetation

The proposed rail corridor transects numerous small patches of High Value Regrowth (HVR) REs as mapped by DERM (2009, 2010). These are predominantly LCREs but also include regrowth of three TECs / EREs and eight OCREs. The HVR REs transacted by the proposed rail corridor are listed in Table 3.

Table 3. High value regrowth REs transected by the rail corridor

PRECLEARING RE	PRECLEARING VM ACT STATUS	EPBC ACT STATUS	LOCATION (KP)	NOTES
11.10.12	LC		106	
11.11.1	LC		85 / 90	
11.11.13	OC		90 / 343	
11.11.8	LC		90	
11.11.9	LC		85 / 90	
11.12.1	LC		29 / 32 / 52	
11.12.9	LC		32	
11.3.1	E	TEC	52 / 314	Brigalow dominant community
11.3.10	LC		29	
11.3.2	OC		136 / 368 / 370	
11.3.25	LC		242 / 368 / 478	
11.3.29a	LC		3	
11.3.30	LC		3 / 16 / 29	
11.3.3	OC		242 / 372 / 376	
11.3.32	LC		3 / 16 / 29	
11.3.33	OC		3 / 16	
11.3.35	LC		3	
11.3.37	LC		303	
11.3.4	OC		32 / 52 / 225	
11.3.5	LC		225 / 376	
11.4.5	OC		202	
11.4.6	OC		303 / 314	
11.4.8	E	TEC	314 / 370	RE is brigalow sub-dominant community
11.4.9	E	TEC	202 / 370	Brigalow dominant community
11.5.12	LC		243	
11.5.3	LC		136 / 241 / 247 / 314 / 344	
11.5.9b	LC		128	
11.5.9c	LC		159	
11.7.2	LC		128 / 243 / 246 / 247	
11.9.10	OC		247	

6.3.1.6 Threatened and Near Threatened Flora Species

The review of Queensland Herbarium HERBRECS, Wildnet and EPBC Act Protected Matters databases identified 34 Threatened or Near Threatened plant species that are known to occur or have ranges that overlap with the proposed rail corridor (Table 4). These include:

- Thirty one species listed under the *Nature Conservation Act 1992* (NC Act), including three Endangered, ten Vulnerable and eighteen Near Threatened species; and
- nine species listed under the EPBC Act including one Endangered and eight Vulnerable.

Potential habitat is present for 30 Threatened and Near Threatened flora species. Of these, only, black ironbox (*Eucalyptus raveretiana*) was recorded during the field survey.

Black ironbox is known to occur between Rockhampton and Ayr in Queensland. The extent of occurrences is about 90,000 km² (QLD Herbarium, 2008). However, the area of occupancy would be less than the extent of occurrence due to the species habitat preference for riparian areas and alluvial flats. The total population is unknown but many thousands are known to occur within each of several major watercourses in both of these areas.

The Species Profile and Threats Database (SPRAT) species profile for black ironbox refers to the species being known from 23 sites in two main areas of occurrence: Nebo to Ayr and Apis Creek to Rockhampton. Whilst unable to source information on the location, boundaries and definition of the 23 sub-populations mentioned in SPRAT, the high level mapping provided indicates that a number of these 23 sub-populations would be in the general region of the rail alignment.

Threats to black ironbox are listed as habitat disturbance and smothering by rubber vine (Cryptostegia grandiflora); inhibition of seedling regeneration, and increased fire frequency resulting from invasion of habitat by large exotic grasses; habitat loss or degradation from water resource developments, and; logging – in particular in the past this species was used for railway sleepers, for light and heavy construction and for fenceposts (SEWPAC, 2011).

There are 23 recorded sites or subpopulations in two main areas of occurrence: Nebo to Ayr and Apis Creek to Rockhampton (Halford, 1997; QLD Herbarium, 2008). The total population is unknown but many thousands are known to occur within each of several major watercourses in both of these areas.

Black ironbox is a dominant and co-dominant canopy species along a number of watercourses between KP 0 – 100 along the rail alignment. It is considered to be widespread in the larger watercourses between KP 0 – 100. In these locations, the species occurs in a ribbon along the banks of these watercourses for at least several hundred metres each side of the sites surveyed, and most likely for several kilometres. Plant densities in these locations are estimated to be in excess of >100 individuals per kilometre.

Black ironbox was observed at seven locations (see Figure 5, Figure 6 and Figure 7 in Volume 5, Appendix 26). In all instances the plants were observed within the beds or banks of watercourses. Several age classes are represented at these locations and specimens generally ranged from 0.5 – 8 m in height in the channel and up to 25 m along the banks.

In the experience of Unidel (who have surveyed more than 50 sites containing black ironbox for several linear infrastructure projects which have needed to transect black ironbox dominated watercourses in the last 10 years), the potential removal of the trees required represents a small proportion of those occurring within one km of each transect location. For example, in this area a 100 m wide easement would be likely to contain approximately 5 % of individuals within a one km buffer (noting that usually the species extends for several to tens of kilometres in either or both directions along those watercourses). Based on prior experience, it is possible about 50 % of the time to find a 30 m strip close enough to proposed alignments to traverse a watercourse without impacting any individuals. However, gaps between individuals are rarely greater than 30 m, so it may not be possible to avoid all individuals in areas where the width of the rail alignment at creek crossings may need to be greater than 30 m. Where avoidance is found not to be possible, it will be due to the fact that the species follows these watercourses and is numerous and spread to the extent that it is not able to be avoided.

Between KP 0 – 100 In this section of the proposed rail corridor this species is considered likely to be present in additional watercourses to those recorded during the helicopter survey (depicted in Figure 5, Figure 6 and Figure 7). Black ironbox was found to follow the

Table 4. Threatened and Near Threatened Flora Species recorded as occurring within or having ranges that overlap the rail corridor

COMMON NAME	SCIENTIFIC NAME	STATUS		PREFERRED HABITAT	SOURCE	PREFERRED HABITAT PRESENT
		NC ACT	EPBC ACT			
N/A	*Acacia jackesiana*	NT	-	Rocky hillsides in open Eucalypt and Acacia woodland. Extends from north of Mackay to north of Townsville, mostly inland.	2,3	Yes
N/A	*Acacia ramiflora*	-	V	Woodland on sandstone hills.	3	Yes
N/A	*Acacia spania*	NT	-	Shallow sandstone-derived soils in open Eucalypt or Acacia shrublands and woodlands.	2,3	Yes
N/A	*Aristida granitica*	E	E	Known only from the type locality in the foothills of Mt Pring, 10 km west of Bowen, Queensland, where it is common.	2,3	No
N/A	*Bertya pedicellata*	NT	-	Commonly found in open and closed forest on rocky hills with shallow skeletal or sandy soils. It is recorded at altitudes of 320 to 840 m. Associated with *Corymbia trachyphloia* (brown bloodwood), *Dodonaea filifolia* (shrub), *Acacia catenulata*, *A. curvinervia* and *A. shirleyi* (Lancewood).	3	Yes
N/A	*Bertya sharpeana*	NT	-	Tall shrub on rocky terrain north and south of Mackay.	3	Yes (KP 0 - 100)
Dietrich's morning glory	*Bonamia dietrichiana*	NT	-	Dry rainforest and SEVT; less commonly in Eucalypt woodland; mostly coastal from Townsville south to just north of Rockhampton.	2,3	Yes (KP 0 - 140)
N/A	*Cerbera dumicola*	NT	-	Open woodland and SEVT often associated with 'jump-ups' and ridges.	2,3	Yes
Native Jute	*Corchorus hygrophilus*	V	-	Small shrub in SEVT and dry rainforest from Rockhampton to Townsville.	2,3	Yes (KP 0 - 140)
N/A	*Corymbia clandestina*	V	V	Restricted to a small area near Blair Athol, growing in eucalypt woodland.	2,3	No
N/A	*Croton magneticus*	V	V	Vine thickets on skeletal granite, limestone or sandstone soils, including rocky seashores.	2,3	Yes (KP 0 - 140)

COMMON NAME	SCIENTIFIC NAME	STATUS		PREFERRED HABITAT	SOURCE	PREFERRED HABITAT PRESENT
		NC ACT	EPBC ACT			
N/A	*Desmodium macrocarpum*	NT	-	Open woodland and open forest communities on redearths, rarely on sandy clay soils, to 884 m. Also occurs in semideciduous vine thicket.	2,3	Yes
King Blue-grass	*Dichanthium queenslandicum*	V	-	Restricted to Emerald and rarely in the Darling Downs in Queensland. Found on black clay soils in native grassland communities.	1,3	Yes (KP 70 - 110)
Bristly bluegrass	*Dichanthium setosum*	NT	-	Restricted to eastern Queensland. Grassy woodland and open forest.	2,3	Yes
Finger Panic Grass	*Digitaria porrecta*	NT	-	Occurs in coastal regions of south Queensland and in northern New South Wales. Found in tropical and subtropical rainforests and sub-humid woodlands.	1	Yes (KP 0 - 100)
Black Ironbox	*Eucalyptus raveretiana*	V	V	Along watercourses and on riverflats. Open forest or woodland communities in association with *Eucalyptus tereticornis* (Forest Red Gum), *Corymbia tessellaris* (Moreton Bay Ash), *E. camaldulensis* (River Red Gum), *Melaleuca* spp. and *Casuarina cunninghamiana* (River Oak).	2,3,4	Yes (KP 0 - 100)
Scarlet fuchsia	*Graptophyllum excelsum*	NT	-	Occurs in Semi-evergreen vine thickets, although near Chillagoe it is also recorded growing in grassy woodland in association with *Eucalyptus cullenii* and *Corymbia erythrophloia*. Usually found in soil pockets among rocks and in rock crevices on quite steep, rough, rocky, eroded hillsides.	3	Yes (KP 0 -140)
Halifax fan palm	*Livistona drudei*	V	-	In coastal rainforest and *Melaleuca* forest.	3	Yes (KP 0 - 20)
Burdekin palm	*Livistona lanuginose*	V	V	Restricted to a small area of the Burdekin River Basin along sandy river and creek channels.	3	Yes (KP 0 - 20)

COMMON NAME	SCIENTIFIC NAME	STATUS		PREFERRED HABITAT	SOURCE	PREFERRED HABITAT PRESENT
		NC ACT	EPBC ACT			
Smooth-Barked Bonewood	*Macropteranthes leiocaulis*	NT	-	Maryborough to south of Townsville, in semi-evergreen vine thickets.	3	Yes (KP 0 - 140)
N/A	*Marsdenia pumila*	V	-	Grass tussocks in woodland with *Eucalyptus leichhardii, E. trachyphloia, Acacia shirleyi* and *Lysicarpus*.	2,3	Yes
N/A	*Omphalea celata*	V	V	Occurs in fragmented Semi evergreen vine thicket or araucarian microphyll vine forest. Recorded along watercourses in steep sided gorges and gullies on weathered metamorphic or granitic soils.	3	Yes (KP 0 - 140)
N/A	*Ozothamnus eriocephalus*	V	V	Known from a range of habitat types, including the margins of disturbed notophyll vine forest, margins of gallery forest, microphyll vine forest, tall open *Eucalyptus andrewsii -E. resinifera* forest with an understorey of *Allocasuarina littoralis*, in open eucalypt forest and on rocky ridges within Eucalyptus spp. - Acacia spp.	2	Yes
N/A	*Paspalidium scabrifolium*	NT	-	Restricted to coastal regions of north and central Queensland. Found in brigalow country in Eucalypt and *Acacia harpophylla* woodland.	2,3	Yes
N/A	*Peripleura scabra*	NT	-	Eucalypt woodland on rocky hills and slopes.	2,3	Yes
N/A	*Peripleura sericea*	NT	-	From Stannary Hills to about Collinsville in eucalypt woodland.	3	Yes
N/A	*Polianthion minutiflorum*	V	-	From Mackay to about Nanango growing in open woodland.	3	Yes
N/A	*Rhamphicarpa australiensis*	NT	-	Occurs at 200 to 570 m altitude. It grows in *Melaleuca-Casuarina* open woodland and open sclerophyll woodland. It has been found on wet ground and in seepage areas near pools and swamps.	3	Yes

COMMON NAME	SCIENTIFIC NAME	STATUS		PREFERRED HABITAT	SOURCE	PREFERRED HABITAT PRESENT
		NC ACT	EPBC ACT			
N/A	*Sarcotoechia heterophylla*	NT	-	Usually occurs at an altitude of 200 to 900 m. It has been recorded in simple or mixed notophyll vine forests on ridges. It often grows on light loams derived from granite. The associated species include *Schizomeria ovata* (White Birch), *Acmena resa* (Red Eungella Satinash) and *Syzygium wesa* (White Eungella Satinash).	3	No
Brush senna	*Senna acclinis*	NT	-	Appears to prefer rainforest margins and adjacent open forests. Occurs at altitudes of 100 to 660 m on soils derived from a mixture of basalt and metamorphic rocks. In rainforest, associated with *Pleiogynium timorense* (Burdekin Plum or Tulip Plum) and *Elattostachys* sp. In open forests, associated with *Eucalyptus grandis* (Flooded Gum), *Syncarpia glomulifera* and *Alphitonia excelsa* (Red Ash or Soap Tree).	3	Yes (KP 0 - 140)
N/A	*Solanum adenophorum*	E	-	Brigalow scrub.	2	Yes
N/A	*Solanum sporadotrichum*	NT	-	Mainly coastal from Townsville to Mackay in Semi-evergreen vine thickets, open eucalypt woodland and littoral rainforest margins.	3	Yes (KP0 - 200)
N/A	*Tephrosia leveillei*	V	V	Habitat poorly known. Only 3 records, on from open woodland beside creek.	3	Yes
Belyando cobblers peg	*Trioncinia retroflexa*	E	-	Recorded from Blair Athol and Springsure areas in grassland and in sparse eucalypt woodland.	3	No

Source: 1 = EPBC Protected Matters search; 2 = QEPA WildNet record; 3 = Herbrecs

Status: [1]: Commonwealth (EPBC) listed: **E** = Endangered; **V** = Vulnerable.
[2]: State (NC Act) listed: **E** = Endangered; **V** = Vulnerable; **NT** = Near Threatened.

watercourses as the dominant or co-dominant species and at many of the locations and may be unavoidable without significant detour.

Detailed surveys will be required of all watercourses between KP0-100 to confirm the presence/absence of this species and to select crossing points which will minimise the need to remove (or totally avoid where possible). These detailed surveys will also provide a high level quantification of the numbers of individuals within the adjoining (undisturbed) areas (e.g. estimated numbers within one km of the crossing point).

Based on the general distributional characteristics of this species, the potential for unavoidable significant impacts is considered low.

There is potential for one or more of the other 29 Threatened and Near Threatened flora species also to occur within the proposed rail corridor.

The Brigalow Belt (North) Planning Assessment (EPA 2008) and the ANRA (2002) do not identify regionally significant flora species.

6.3.1.7 Least Concern Flora Species

A total of 187 Least Concern flora species were identified during the field survey.

6.3.1.8 Significant Weed Species

This study identified 16 significant weed species within the project footprint including eight declared species (Table 5).

Parthenium Weed is possibly the most significant weed identified within the rail corridor. It was observed at KPs 86, 101, 116, 125, 205 / 206, 226, 228, 232 / 233, 260, 263, 270 and 316 but is likely to occur in other parts of the rail corridor. Parthenium weed commonly displaces native and pasture grasses in areas of heavy clay soils which are intensively grazed and / or cropped. Parthenium weed is also known to cause human health problems.

Prickly acacia is a significant weed which can form dense thickets. One individual was recorded at KP 72.5 (Site 10) but it is known to occur in dense stands in the local vicinity.

Rubber vine is a widespread pest in the area which often forms dense thickets particularly along drainage lines closer to the coast. Rubber Vine reduces fauna and flora habitat values as well as grazing productivity when dense. Rubber Vine was observed at KPs 22, 50, 54, 67, 72 / 73, 75 / 76 and 86 but is likely to occur in other parts of the proposed rail corridor.

Harissa cactus is frequently present along the entire length of the rail corridor, usually in low numbers as scattered individuals or small clumps. This species was observed at KPs 54, 67, 78, 205 / 206, 232 / 233, 241 / 242, 260, 270, 306, 208 and 309.

Common lantana was observed at KP 84 but is likely to occur in other parts of the proposed rail corridor.

Table 5. Declared weed species recorded within the rail corridor

COMMON NAME	SCIENTIFIC NAME	CLASSIFICATION		SITE NUMBER
		WONS	LP ACT CLASS	
Prickly Acacia	*Acacia nilotica* subsp. *indica*	X	Class 2	10
Buffel Grass	*Cenchus ciliaris*			12, 15, 18, 24, 28, 36, 37, 39 - 44, 48 - 49, 51 - 52
Rubber Vine	*Cryptostegia grandiflora*	X	Class 2	3, 5, 7, 9 - 10, 14
Harissa Cactus	*Harrissia martinii*		Class 2	7, 10, 12, 29, 32 - 33, 37, 39, 42 - 43
Common Lantana	*Lantana camara*	X	Class 3	13
Parthenium Weed	*Parthenium hysterophorus*	X	Class 2	14, 16 - 17, 19, 29 - 32, 37 - 39, 44
Velvet Tree Pear	*Opuntia tomentosa*		Class 2	24, 31, 37, 40, 42 - 43
Parksonia	*Parkinsonia aculeate*	X	Class 2	57

Velvet tree pear was observed at KPs 165, 228, 260, 275, 306, 208 and 309 but is likely to occur in other parts of the proposed rail corridor.

Parkinsonia was observed at KP 415 but is likely to occur in other parts of the rail corridor.

Buffel grass is widespread throughout much of the proposed rail corridor as the majority of the land has been previously cleared to accommodate agricultural uses, particularly cattle grazing. This species is an introduced and highly valued pasture grass in many areas; however, it has the potential to out-compete native groundcover species and increase biomass.

6.3.2 FAUNA

6.3.2.1 Terrestrial Fauna Field Assessment

The terrestrial fauna habitat assessment of the proposed corridor was conducted over ten days in July 2010. The assessment was conducted by helicopter and included:

- aerial observation of the entire length of the route; and
- detailed (on-ground) fauna habitat surveys at 57 sites.

Data collected at each survey site included general observations of the following fauna habitat values:

- landform;
- structural vegetation characteristics;
- density and nature of groundcover (e.g. rocks, logs, vegetation and leaf litter);
- presence / abundance of hollow-bearing trees;
- level of disturbance (including vehicular, grazing or agricultural activities);
- degree of environmental weed infestation;
- evidence of, and estimated time since last bushfire;
- presence / absence of permanent or ephemeral freshwater resources and distance to riparian areas and free standing water; and
- weather conditions.

No fauna trapping was conducted.

Using the field habitat observations and the desktop data, a determination was made on whether or not preferred habitat for Threatened and Near Threatened fauna species was present along the rail corridor. Likely impacts on those species for which preferred habitat was found to be present were analysed based on the known ecology of each species.

6.3.2.2 Fauna Environment

The corridor commences in an area of open Eucalypt woodland, subject to cattle grazing, on the northern side of the Bruce Highway. It then travels to the west through a gap in the Great Dividing Range and crosses a number of creeks in undulating rocky country with eucalypt woodlands and sparse, grassy understorey. Creeklines in the area are lined with gallery forest and dominated by melaleuca, with many hollow trees. Both the eucalypts and melaleucas provide seasonal nectar supplies for birds and some mammals. Most creeks are heavily infested with weeds, including dense stands of rubber vine, Mexican poppy and noogoora burr, and are also subject to heavy grazing.

From Sites 11 to 13, the corridor runs through undulating hills that support open eucalypt woodlands with degraded and severely grazed understorey dominated by buffel grass, although patches of native grass were observed. Creeklines in this area were smaller and fringed by open eucalypt woodlands, sometimes with semi-evergreen vine thicket plant species present in the understorey in some more sheltered areas.

From the Collinsville area (Site 13) to the south, the corridor moves into gently undulating plains supporting eucalypt woodlands and scattered patches of Brigalow with grassy understorey. Most areas were heavily grazed and overall habitat assessment for fauna was judged to be poor with watercourses providing better habitats with a greater diversity of microenvironments (leaf litter, understorey vegetation, hollows, bark refuges). As the corridor proceeds south from this area (from Site 16), it moves into slightly steeper terrain and the overall quality of habitats improves (Sites 17 to 24).

South of the Bowen Developmental Road (Site 24 nearby) the corridor traverses an area of sandstone range with bare, exposed rock and skeletal soils (Site 25). This area has been extensively burnt recently by a very severe fire; however, sufficient pockets of protected vegetation remained. This may be a significant habitat for reptiles and possibly northern quoll. In some areas, these rocky hills support lancewood thickets (Sites 26, 34) with spinifex understorey. Site 28 is in an extensive area or remnant vegetation that is significant in terms of its size and quality with woodlands supporting grassy and shrubby understorey. Fauna habitat values in this area were assessed as high.

South of the Suttor Development Road (from Site 29), the corridor enters an extensive region of gently undulating plains, intersected by large, braided river systems. This includes the Suttor River, Mistake Creek and Belyando River. This area is subject to extensive seasonal inundation and is undoubtedly important habitat for water birds, including migratory species. It may also be significant habitat for the black-throated finch. The habitat throughout this region is comprised of open eucalypt woodlands with interspersed patches of Brigalow. Larger trees and dense vegetation predominate in the areas subject to seasonal flooding. Overall habitat quality in this area varied from good to exceedingly poor, depending on the intensity of grazing pressure and extent of Buffel grass establishment. This pattern continues south to the proposed mine site.

Table 6 examines the general habitats across the length of the corridor and the relative quality and connectivity of each.

6.3.2.3 Threatened, Near Threatened and Listed Migratory Fauna Species

Database searches identified 35 terrestrial Threatened and Near Threatened fauna species listed either under the EPBC or NC Act as potentially occurring in the area. These include:

- 5 Endangered, 13 Vulnerable under the EPBC Act; and
- 5 Endangered, 13 Vulnerable and 12 Near Threatened under the NC Act.

Additionally, the searches identified 26 other Migratory species under the EPBC Act. A list of these species, together with their preferred habitat and an indication as to whether the species is known to occur or has the potential to occur within the proposed rail corridor is provided in Table 7.

Table 7 also presents information on the habitat preferences of each species. The basis for mapped distributions were sourced from available descriptions and distribution maps (included in the references cited). These distributions and habitat descriptions were then extrapolated against Queensland Herbarium Regional Ecosystem (RE) mapping. In most cases, because they are poorly known, distributions were defined using the RE land zones. In one case however, (*Xeromys myoides*) specific REs are listed as most likely habitat.

In all cases, the distributions described relate to the preferred habitat based on available information, however species may be found to occur outside these areas when comprehensive surveys are undertaken.

Additional information in the form of potential habitat maps for striped-tailed delma, ornamental snake, yakka skink, brigalow scaly-foot, Australian painted snipe, northern quoll, star finch and black-throated finch can be found in Figures 12 to 57 of the MNES standalone report in Chapter 26 of Volume 5.

27 species were considered to have the potential to occur within the study area based on the presence of their suitable habitat.

Table 6. Assessment of general habitat value for threatened species and connectivity between habitat areas.

HABITAT	QUALITY OF EXISTING HABITAT	LIKELY EVNT SPECIES OCCURRENCES	CONNECTIVITY
Open Eucalypt woodland, possibly used for grazing. Creeklines are lined with gallery forest and dominated by melaleuca, with many hollow bearing trees.	High to medium	Forest species (associated with flowering trees and hollow-nesting), gallery forest. In particular, Northern Quoll, Common Death Adder, *Delma labialis*, Yakka Skink, Red Goshawk, Forest birds - flycatchers, honeyeaters, cuckoos. Species attracted to seasonal nectar food source.	Joins rugged slopes and ridges of the Great Dividing Range with strongest connectivity to the south and east.
Undulating hills supporting open Eucalypt woodlands with degraded and grazed understorey dominated by Buffel grass. Smaller creeklines fringed by open Eucalypt woodland	High	Riverine, aquatic and species associated with large trees (blossom feeding and hollow-nesting; migratory water birds.	Variable. Some vegetation is isolated while other areas have strong connectivity to the west.
Gently undulating plains supporting eucalypt woodlands and scattered patches of Brigalow with grassy understorey. Most areas were heavily grazed and overall habitat assessment for fauna was judged to be poor with watercourses providing better habitats with a greater diversity of microenvironments.	Low	Possibly some woodland species including finches and honeyeaters. Also migratory and some water-dependant species near creeks and during wet seasons	Poor connectivity in the northern areas but sites 22 to 24 with excellent connectivity to large areas of remnant vegetation to the east.
A sandstone range with bare, exposed rock and skeletal soils (Site 25). This area has been extensively burnt by a recent, very severe fire; however, sufficient pockets of protected vegetation remained consisting of Lancewood thickets (Sites 26, 34) with spinifex understorey.	High	Rocky habitat that is potential habitat for Northern Quoll and EVNT reptiles.	Excellent connectivity to large areas of remnant vegetation to the east.
Gently undulating plains, intersected by large, braided river systems, subject to extensive seasonal inundation. Is comprised of open eucalypt woodlands with interspersed patches of Brigalow.	High to very low in areas subject to intensive grazing.	Riverine, aquatic and species associated with large trees (blossom feeding and hollow-nesting); important habitat for water birds, including migratory species, possibly Black-throated Finch.	High levels of connectivity with other remnant areas, although fragmented around the Suttor River.

Table 7. Threatened, Near Threatened and listed migratory terrestrial fauna species recorded as occurring within or having ranges that overlap the rail alignment

COMMON NAME	SCIENTIFIC NAME	STATUS		PREFERRED HABITAT	LIKELIHOOD OF OCCURRENCE WITHIN STUDY CORRIDOR	BASIS FOR MAPPED LIKELIHOOD OF OCCURRENCE
		NC ACT	EPBC ACT			
Amphibian						
Rough Frog	*Cyclorana verrucosa*	NT	-	Open grasslands and woodlands, usually near temporary pond, ditches, claypans and creeks.	No records	Not likely to occur
Eungella Tinker Frog	*Taudactylus liemi*	NT	-	Montane forests in north-east Queensland. It is found amongst rocks and plants beside small mountain streams.	No records from project area or environs	Not likely to occur
Eungella Day Frog	*Taudactylus eungellensis*	E	E	Along small creeks in rainforest as well as wet sclerophyll forest (Liem and Hosmer 1973). The immediate streamside habitat is dense rainforest with ferns, vines, palms and epiphytes in the understorey (Retallick *et al.* 1997).	No records from project area or environs	Not likely to occur
Reptiles						
Common Death Adder	*Acanthophis antarcticus*	NT	-	Wet and dry eucalypt forests, woodlands and coastal heaths.	Likely	All remnant vegetation except Landzones 1, 2.
Estuarine Crocodile	*Crocodylus porosus*	V	-	Tidal rivers, coastal floodplains and channels, billabongs and swamps.	No records from project area or environs	Not likely to occur
Capricorn Ctenotus	*Ctenotus capricorni*	NT	-	Open scrub, woodland.	Highly unlikely	Landzones 5,6,& 9 South of latitude -22.8
Striped-tailed Delma	*Delma labialis*	V	V	Low open forest with a grassy understorey (Shea 1987).	Likely	Landzones 3,4,5,6,8,9,10,11,12 North of latitude -20.35
Ornamental Snake	*Denisonia maculata*	V	V	Brigalow (*Acacia harpophylla*) woodland growing on clay and sandy soils, riverside woodland, and open forest growing on natural levees (Shine 1983; Cogger *et al.* 1993). Occurs on black cracking clay soils in non-remnant areas - pastures and crops.	Likely	Landzones 3,4,& 8 South of Latitude -20.40
Yakka Skink	*Egernia rugosa*	V	V	Poplar box, ironbark, brigalow, white cypress pine, mulga, bendee and lancewood woodlands, open forests. Substrates include rock, sand, clay and loamy red earth.	Likely	All remnant vegetation in project area except Landzones 1 & 2.

COMMON NAME	SCIENTIFIC NAME	STATUS		PREFERRED HABITAT	LIKELIHOOD OF OCCURRENCE WITHIN STUDY CORRIDOR	BASIS FOR MAPPED LIKELIHOOD OF OCCURRENCE
		NC ACT	EPBC ACT			
Lemon-barred Forest-skink	*Eulamprus amplus*	NT	-	Found in the rainforest habitats around Eungella.	No records from project area or environs	Not likely to occur
Dunmall's Snake	*Furina dunmalli*	V	V	Brigalow forest and woodland with fallen timber and ground litter, growing on cracking clay soils and clay loam soils.	No records from project area or environs	Not likely to occur
Brigalow Scaly-foot	*Paradelma orientalis*	V	V	Variety of open forest habitats on several soil types (Schultz & Eyre 1997; Tremul 2000). Southern parts of the project area.	Likely	Landzones 3,4,5,7,8,9 & 10 South of Latitude -21.70
Golden-tailed Gecko	*Strophurus taenicauda*	NT	-	Brigalow belt in dry eucalypt, Callitris and Acacia woodlands and forests. Rarely outside remnant vegetation areas.	No records from project area or environs	Not likely to occur
Fitzroy River Turtle	*Rheodytes leukops*	V	V	Rivers with large deep pools with rocky, gravelly or sandy substrates, connected by shallow riffles. High water clarity, often associated with Ribbonweed (*Vallisneria* sp.) beds (Cogger *et al.* 1993).	No records from project area or environs	Not likely to occur
Birds						
Fork-tailed Swift	*Apus pacificus*	-	Mi	Aerial forager of insects. Often seen flying before storm fronts. Not known to land on the Australian continent.	Likely	Throughout study area
Great Egret	*Ardea alba*	-	Mi	Widespread species – common.	Likely	Throughout Study area, Landzones 1,3, 4,5,9
Cattle Egret	*Ardea ibis*	-	Mi	Widespread species – common.	Likely	Throughout Study area, Landzones 1,3, 4,5,9
Lesser Sand Plover	*Charadrius mongolus*	-	Mi	Coastal littoral and estuarine environments. Large intertidal sandflats or mudflats in sheltered bays, harbours and estuaries, and occasionally sandy ocean beaches, coral reefs, wave-cut rock platforms and rocky outcrops.	Highly unlikely	Landzone 1
Sharp-tailed Sandpiper	*Calidris acuminata*		Mi	Fresh or salt water wetlands, edges of lagoons, swamps, lakes and similar habitats.	Yes	Landzone 1,3

COMMON NAME	SCIENTIFIC NAME	STATUS		PREFERRED HABITAT	LIKELIHOOD OF OCCURRENCE WITHIN STUDY CORRIDOR	BASIS FOR MAPPED LIKELIHOOD OF OCCURRENCE
		NC ACT	EPBC ACT			
Red-necked Stint	*Calidris ruficollis*		Mi	Tidal and inland mudflats, salt marshes and beaches.	Yes	Landzone 1
Streaked Cisticola	*Cisticola juncidis*	NT	-	Coastal swamps and grassy plains. Margins of mangrove swamps.	Likely	Landzone 1,3
Red Goshawk	*Erythrotriorchis radiatus*	E	V	Coastal and sub-coastal areas in wooded and forested lands of tropical and warm-temperate Australia (Marchant & Higgins 1993), including eucalypt woodland, open forest, tall open forest, gallery rainforest, swamp sclerophyll forest, and rainforest margins.	Likely	Landzones 3 to 12. Throughout study area in remnant vegetation areas
Black-necked Stork	*Ephippiorhynchus asiaticus*	NT	-	Permanent freshwater wetlands including margins of billabongs, swamps, shallow floodwaters, and adjacent grasslands and savannah woodlands.	Likely	Landzone 1,3
Beach Stone-curlew	*Esacus magnirostris (neglectus)*	V	-	Estuarine, lagoon, mangrove, marine shore-tidal sandflat, mudflat, open beach, rock reef, tidal sandbar (Christidis *et al.* 2008).	Likely	Landzone 1
Horsfield's Bronze-cuckoo	*Chalcites basalis*		Mi	Found in many wooded habitats (such as open and dry woodland and forest) with a range of understoreys from grasses to shrubs or heath.	Yes	Throughout the study area in remnant vegetation areas
Latham's Snipe	*Gallinago hardwickii*	-	Mi	Marshes and swamps in tall grass.	Likely	Throughout Study area in Landzones 1,3
Squatter Pigeon (southern)	*Geophaps scripta scripta*	V	V	Patchy distribution in dry eucalypt forest, often near water. Recorded from Abbot Point area. Locally extinct in former southerly parts of its range.	Likely	Throughout study area
Sarus Crane	*Grus antigone*	-	Mi	Swamps, grasslands and coastal mudflats.	Likely	Throughout Study area in Landzones 1,3
Sooty Oystercatcher	*Haematopus fuliginosus*	NT	-	Rocky headlands, rocky shelves, exposed reefs with rock pools, beaches and muddy estuaries.	Unlikely	Landzone 1
White-bellied Sea-eagle	*Haliaeetus leucogaster*	-	Mi	In association with large, permanent water bodies.	Unlikely	Landzone 1,3

COMMON NAME	SCIENTIFIC NAME	STATUS		PREFERRED HABITAT	LIKELIHOOD OF OCCURRENCE WITHIN STUDY CORRIDOR	BASIS FOR MAPPED LIKELIHOOD OF OCCURRENCE
		NC ACT	EPBC ACT			
White-throated Needletail	*Hirundapus caudacutus*	-	Mi	Migrant, occasionally found in airspace over project area only.	Likely	Throughout the study area
Barn Swallow	*Hirundo rustica*	-	Mi	Summer seasonal migrant to parts of northern Australia. Breeds in Europe, Asia and North America.	Unlikely	Throughout study area north of Latitude -21.80
Broad-billed Sandpiper	*Limicola falcinellus*	-	Mi	Estuarine mudflats, salt marshes and reefs as feeding and roosting habitat.	Unlikely	Landzone 1
Black-tailed Godwit	*Limosa limosa*	-	Mi	Along the coast on sand spits, lagoons and mudflats.	Unlikely	Landzone 1
Square-tailed Kite	*Lophoictinia isura*	NT	-	Variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses.	Likely	Throughout study area in Landzones 3, 8-12
Black-chinned Honeyeater	*Melithreptus gularis*	NT	-	Upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (*Eucalyptus sideroxylon*), White Box (*Eucalyptus albens*), Grey Box (*Eucalyptus microcarpa*), Yellow Box (*Eucalyptus melliodora*) and Forest Red Gum (*Eucalyptus tereticornis*).	Likely	All remnant vegetation south of -20.02 and north of -22.21
Rainbow Bee-eater	*Merops ornatus*	-	Mi	Variety of habitats. May breed in sand banks of creeks and rivers. Seasonal visitor.	Likely	Throughout study area
Spectacled Monarch	*Monarcha trivirgatus*	-	Mi	Thick understorey in rainforests, wet gullies and waterside vegetation, as well as mangroves.	Likely	Landzone 1,2,3, 12 North of Latitude -21.16
Satin Flycatcher	*Myiagra cyanoleuca*	-	Mi	Tall forests, preferring wetter habitats such as heavily forested gullies, but not rainforests.	Likely	Landzone 1,2,3, 12 North of Latitude -21.16
Southern Boobook	*Ninox novaeseelandiae*		Mi	Southern Boobooks are seen in a variety of habitats from dense forest to open desert.	Yes	Throughout study area
Star Finch (eastern)	*Neochmia ruficauda ruficauda*	E	E	Open grasslands and eucalypt woodlands. Along creeks and streams in reeds and tall grasses. Locally extinct in the former southern areas of its range.	Possible	Landzone 3, 4, 5, 8 north of Latitude -22.00

COMMON NAME	SCIENTIFIC NAME	STATUS		PREFERRED HABITAT	LIKELIHOOD OF OCCURRENCE WITHIN STUDY CORRIDOR	BASIS FOR MAPPED LIKELIHOOD OF OCCURRENCE
		NC ACT	EPBC ACT			
Australian Cotton Pygmy-goose	*Nettapus coromandelianus albipennis*	-	Mi	Freshwater lakes, swamps and large water impoundments.	No records from project area or environs	Not likely to occur
Little Curlew	*Numenius minutus*	-	Mi	Coastal and inland grasslands and black soil plains in northern Australia, near swamps and flooded areas.	Likely	Throughout Study area in Landzones 1,3, 4,5,8
Eastern Curlew	*Numenius madagascariensis*	NT	-	Intertidal mudflats and sandflats, often with beds of seagrass, on sheltered coasts, especially estuaries, mangrove swamps, bays, harbours and lagoons.	Likely	Landzone 1
Whimbrel	*Numenius phaeopus*		Mi	Mudflats and estuaries, often near mangroves. Sandy beaches.	Yes	Landzone 1
Black-throated Finch (southern)	*Poephila cincta cincta*	E	E	*Eucalypt* woodland and riverside vegetation, including paperbark and Acacia shrublands and dense riverine grass and reed areas with scattered trees.	Likely	17 REs in which this subspecies was recorded between 1994 and 2007 (Black-throated Finch Recovery Team et al. 2007)
Kermadec Petrel (western)	*Pterodroma neglecta neglecta*	-	V	Marine, pelagic of the subtropical and tropical water of the south Pacific Ocean.	No records from project area or environs	Not likely to occur
Sacred Kingfisher	*Todiramphus sanctus*		Mi	Shallow inland wetlands, either freshwater or brackish, and seasonally or ephemerally inundated pastures and grasslands.	Yes	Throughout Study area in Landzones 1,3,4,5,8
Australian Painted Snipe	*Rostratula australis*	V	V/Mi	The Sacred Kingfisher inhabits woodlands, mangroves and paperbark forests, tall open eucalypt forest and melaleuca forest.	Likely	Throughout the study area
Common Greenshank	*Tringa nebularia*	-	Mi	On the coast and inland, in estuaries and mudflats, mangrove swamps and lagoons, and in billabongs, swamps, sewage farms and flooded crops.	Likely	Throughout Study area in Landzones 1,3,4,5,8

COMMON NAME	SCIENTIFIC NAME	STATUS		PREFERRED HABITAT	LIKELIHOOD OF OCCURRENCE WITHIN STUDY CORRIDOR	BASIS FOR MAPPED LIKELIHOOD OF OCCURRENCE
		NC ACT	EPBC ACT			
Marsh Sandpiper	*Tringa stagnatilis*	-	Mi	Fresh or brackish (slightly salty) wetlands such as rivers, water meadows, sewage farms, drains, lagoons and swamps.	Likely	Throughout Study area in Landzones 1,3,4,5,8
Channel-billed Cuckoo	*Scythrops novaehollandiae*		Mi	Summer breeding migrant to the tall open forests in northern and eastern Australia. Widespread in suitable habitat where it parasitises currawongs, crows and magpies.	Yes	Throughout the study area
Little Tern	*Sterna albifrons*	-	Mi	Exclusively coastal with sheltered environments preferred.	No records from project area or environs	Not likely to occur
Mammals						
Northern Quoll	*Dasyurus hallucatus*	-	E	Woodlands and forests with a preference for rocky hills and associated watercourses, occasionally in coastal rainforest, SEVT and beaches.	Likely	Landzones 1, 7-12
Northern Hairy-nosed Wombat	*Lasiorhinus krefftii*	E	E	Semi-arid cattle grazing country (Horsup 1999). Deep sandy soils are required for burrow construction.	No records from project area or environs	Not likely to occur
Eastern Long-eared Bat	*Nyctophilus timoriensis*	V	V	Mallee, bulloke Allocasuarina leuhmanni and box eucalypt dominated communities. Roosts in tree hollows, crevices, and under loose bark.	Unlikely	All remnant veg south of -21.69
Spectacled Flying-fox	*Pteropus conspicillatus*	-	V	Rainforest and sometimes mangroves containing Black Flying-foxes (Hall and Richards 2000; Richards 1990).	No records from project area or environs	Not likely to occur
Coastal Sheathtail Bat	*Taphozous australis*	V	-	Sand dune scrub, mangroves, melaleuca swamps, coastal heathlands, open eucalypt forest, and grasslands.	Likely	Landzones 1,2.
False Water Rat	*Xeromys myoides*	V	V	Mangrove forests, freshwater swamps and floodplain saline grasslands (Woinarski et al. 2000).	No records from project area or environs	Not likely to occur

Source: EPBC Protected Matters Search; QEPA WildNet records; Queensland Museum (QM) records;

Status: Commonwealth (EPBC) listed: **E** = Endangered; **V** = Vulnerable; **Mi** = Migratory Species ; State (NC Act) listed: **E** = Endangered; **V** = Vulnerable; **NT** = Near Threatened.

6.3.2.3.1 Regionally Significant Fauna Species

Brigalow Belt North bioregion

There are 30 fauna species that are not listed as Threatened or Near Threatened species under the EPBC Act and / or NC Act, but that have been listed as non-threatened priority taxa for the Brigalow Belt North bioregion (EPA 2008). Of these 30 species, 15 were to have the potential to occur within the rail corridor (Table 8).

Table 8. Regionally significant fauna species of the Brigalow Belt North bioregion having the potential to occur within the proposed rail corridor

COMMON NAME	SPECIES NAME
Birds	
Cotton Pygmy-goose	*Nettapus coromandelianus*
Wompoo Fruit-dove	*Ptilinopus magnificus*
Superb Fruit-dove	*Ptilinopus superbus*
Gould's Bronze-cuckoo	*Chrysococcyx russatus*
White-rumped Swiftlet	*Aerodramus spodiopygius*
Noisy Pitta	*Pitta versicolor*
Yellow-throated Scrubwren	*Sericornis citreogularis*
Fairy Gerygone	*Gerygone palpebrosa*
Yellow Honeyeater	*Lichenostomus flavus*
Brown-backed Honeyeater	*Ramsayornis modestus*
White-eared Monarch	*Monarcha leucotis*
Barred Cuckoo-shrike	*Coracina lineate*
Black-throated Finch	*Poephila cincta*
Olive-backed Sunbird	*Nectarinia jugularis*
Russet-tailed Thrush	*Zoothera heinei*

Desert Uplands bioregion

There are 46 fauna species that are not listed as Threatened or Near Threatened species under the EPBC Act and / or NC Act, but have been listed as non-threatened priority taxa for the Desert Uplands bioregion (EPA 2005). Of these 46 species, 33 may occur within the rail corridor (refer Table 9).

Table 9. Regionally significant fauna species of the Desert Uplands bioregion having the potential to occur within the proposed rail corridor

COMMON NAME	SPECIES NAME
Frogs	
Great Brown Broodfrog	*Pseudophryne major*
Reptiles	
Skink	*Ctenotus rosarium*
Wood Gecko	*Diplodactylus vittatus*
Winnecke's Dragon	*Diporiphora winneckei*
Gidgee Skink	*Egernia stokesii*
Desert Uplands' Skink	*Lerista sp.*
Blackheaded / Dwyer's Snake	*Suta spectabilis dwyeri*
Centralian Blue-tongued Lizard	*Tiliqua multifasciata*
Birds	
Brown Thornbill	*Acanthiza pusilla*
Australian Bustard	*Ardeotis australis*
Bush Stonecurlew	*Burhinus grallarius*
Brown Treecreeper	*Climacteris picumnus*
Black Falcon	*Falco subniger*
White-eared Honeyeater	*Lichenostomus leucotis*
Hooded Robin	*Melanodryas cucullata*
Grey-crowned Babbler	*Pomatostomus temporalis*
Masked Owl	*Tyto novaehollandiae*
Mammals	
Rufous Bettong	*Aepyprymnus rufescens*
Spectacled Hare-wallaby	*Lagorchestes conspicillatus*
Lakeland Downs Mouse	*Leggadina lakedownensis*
Gould's Long-eared Bat	*Nyctophilus gouldi*
Greater Glider	*Petauroides volans*
Squirrel Glider	*Petaurus norfolcensis*
Koala	*Phascolarctos cinereus*
Common Planigale	*Planigale maculata*
Desert Mouse	*Pseudomys desertor*
Queensland Pebble-mound Mouse	*Pseudomys patrius*
Common Dunnart	*Sminthopsis murina*
Common Brushtail Possum	*Trichosurus vulpecula*
Inland Forest Bat	*Vespadelus baverstocki*
Inland Cave Bat	*Vespadelus finlaysoni*
Swamp Wallaby	*Wallabia bicolor*
Common Rockrat	*Zyzomys argurus*

6.3.2.3.2 Introduced Fauna Species

Two common introduced species were recorded from the study area (i.e. cat (*Felis catus*) and feral pig (*Sus scrofa*)) and both species are declared Class 2 animals under the *Land Protection (Pest and Stock Route Management) Act 2002* (LP Act).

6.3.2.3.3 Essential Habitat Areas

There are no DERM mapped Essential Habitat Areas within 2 km of the proposed rail corridor.

6.3.2.3.4 Wetlands

There are no Nationally Important Wetlands or Wetlands of International Importance (Ramsar sites) within and / or in the vicinity of the study area.

The DERM Queensland Wetland Mapping identifies several freshwater palustrine and lacustrine wetlands within the study area. These wetlands are identified as mostly ephemeral watercourses as well as some large, braided river systems including the Suttor River, Mistake Creek and Belyando River.

An assessment of the aquatic values associated with these watercourses is provided in Chapter 7 of this volume and in more detail in a separate technical report to the EIS.

6.4 POTENTIAL IMPACTS DURING CONSTRUCTION

6.4.1 SIGNIFICANCE OF CONSTRUCTION OF THE RAIL INFRASTRUCTURE IN A STATE, BIOREGIONAL AND LOCAL CONTEXT

The potential impacts to terrestrial flora and fauna values associated with the construction of the rail infrastructure are detailed in the following sub-sections. The clearance corridor width will range from 50 m in open flat terrain to up to 150 m in areas where cross-slopes will require cutting and benching. In areas of environmental sensitivity, clearing could be reduced to 40 m width if necessary. For the purposes of the clearance footprints estimated in this report a conservative average width of 100 m has been utilised. As detailed below, there is potential to have medium impacts on:

- 2 TECs;
- 3 Endangered REs;
- 13 Of Concern REs; and
- 45 Least Concern REs.

Within the Desert Upland bioregional context, the rail clearance footprint is estimated to require the unavoidable removal of approximately 422 ha of Least Concern remnant vegetation, which represents approximately 0.02 % of the remnant vegetation in the Bioregion (and less than 0.06 % for each RE type proposed to be cleared). Locally this clearing represents less than 0.6 % of that which occurs within 10 km (and less than 3 % for each RE type proposed to be cleared within 10 km). This clearing is unavoidable and will have a minor consequence within state, bioregional and local contexts. As such, these impacts have been determined to be medium.

Within the Brigalow Belt North bioregional context, the rail clearance footprint is estimated to require the unavoidable removal of approximately 2,251 ha of Least Concern remnant vegetation, which represents approximately 0.04 % of the remnant vegetation in the Bioregion (and less than 0.4 % of all except one of the RE types proposed to be cleared). This clearing is unavoidable and will have a minor consequence within state, bioregional and local contexts. As such, these impacts have been determined to be medium. Areas mapped by EPA (2005 and 2008) as being of State, Regional and Local significance are shown in Figure 8 to Figure 10.

The clearing includes removal of approximately 2.35 % of RE 11.11.15d which is classified as Least Concern under the VM Act and Not of Concern at present under its DERM Biodiversity Status. This clearing is unavoidable and will have a minor consequence within State, Bioregional and local contexts. As such, this impact has been determined to be medium.

There is a potential to have a high impact on one Threatened flora species (Black Ironbox), although with appropriate mitigation measures this should be a medium impact. Potentially there may be medium impacts on any of 34 other Threatened and Near Threatened flora species, although none of these have been identified by field survey to date.

The proposed rail corridor has been selected to avoid impact upon any Category A ESA. The only ESAs within the proposed rail corridor are Category B ESAs consisting of seven REs listed as Endangered under DERM Biodiversity Status, upon which construction has the potential to cause medium impacts.

The construction has the potential to cause high social and economic impacts through spreading declared weeds (including parthenium weed which exists along significant section of the proposed rail corridor).

The construction of the rail infrastructure also has the potential for:

- medium impacts upon Least Concern fauna as a group;
- medium impacts upon a number of Regionally Significant fauna species; and
- medium impacts upon a number of Threatened and Near Threatened fauna species.

There is also potential for the construction to result in high impacts upon terrestrial flora and fauna values through alteration to hydrological characteristics of several freshwater palustrine and lacustrine wetlands (mostly ephemeral watercourses as well as some large, braided river systems including the Suttor River, Mistake Creek and Belyando River) although this may be reduced to a Medium impact where rail infrastructure design minimises the risk of significant hydrological change.

Figure 8. DERM Biodiversity Significance (Map 1 of 3)

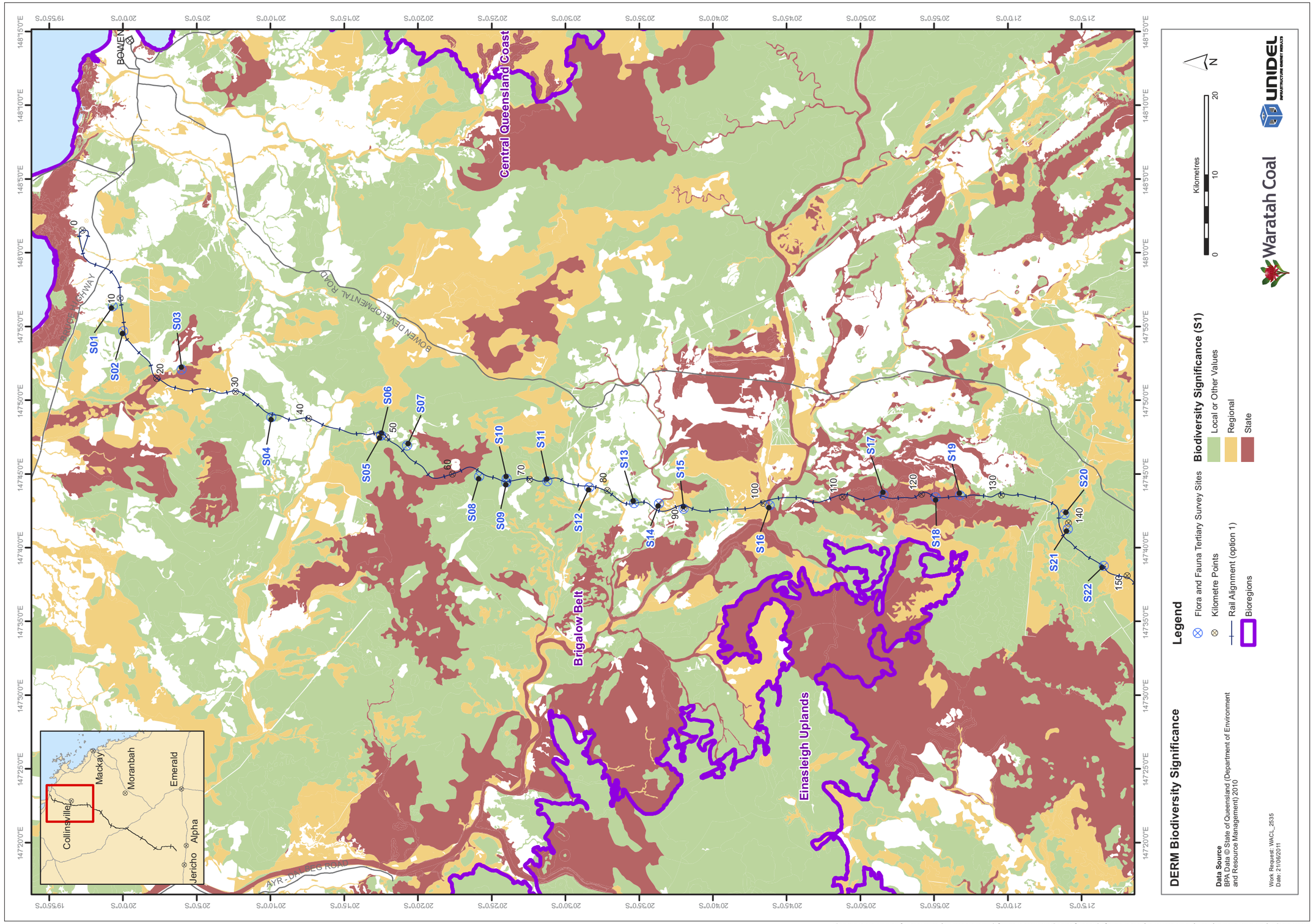


Figure 9. DERM Biodiversity Significance (Map 2 of 3)

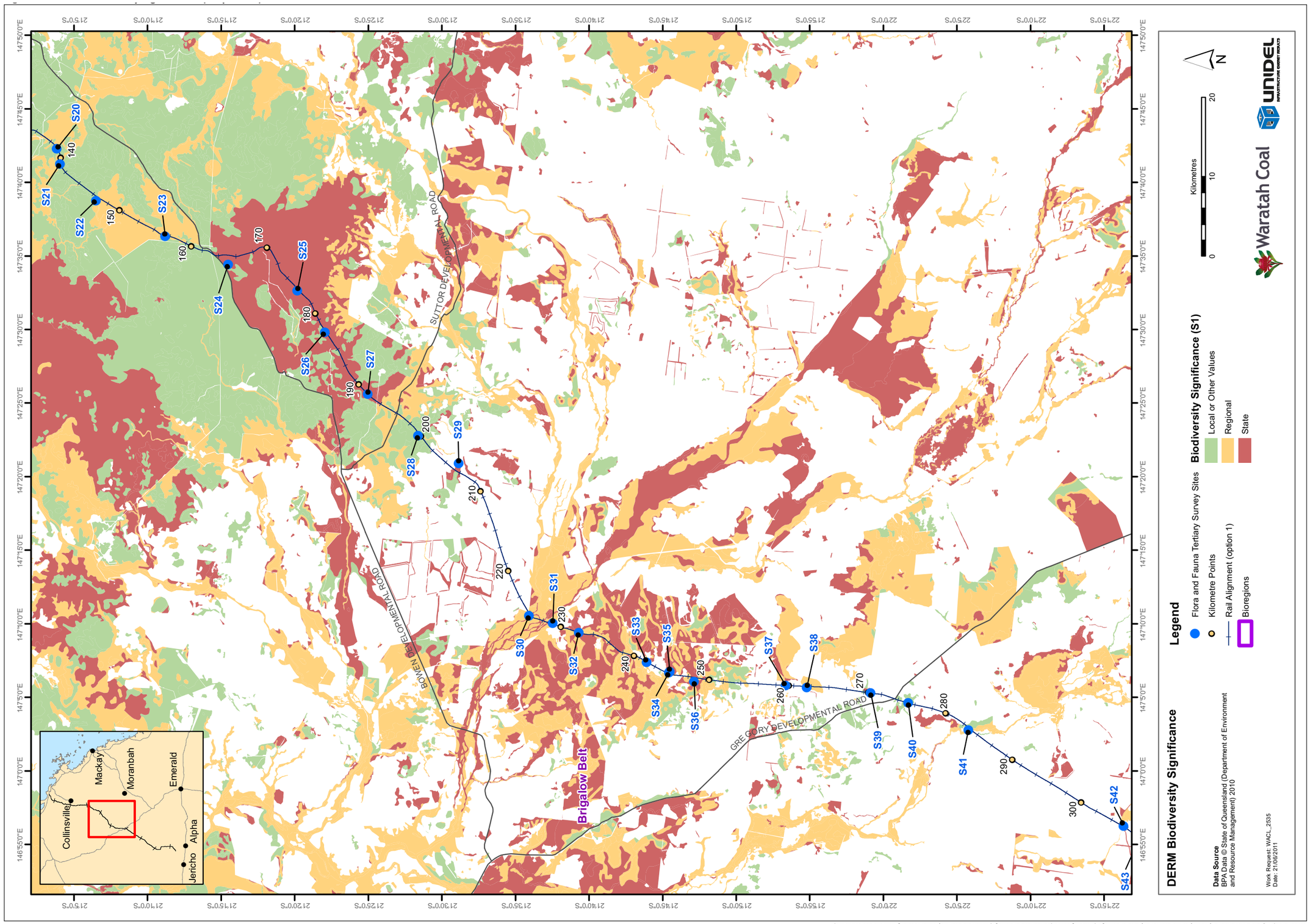
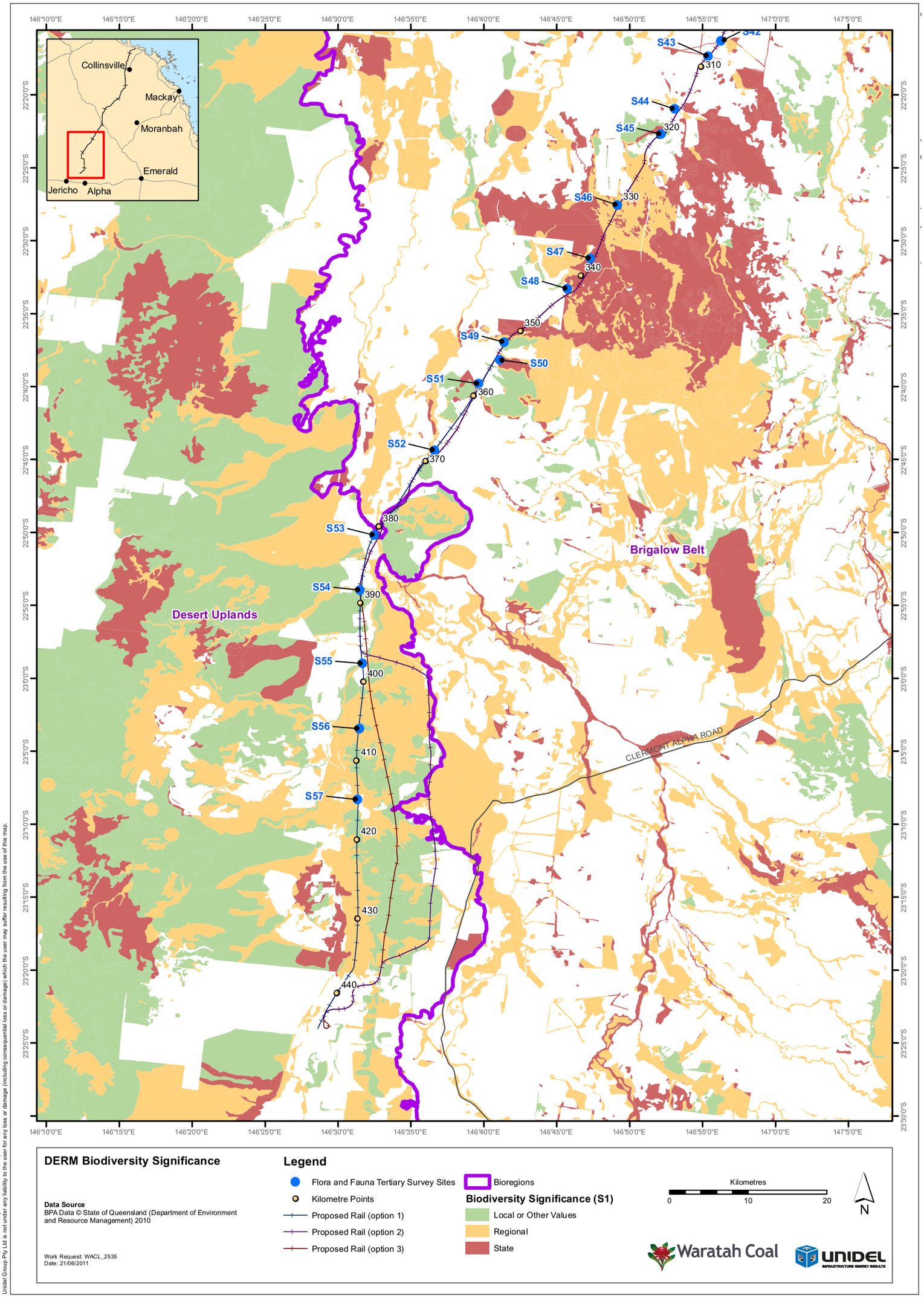


Figure 10. DERM Biodiversity Significance (Map 3 of 3)



6.4.2 POTENTIAL IMPACTS OF CONSTRUCTION ON FLORA IN GENERAL

While a significant length (176 km) of the proposed rail corridor transects cleared grazing land, the majority (269 km) is within mapped remnant vegetation. The breakdown of remnant vegetation type is discussed in this section in terms of the areas of each remnant type and the impact of clearing.

In all, approximately 2,691 ha of remnant vegetation is proposed to be cleared. This represents less than 1 % (approximately 0.51 %) of the entire vegetation extent within a 10 km buffer and less than 1 % (approximately 0.3 %) of that which occurs at the bioregional level (Table 10).

Potential direct and indirect impacts to flora associated with the proposed clearing include:

- direct spatial reduction in remnant vegetation due to clearing (detailed below);
- increased edge effects (through transecting large vegetation areas as well as reducing edge to area ratios) including the potential to increase the abundance of buffel grass and other weeds, feral animals and fire;
- potential for dust to reduce the health of vegetation in the vicinity of the clearance footprint;
- potential for temporary facilities, materials and equipment to damage areas outside the construction footprint;
- potential to alter the hydrological characteristics for areas upstream and downstream of the rail corridor; and
- potential for accidental and inappropriate release of pollutants which could contaminate soil and water, reducing the health of riparian and water dependent vegetation.

6.4.3 POTENTIAL IMPACTS OF CONSTRUCTION ON ECOLOGICAL COMMUNITIES/RES

In relation to direct clearing impacts, Table 10 shows the estimated clearance and the local and bioregional extent of each RE transected. Clearance estimates are based on a clearance width of 100 m along the rail alignment. It should be noted that these are likely therefore to be overestimates, as clearances can be reduced to 40 m in areas of environmental sensitivity (subject to the prevailing terrain).

Table 10. Approximate clearing areas within the project footprint

REGIONAL ECOSYSTEM	EPBC ACT STATUS	VM ACT STATUS	DERM BIODIVERSITY STATUS	AREA (HA)	AREA WITHIN 10 KM BUFFER	CLEARING 10 KM BUFFER %	EXTENT WITHIN BIOREGION	CLEARING WITHIN BIOREGION%
Bioregion: Desert Uplands								
10.10.4a	-	LC	NOC	1.44	50	2.88	39,283	<0.01
10.3.12a	-	LC	NOC	4.33	2,158	0. 20	32,854	<0.01
10.3.13a	-	LC	OC	0.12	539	0.20	31,235	<0.01
10.3.14	-	LC	OC	5.07	1,606	0.32	72,445	<0.01
10.3.27a	-	LC	OC	36.48	8,682	0.42	71,031	0.05
10.3.28a	-	LC	NOC	26.43	6,808	0.38	273,761	0.01
10.3.3	-	LC	NOC	15.47	1,225	1.26	31,641	0.05
10.3.4b	-	LC	OC	3.34	2,434	0.14	16,811	0.02
10.5.1	-	LC	NOC	80.31	15,618	0.51	403,039	0.02
10.5.12	-	LC	NOC	72.25	6267	1.16		
10.5.2	-	LC	NOC	12.04	786	1.53	123,842	0.01
10.5.5a	-	LC	NOC	176.17	31,704	0.56	937,745	0.02
10.7.3	-	LC	NOC	5.73	4,815	0.12	77,409	<0.01
10.7.5	-	LC	OC	3.73	1,509	0..25	26,492	0.01
10.7.7	-	LC	NOC	5.22	625	0.83	31,894	0.02
11.5.5	-	LC	NOC	0.48	419	0.11	2,310	0.02
Total in Desert Uplands				488.61	85,245	0.57		
Bioregion: Brigalow Belt North								
11.10.12	-	LC	NOC	162.57	4,846	3.35	47,710	0.34
11.10.3	-	LC	NOC	22.79	999	2.28	333,419	<0.01
11.10.7	-	LC	NOC	18.18	6,187	0.29	164,772	0.01
11.11.1	-	LC	NOC	21.50	5,427	0.40	161,384	0.01
11.11.10	-	OC	OC	1.26	974	0.13	85,082	<0.01
11.11.13	-	OC	OC	7.84	1,730	0.45	49,830	0.02
11.11.15d	-	LC	NOC	11.04	308	3.59	470	2.35
11.11.19	-	LC	OC	25.56	2,358	1.08	14,849	0.17
11.11.8	-	LC	NOC	1.51	63	2.41	14,989	0.01
11.11.9	-	LC	NOC	34.84	4,748	0.73	53,394	0.07
11.12.1	-	LC	NOC	556.13	96,934	0.57	807,586	0.07
11.12.10	-	OC	OC	2.08	184	1.13	9,185	0.02
11.12.2	-	LC	NOC	81.61	13,795	0.59	186,194	0.04
11.12.7	-	LC	NOC	24.20	11,311	0.21	86,571	0.03
11.12.9	-	LC	NOC	12.17	6,944	0.18	94,484	0.01
11.3.1	E	E	E	1.49	5,511	0.03	80,700	<0.01
11.3.10	-	LC	NOC	63.12	8,288	0.76	168,786	0.04
11.3.2	-	OC	OC	0.87	7,282	0.01	518,290	<0.01
11.3.25	-	LC	OC	58.02	11,317	0.51	493,504	0.01
11.3.3	-	OC	OC	0.26	11,813	0.002	261,967	<0.01

REGIONAL ECOSYSTEM	EPBC ACT STATUS	VM ACT STATUS	DERM BIODIVERSITY STATUS	AREA (HA)	AREA WITHIN 10 KM BUFFER	CLEARING 10 KM BUFFER %	EXTENT WITHIN BIOREGION	CLEARING WITHIN BIOREGION%
11.3.30	-	LC	NOC	39.06	9,612	0.41	66,059	0.06
11.3.32	-	LC	NOC	57.75	10,091	0.57	17,929	0.32
11.3.33	-	OC	E	2.71	471	0.58	1,862	0.15
11.3.35	-	LC	NOC	11.24	5,172	0.22	94,856	0.01
11.3.37	-	LC	NOC	8.78	1,442	0.61	30,452	0.03
11.3.4	-	OC	OC	39.18	8,918	0.44	184,545	0.02
11.3.5	-	LC	OC	4.21	7,339	0.06	55,352	<0.01
11.3.7	-	LC	OC	3.92	3,024	0.13	61,889	<0.01
11.3.9	-	LC	NOC	7.63	2,994	0.25	63,628	0.01
11.4.11	E	OC	OC	7.43	804	0.92	23,777	0.03
11.4.4	E	LC	OC	24.18	5,223	0.46	24,558	0.10
11.4.5	-	OC	E	6.20	723	0.86	13,246	0.05
11.4.6	-	OC	E	4.21	3,593	0.12	34,692	0.01
11.4.8	E	E	E	54.72	9,649	0.57	71,532	0.08
11.4.9	E	E	E	4.36	10,736	0.04	84,920	<0.01
11.5.10	-	OC	OC	4.57	1,787	0.26	9,896	0.05
11.5.12	-	LC	NOC	24.78	5,728	0.43	48,920	0.05
11.5.2	-	LC	NOC	27.22	5,289	0.51	174,287	0.02
11.5.3	-	LC	NOC	363.86	71,386	0.51	388,192	0.09
11.5.9	-	LC	NOC	189.90	21,071	0.90	200,109	0.09
11.7.2	-	LC	NOC	103.49	29,792	0.35	368,211	0.03
11.7.3	-	LC	NOC	12.32	3,546	0.35	91,553	0.01
11.8.4	-	LC	NOC	45.26	4969	0.91		
11.8.11	-	OC	OC	14.83	1667.8	0.86	174,577	<0.01
11.9.10	-	OC	E	6.27	4,953	0.13	81,101	<0.01
11.9.3	E	LC	NOC	16.33	4,276	0.38	103,874	0.02
11.9.9	-	LC	NOC	10.89	3,717	0.29	102,862	0.01
Total in Brigalow Belt North				2,202	438,992	0.50		
TOTAL				**2,691**	**524,237**	**0.51**		

Table 11 shows the estimated clearing extent and local and bioregional extents based on conservation status.

The proposed rail corridor also transects approximately 50 ha of High Value Regrowth (HVR) as mapped by DERM (2009, 2010). The approximate area of each RE with HVR present on the proposed rail corridor is shown in Table 12. Clearance estimates are based on a clearance width of 100 m along the rail alignment. It should be noted that these are likely therefore to be overestimates, as clearances can be reduced to 40 m in areas of environmental sensitivity (subject to the prevailing terrain).

Table 12 further shows those areas of HVR which are mapped as Category X (Cat X), meaning the VM Act may not prevent clearing of those areas of HVR (although other legislation including the EPBC Act may apply).

In total approximately 5.4 ha of the TEC Brigalow (*Acacia harpophylla* dominant and co-dominant) High Value Regrowth is mapped as occurring along the proposed rail corridor. These are made up of numerous small patches.

Table 11. Estimated clearing extents by conservation status

STATUS	AREA (HA)	AREA WITHIN 10 KM BUFFER	% CLEARING 10 KM BUFFER	EXTENT WITHIN BIOREGION	% CLEARING WITHIN BIOREGION
Bioregion: Desert Uplands					
Least Concern	488.61	85,245	0.57		0.02
Bioregion: Brigalow Belt North					
EPBC listed*	129	36,200	0.36	389,360	0.033
Endangered	60.57	25,896	0.23	237,152	0.026
Of Concern	97.71	44,901	0.22	1,448,050	0.007
Least Concern	2044	368,195	0.56	4,522,322	0.045
TOTAL	**2691**	**560437**	**0.48**	**8,204,738**	**0.03**

* EPBC listed Communities are overlapping (and not additional to) VM Act REs.

Table 12. High value regrowth areas transected by the rail corridor

RE	VM STATUS	BVG1M	TEC	HVR AREA HA	HVR CAT X* AREA (HA)	NOTES
11.10.12	LC	17a		0.17	0.00	
11.11.1	LC	13c		0.18	0.07	
11.11.13	OC	25a		0.30	0.01	
11.11.8	LC	13c		0.01	0.01	
11.11.9	LC	17a		0.21	0.14	
11.12.1	LC	13c		3.25	0.30	
11.12.9	LC	9b		0.07	0.07	
11.3.1	E	25a	TEC	0.26	0.00	Brigalow dominant community
11.3.10	LC	17a		0.05	0.05	
11.3.2	OC	17a		1.07	0.67	
11.3.25	LC	16a		3.46	3.15	
11.3.30	LC	18b		0.19	0.19	
11.3.3	OC	16c		2.17	2.17	
11.3.32	LC	18a		0.50	0.50	
11.3.33	OC	26a		0.04	0.04	
11.3.35	LC	9e		0.19	0.19	
11.3.37	LC	16a		0.31	0.31	
11.3.4	OC	16c		1.56	0.02	
11.3.5	LC	26a		2.19	0.11	
11.4.5	OC	26a		1.23	0.00	
11.4.6	OC	26a		6.01	5.85	
11.4.8	E	25a	TEC	2.26	0.61	Brigalow sub-dominant community
11.4.9	E	25a	TEC	2.87	1.02	Brigalow dominant community
11.5.12	LC	9e		3.02	3.02	
11.5.3	LC	17a		8.95	0.11	
11.5.9b	LC	18b		0.51	0.00	
11.5.9c	LC	18b		1.57	0.00	
11.7.2	LC	24a		3.64	3.13	
11.9.10	OC	25a		2.35	0.00	
Total (ha)	**48.58**	**21.71**				

* Cat X area is a subset of the total HVR not additional

6.4.3.1 Potential Impacts of Construction on EPBC Act Threatened Ecological Communities

Two EPBC listed Threatened Ecological Communities (TECs) are transected by the proposed rail corridor, namely

- Brigalow (*Acacia harpophylla* dominant and co-dominant); and
- Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin.

Table 13 shows the estimated clearing extent (on the basis that all Brigalow HVR is TEC) and local and bioregional extents for these TECs. Clearance estimates are based on a clearance width of 100 m along the rail alignment. It should be noted that these are likely therefore to be overestimates, as clearances can be reduced to 40 m in areas of environmental sensitivity (subject to the prevailing terrain).

This clearing is unavoidable and will have a minor consequence for these TECs even within their local and bioregional contexts. As such, it represents a Medium impact. Mitigation measures to minimise these impacts are provided in Section 6.6.

6.4.3.2 Potential Impacts of Construction on Endangered REs

Three Endangered REs (EREs), equating to approximately 60.57 ha of remnant vegetation (and 5.4 ha of HVR), are required to be cleared or will be impacted by the proposed clearance footprint (i.e. REs 11.3.1, 11.4.8 and 11.4.9). These are all Brigalow REs (and are the same as the Brigalow TEC REs). This represents 0.23 % of the RE extent within a 10 km buffer and 0.03 % of the RE extent within the bioregion. For each individual Endangered RE the impact is less than 0.6 % of the RE extent within a 10 km buffer and less than 0.07 % of the RE extent within the bioregion. This clearing is unavoidable and will have a minor consequence for these EREs within the local and bioregional contexts. As such, it represents a Medium impact. Nonetheless, mitigation measures to minimise impacts on EREs are provided in Section 6.6.

6.4.3.3 Potential Impacts of Construction on Of Concern REs

Thirteen Of Concern REs, equating to approximately 97.71 ha, are required to be cleared or will be impacted by the rail corridor clearance footprint. This represents 0.22 % of OCREs within a 10 km buffer and 0.01 % of that which occurs within the bioregion. For each individual Of Concern RE the impact is less than 1 % of the RE extent within a 10 km buffer and less than 0.06 % of the RE extent within the bioregion.

This clearing is unavoidable and will have a minor consequence for these REs within a local and bioregional context. As such, it represents a Medium impact on these REs. Nonetheless, mitigation measures to minimise impacts on OCREs are provided in Section 6.6.

6.4.3.4 Potential Impacts of Construction on Least Concern REs

A total of 48 Least Concern REs, equating to approximately 2,691 ha, are required to be cleared or will be impacted by the rail corridor clearance footprint. This represents 0.48 % of their extent within a 10 km buffer and 0.04 % of their extent within both bioregions. Note that for each of these Least Concern RE the impact is less than 3.3 % of the RE extent within a 10 km buffer and less than 0.4 % of the RE extent within the bioregion. One exception is RE 11.11.15d for which the impact is approximately 2.35 % of the RE extent within the bioregion (11 ha out of 470 ha).

Table 13. Estimated clearing extents for TECs

TECS	AREA (HA)	AREA WITHIN 10 KM BUFFER	% CLEARING 10 KM BUFFER	EXTENT WITHIN BIOREGION	% CLEARING WITHIN BIOREGION
Brigalow Communities	81	25,896	0.31	237,152	0.03
Natural Grassland Communities	48	10,304	0.47	152,208	0.03
TOTAL	**129**	**36,200**	**0.36**	**389,360**	**0.03**

The clearing of LCREs is unavoidable and will have a minor consequence for these REs within a local and bioregional context. As such, it represents a Medium impact on these REs. Mitigation measures to minimise these impacts are provided in Section 6.6.

6.4.4 POTENTIAL IMPACTS ON THREATENED AND NEAR THREATENED FLORA SPECIES

As detailed in Table 14, the proposed rail corridor contains potential habitat for 31 EVR flora species.

Detailed survey is required to confirm the presence or absence and potential presence of each of these flora species along the proposed rail corridor prior to alignment finalisation. It is anticipated that Threatened and Near Threatened flora species recorded during detailed corridor survey will generally be able to be avoided by alignment refinement. There may however, be some individual and populations which are unavoidable. Generally this would relate to species with restricted habitat niches from which the rail corridor may not be able to deviate. For example, the Vulnerable black ironbox occurs as a dominant and co-dominant canopy species along a number of watercourses between KP 0 – 100. These watercourses will need to be crossed by the rail corridor and it is likely that some individual trees and seedlings will need to be displaced to facilitate construction.

In circumstances where Threatened and Near Threatened species are unavoidable, Significant Species Management Plans will be developed and approval sought from both DSEWPC (for EPBC Act listed species) and EPA (for NC Act EVRs) prior to alignment finalisation.

Potential direct and indirect impacts associated with construction of the rail corridor on Threatened and Near Threatened flora species include:

- direct loss of individuals through clearing activities;
- reduction in the long term viability of the local populations by removing individual plants, population reduction and increased spatial isolation of plant populations;
- direct loss of potential habitat; and
- potential effects on health and viability of plants outside the clearance footprint through
  - increased edge effects and associated potential to increasing the abundance of weed species and fire intensity;
  - potential for dust to reduce the health of plants and associated vegetation retained outside the construction footprint; and
  - potential for temporary facilities, materials and equipment to damage plants and associated vegetation outside the construction footprint.

Table 14 identifies the potential impacts on each potential threatened and near threatened flora species. Mitigation measures are discussed in Section 6.6.

The analysis provided in Table 14 identifies that in the absence of appropriate mitigation measures there are medium impacts on these species. Mitigation measures to help minimise the impacts upon Threatened and Near Threatened Species including Black Ironbox are provided in Section 6.6.

Assuming the implementation of the mitigation measures, the impacts on these species is determined to be low for all species with the exception of Black Ironbox where the impact is determined to be medium.

Table 14. Potential impacts and significance of impacts on threatened and Near Threatened flora species likely to occur within the rail corridor

SPECIES	STATUS		PREFERRED HABITAT	OCCURRENCE OF PREFERRED HABITAT WITHIN PROJECT FOOTPRINT	POTENTIAL TO BE IMPACTED IN THE ABSENCE OF MITIGATION MEASURES
	NC ACT	EPBC ACT			
Acacia jackesiana	NT	-	Rocky hillsides in open eucalypt and acacia woodland. Extends from north of Mackay to north of Townsville, mostly inland.	Yes throughout	Potential to remove individuals or populations May result in removal of suitable habitat but extensive areas of similar habitat retained.
Acacia ramiflora	-	V	Woodland on sandstone hills	Yes throughout	Potential to remove individuals or populations May result in removal of suitable habitat but extensive areas of similar habitat retained.
Acacia spania	NT	-	Shallow sandstone-derived soils in open eucalypt or acacia shrub-lands and wood-lands.	Yes throughout	Potential to remove important populations Unlikely to result in removal of suitable habitat.
Bertya pedicellata	NT	-	Commonly found in open and closed forest on rocky hills with shallow skeletal or sandy soils. It is recorded at altitudes of 320 to 840 m. Associated with *Corymbia trachyphloia, Dodonaea filifolia, Acacia catenulata, A. curvinervia* and *A. shirleyi*	Yes (KP 0 - 100)	Potential to remove individuals or populations Unlikely to result in removal of suitable habitat.
Bertya sharpeana	NT	-	Mall shrub on rocky terrain north and south of Mackay.	Yes throughout	Potential to remove individuals or populations Unlikely to result in removal of suitable habitat.
Bonamia dietrichiana	NT	-	Dry rainforest and SEVT; less commonly in eucalypt woodland; mostly coastal from Townsville south to just north of Rockhampton.	Yes (KP 0 - 140)	Potential to remove individuals or populations Unlikely to result in removal of suitable habitat.
Cerbera dumicola	NT	-	Open woodland and SEVT often associated with 'jump-ups' and ridges.	Yes throughout	Potential to remove important populations May result in removal of suitable habitat but extensive areas of similar habitat retained.
Corchorus hygrophilus	V	-	Small shrub in SEVT and dry rainforest from Rockhampton to Townsville.	Yes (KP 0 - 140)	Potential to remove important populations Unlikely to result in removal of suitable habitat.

SPECIES	STATUS		PREFERRED HABITAT	OCCURRENCE OF PREFERRED HABITAT WITHIN PROJECT FOOTPRINT	POTENTIAL TO BE IMPACTED IN THE ABSENCE OF MITIGATION MEASURES
	NC ACT	EPBC ACT			
Croton magneticus	V	V	Vine thickets on skeletal granite, limestone or sandstone soils, including rocky seashores.	Yes (KP 0 - 140)	Potential to remove individuals or populations Unlikely to result in removal of suitable habitat but extensive areas of similar habitat retained.
Desmodium macrocarpum	NT	-	Open woodland and open forest communities on red earths, rarely on sandy clay soils, to 884 m. Also occurs in SEVT.	Yes throughout	Potential to remove individuals or populations May result in removal of suitable habitat but extensive areas of similar habitat retained.
Dichanthium queenslandicum (King Blue-grass)	V	-	Restricted to Emerald and rarely in the Darling Downs in Queensland. Found on black clay soils in native grassland communities.	Yes (KP 70 - 110)	Potential to remove individuals or populations May result in removal of suitable habitat but extensive areas of similar habitat retained.
Dichanthium setosum	NT	-	Occurs in coastal regions of south Queensland and in northern New South Wales. Found in tropical and subtropical rainforests and sub-humid woodlands.	Yes throughout	Potential to remove individuals or populations May result in removal of suitable habitat but extensive areas of similar habitat retained.
Digitaria porrecta (Finger Panic Grass)	NT	-	Occurs in coastal regions of south Queensland and in northern New South Wales. Found in tropical and subtropical rainforests and sub-humid woodlands.	Yes (KP 0 - 100)	Potential to remove individuals or populations May result in removal of suitable habitat but extensive areas of similar habitat retained.
Eucalyptus raveretiana (Black Ironbox)	V	V	Along watercourses and on riverflats. Open forest or woodland communities in association with Eucalyptus tereticornis, Corymbia tessellaris, E. camaldulensis, Melaleuca spp. and Casuarina cunninghamiana.	Yes (KP 0 - 100)	Almost certain to require removal of individuals but extensive areas of similar habitat and hundreds of adjoining individuals retained.
Graptophyllum excelsum	NT	-	Occurs in semi-evergreen vine thickets, although near Chillagoe, also recorded growing in grassy woodland in association with Eucalyptus cullenii and Corymbia erythrophloia. Usually found in soil pockets among rocks and in rock crevices on quite steep, rough, rocky, eroded hillsides.	Yes (KP 0 - 140)	Potential to remove individuals or populations Unlikely to result in removal of suitable habitat.

SPECIES	STATUS		PREFERRED HABITAT	OCCURRENCE OF PREFERRED HABITAT WITHIN PROJECT FOOTPRINT	POTENTIAL TO BE IMPACTED IN THE ABSENCE OF MITIGATION MEASURES
	NC ACT	EPBC ACT			
Livistona drudei	V	-	In coastal rainforest and melaleuca forests.	Yes (KP 0 - 20)	Potential to remove individuals or populations Unlikely to result in removal of suitable habitat.
Livistona lanuginosa	V	V	Restricted to a small area of the Burdekin River Basin along sandy river and creek channels.	Yes (KP 0 - 20)	Potential to remove individuals or populations Unlikely to result in removal of suitable habitat.
Macropteranthes leiocaulis	NT	-	Maryborough to south of Townsville, in SEVT.	Yes (KP 0 - 140)	Potential to remove individuals or populations Unlikely to result in removal of suitable habitat.
Marsdenia pumila	V	-	Grass tussocks in woodland with *Eucalyptus leichhardii, E. trachyphloia, Acacia shirleyi* and *Lysicarpus*.	Yes throughout	Potential to remove individuals or populations May result in removal of suitable habitat but extensive areas of similar habitat retained.
Omphalea celata	V	V	Occurs in fragmented SEVT or araucarian microphyll vine forest. Recorded along watercourses in steep sided gorges and gullies on weathered metamorphic or granitic soils.	Yes (KP 0 - 140)	Potential to remove individuals or populations Unlikely to result in removal of suitable habitat.
Ozothamnus eriocephalus	V	V	Known from a range of habitat types, including the margins of disturbed notophyll vine forest, margins of gallery forest, microphyll vine forest, tall open *Eucalyptus andrewsii - E. resinifera* forest with an understorey of *Allocasuarina littoralis*, in open eucalypt forest and on rocky ridges within *Eucalyptus* spp. - *Acacia* spp. scrub.	Yes throughout	Potential to remove individuals or populations May result in removal of suitable habitat but extensive areas of similar habitat retained.
Paspalidium scabrifolium	NT	-	Restricted to coastal regions of north and central Queensland. Found in brigalow country in eucalypt and Brigalow woodlands.	Yes throughout	Potential to remove individuals or populations May result in removal of suitable habitat but extensive areas of similar habitat retained.
Peripleura scabra	NT	-	Eucalypt woodland on rocky hills and slopes.	Yes throughout	Potential to remove individuals or populations May result in removal of suitable habitat but extensive areas of similar habitat retained.

SPECIES	STATUS		PREFERRED HABITAT	OCCURRENCE OF PREFERRED HABITAT WITHIN PROJECT FOOTPRINT	POTENTIAL TO BE IMPACTED IN THE ABSENCE OF MITIGATION MEASURES
	NC ACT	EPBC ACT			
Peripleura sericea	NT	-	From Stannary Hills to about Collinsville in eucalypt woodland.	Yes throughout	Potential to remove individuals or populations May result in removal of suitable habitat but extensive areas of similar habitat retained.
Polianthion minutiflorum	V	-	From Mackay to about Nanango growing in open woodland.	Yes throughout	Potential to remove individuals or populations May result in removal of suitable habitat but extensive areas of similar habitat retained.
Rhamphicarpa australiensis	NT	-	Occurs at 200 to 570 m altitude. It grows in *Melaleuca - Casuarina* open woodland and open sclerophyll woodland. It has been found on wet ground and in seepage areas near pools and swamps.	Yes throughout	Potential to remove important populations Unlikely to result in removal of suitable habitat.
Senna acclinis	NT	-	Rainforest margins and adjacent open forests at altitudes of 100 to 660 m on soils derived from a mixture of basalt and metamorphic rocks. In rainforest, associated with *Pleiogynium timorense* and *Elattostachys* sp. In open forests, associated with *Eucalyptus grandis, Syncarpia glomulifera* and *Alphitonia excelsa*.	Yes (KP 0 - 140)	Potential to remove individuals or populations May result in removal of suitable habitat but extensive areas of similar habitat retained.
Solanum adenophorum	E	-	Brigalow scrub.	Yes throughout	Potential to remove individuals or populations May result in removal of suitable habitat but extensive areas of similar habitat retained.
Solanum sporadotrichum	NT	-	Mainly coastal from Townsville to Mackay in SEVT open eucalypt woodland and littoral rainforest margins,	Yes (KP 0 - 200)	Potential to remove important populations Unlikely to result in removal of suitable habitat.
Tephrosia leveillei	V	V	Habitat poorly known. Only 3 records, on from open woodland beside creek.	Yes throughout	Potential to remove important populations Unlikely to result in removal of suitable habitat.

6.4.5 POTENTIAL IMPACTS OF CONSTRUCTION ON ENVIRONMENTALLY SENSITIVE AREAS

The proposed rail corridor has been selected to avoid impact upon any Category A Environmentally Sensitive Area.

The only ESAs, as mapped by DERM (2010), occurring within the proposed rail corridor are Category B ESAs - Regional Ecosystems listed as Endangered under DERM Biodiversity Status. The presence of Category B ESAs within the project area triggers the need for an environmental authority under the *Environmental Protection Act 1994* in the Category B areas. The balance of the site is exempt from this particular requirement.

Seven REs classified as Endangered under the DERM Biodiversity Status classification will be transected by the proposed rail corridor (Table 10). REs listed as Endangered (DERM biodiversity status) in the study area do not affect any exemptions or consent requirements under the VM Act for the project.

A total of approximately 79.96 ha of these REs will be cleared. The proportion of these REs that this clearing would represent is 0.22 % and 0.02 % of that which occurs within a 10 km buffer and the bioregion respectively. For each individual RE the impact is less than 0.9 % of the RE extent within a 10 km buffer and less than 0.16% of the RE extent within the bioregion (Table 10).

Other potential impacts on these ESAs associated with the construction of the rail infrastructure include:

- increased edge effects;
- potential for increased weed infestation;
- potential for increased risk of bushfire;
- potential for dust to reduce the health of retained vegetation in the vicinity of the clearance footprint; and
- potential for temporary facilities, materials and equipment to damage areas outside the construction footprint.

The main impacts of direct clearing and edge effects are largely unavoidable and will have a minor consequence for these ESAs. As such, it represents a medium impact. Nonetheless, mitigation measures to minimise impacts on these ESAs are provided in Section 6.6.

6.4.6 POTENTIAL IMPACTS ASSOCIATED WITH SIGNIFICANT WEEDS

The construction of the rail infrastructure has the potential to spread existing significant, environmental and other weeds and introduce new weed species to the area.

Introduction and spread of significant weeds can render land less productive and in some cases have serious health impacts on livestock and people. Parthenium weed is of particular interest to land holders and the community due to its potential impacts on agricultural productivity and human health. The proposed rail corridor transects extensive areas of parthenium weed and there is potential for construction activities to spread parthenium weed into currently clean areas through earthworks, movement of vehicles, machinery, equipment, materials and fill.

There is also potential for construction of the rail infrastructure to spread other significant weeds (including the seven detected during the fieldwork) into currently clean areas. The rail construction activities also have the potential to spread weeds into the adjoining woodlands and riparian areas where they do not currently occur. There is potential for the density and prevalence of buffel grass to be increased through edge effects and increased traffic. This species is an introduced and highly valued pasture grass in many areas; however, it has the potential to out-compete native groundcover species and increase biomass. An increase in biomass may bias fire regimes towards much more intense and frequent fire events which could degrade fire sensitive communities, particularly Brigalow forests and woodlands. The grass itself also provides very little nutritive or forage value for wildlife and therefore areas dominated by the buffel grass can become less diverse.

Even with the implementation of mitigation measures, potential impacts associated with the introduction and spread of weeds remain possible and, at least in the case of parthenium weed, could have major social and economic consequences. As such, these potential impacts have been determined to be Medium. Recommendations aimed at controlling the introduction and spread of weed species are provided in Section 6.6.

6.4.7 POTENTIAL IMPACTS OF CONSTRUCTION ON FAUNA IN GENERAL

Potential direct and indirect impacts on fauna are likely to include the following:

- loss of habitat such as mature vegetation, hollow-bearing trees and fallen logs, and therefore loss of nesting, refuge and foraging resources;
- mortality;
- habitat fragmentation and loss of connectivity (disturbance to fauna movement corridors);
- barrier effects; and
- edge effects.

The significance of these impacts on Threatened, Near Threatened, Migratory and Regionally Significant fauna species is considered in the following sections. The potential impacts on Least Concern fauna species as a group are largely unavoidable and will be of minor significance to these species. As such the impacts on Least Concern fauna as a group are medium.

6.4.7.1 Loss of habitat

Clearing of remnant vegetation inevitably results in habitat loss for wildlife fauna species.

An important potential impact on fauna is the loss of hollow-bearing trees. A large number of Australian vertebrate fauna species are dependent on tree hollows for shelter and nesting, including (amongst others) parrots, owls, possums, gliders and bats (Gibbons *et al.* 2002). Within the study area large habitat trees were observed, in particular, along creeklines (e.g. Sites 2, 21, 30, 41, 53, 55, 57).

Additionally, 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, dasyurids, bandicoots, lizards, snakes, frogs, and some birds. Fallen logs and dead timber mostly occur in the riverine habitat.

6.4.7.2 Mortality

Fauna injury or death has the greatest potential to occur during the start-up phase of construction when vegetation and habitats are being cleared. While some mobile species, such as birds, may be able to move away from the path of clearing, other species that are less mobile, or those that are nocturnal, restricted to tree hollows and / or burrowing species, could find it difficult to escape direct impacts.

6.4.7.3 Habitat Fragmentation and Loss of Connectivity

Fauna values in the majority of the study area are minimal and do not provide strong connectivity due to the land under pressure from heavy agricultural and grazing activities. However, bridges and underpasses which have been constructed for cattle access through watercourse areas allow some degree of fauna movement.

Some extensive areas of remnant vegetation will be transected by the proposed rail corridor, namely at Sites 38 to 40. As a result, fragmentation at these sites will be unavoidable.

The most significant habitats for fauna are the riparian corridors particularly within the gallery forests within the northern section of the proposed alignment and the associated areas of intact and healthy remnant vegetation.

Barrier effects occur where particular species are either unable or are unwilling to move between suitable areas of fragmented habitat. This could result in either a complete halt to movement or a reduced level of movement between fragments. Species most vulnerable to barrier effects are smaller ground-dwelling species and species with low mobility. Species least vulnerable to barrier effects tend to be those that are highly mobile (e.g. birds and bats), although even these species can vary in their response to barriers.

It is unlikely that the impacts will be significant given that the majority of species identified as potentially occurring on site are highly mobile species. Large portions of the proposed rail corridor have also been previously cleared to accommodate agricultural uses with a high occurrence of buffel grass

6.4.7.4 Edge effects

Edge effects refer to disturbance associated with an edge or boundary between retained vegetated habitats and cleared areas such as infrastructure. While the existing vegetated habitats are already affected by edge effects resulting from previous clearing, grazing and roads, new edges would be created during the construction phase of the Project. Edge effects may

potentially reduce soil moisture and impact on retained boundary vegetation through increased wind, dust, noise and light. Such changes have the potential to alter species composition and abundance in the vicinity of the rail corridor, increase predation and competition, and particularly increase weed invasion.

It is unlikely that the impacts as a result of the proposed rail corridor will be significant; however, the introduction of pest flora species and the increased likelihood of fire occurrences could potentially result in edge effects. It should be noted however that various locations of the proposed alignment have already been subject to fire occurrences and are degraded as a result.

6.4.8 POTENTIAL IMPACTS ON THREATENED, NEAR THREATENED AND LISTED MIGRATORY FAUNA SPECIES

No detailed field survey was undertaken for fauna species. Twenty-seven species (including listed Migratory species) were, however, identified as potentially occurring within the vicinity of the proposed rail corridor based on the occurrence of their preferred habitat (Table 6). Table 15 provides the area of potential habitat for each threatened species known to occur or potentially occurring within the project area and the area available within a 10 km radius of the corridor. The proportion that is to be cleared is provided as a percentage of the total within 10 km to indicate the signficance of loss of this habitat.

With the exception of one species, the striped-tailed delma, the loss of potential habitat is generally less than 1 % of the available habitat within a 10 km buffer of the rail corridor. For most potentially occurring species it is less than 0.5 % of the possible habitat within a 10 km buffer. Clearing of potential habitat for the striped –tailed delma for the rail corridor equates to approximately 12 % of the potential habitat within the 10 km buffer. The impacts on the habitat of potentially occurring Threatened, Near Threatened and listed migratory species, including the triped-tailed delma, are to be addressed through mitigation and habitat offsets.

The degree of impact on each of these species is shown in Table 16.

For the purposes of this study, at this stage, these species are considered to be present in the area and are thus treated accordingly and included in the implementation of the mitigation measures presented in Section 6.6.

6.4.9 POTENTIAL IMPACTS OF CONSTRUCTION ON REGIONALLY SIGNIFICANT FAUNA SPECIES

Regionally Significant fauna, including the 48 species which have been identified as potentially occurring within the proposed rail corridor, have the potential to be affected by the direct loss of habitat and other potential indirect impacts described in Section 6.4. The direct habitat loss and some edge effect impacts are unavoidable. The consequences of these impacts will be minor for most of these species which are generally either mobile (e.g. bush stone-curlew, grey-crowned babbler, brown treecreeper), able to utilise adjoining habitats (e.g. great brown broodfrog, Australian bustard, rufus bettong, hooded robin) and / or relatively tolerant of disturbance (common brushtail possum, swamp wallaby and spectacled hare-wallaby). As such the impacts on these species have been determined to be medium.

6.4.10 POTENTIAL IMPACTS ASSOCIATED WITH PEST FAUNA SPECIES

Two introduced fauna species were recorded in the study area (i.e. cat and feral pig). These pest species are listed under Class 2 of the LP Act, which are pests that are established in Queensland and have, or could have, a substantial adverse economic, environmental or social impact. Management of these pests requires coordination and they are subject to programs led by local government, community or landowners. Under the LP Act, landowners must take reasonable steps to keep land free of Class 2 pests.

It is possible that the construction of the rail infrastructure will favour pest fauna species and the consequence on adjoining remnant vegetation areas could potentially be moderate. As such the potential impacts associated with enhancing the environment for pest fauna species is medium.

6.4.11 POTENTIAL IMPACTS TO WETLANDS

The construction of the proposed rail corridor has the potential to alter hydrological regimes upstream and downstream of the corridor particularly where it crosses several freshwater palustrine and lacustrine wetlands (mostly ephemeral watercourses as well as some large, braided river systems including the Suttor River, Mistake Creek and Belyando River).

Table 15. Clearing of potential habitat for Threatened. Near Threatened and listed migratory species within the rail corridor and a 10 km radius

COMMON NAME	SCIENTIFIC NAME	STATUS		POTENTIAL HABITAT WITHIN 100M RAIL CORRIDOR	POTENTIAL HABITAT WITHIN 10 KM RADIUS	PERCENTAGE OF HABITAT WITHIN PROJECT AREA TO BE CLEARED
		NC ACT	EPBC ACT			
Common Death Adder	*Acanthophis antarcticus*	NT	-	4681	564619.79	0.829053477
Striped-tailed Delma	*Delma labialis*	V	V	3244	26836	12.08823968
Ornamental Snake	*Denisonia maculata*	V	V	555	330587.76	0.167882804
Yakka Skink	*Egernia rugosa*	V	V	4681	565231.2	0.828156691
Brigalow Scaly-foot	*Paradelma orientalis*	V	V	154	267277.05	0.057618116
Fork-tailed Swift	*Apus pacificus*	-	Mi	nil		
Great Egret	*Ardea alba*	-	Mi	1558	318411.23	0.48930435
Cattle Egret	*Ardea ibis*	-	Mi	1558	318411.23	0.48930435
Red Goshawk	*Erythrotriorchis radiatus*	E	V	4681	564619.79	0.829053477
Black-necked Stork	*Ephippiorhynchus asiaticus*	NT	-	497	122228.61	0.406615112
Beach Stone-curlew	*Esacus magnirostris (neglectus)*	V	-	0	4317.52	0
Latham's Snipe	*Gallinago hardwickii*	-	Mi	497	122228.61	0.406615112
Squatter Pigeon (southern)	*Geophaps scripta scripta*	V	V	nil		
Sarus Crane	*Grus antigone*	-	Mi	497	122228.61	0.406615112
Square-tailed Kite	*Lophoictinia isura*	NT	-	1326	341059.38	0.388788603
Black-chinned Honeyeater	*Melithreptus gularis*	NT	-	2878	388817.8	0.74019245
Rainbow Bee-eater	*Merops ornatus*	-	Mi	All is potential habitat		
Spectacled Monarch	*Monarcha trivirgatus*	-	Mi	778	173115.42	0.44941115
Satin Flycatcher	*Myiagra cyanoleuca*	-	Mi	778	173115.42	0.44941115
Little Curlew	*Numenius minutus*	-	Mi	1552	310092.63	0.50049561
Eastern Curlew	*Numenius madagascariensis*	NT	-	0	4317.52	0
Black-throated Finch (southern)	*Poephila cincta cincta*	E	E	2467	500392.7	0.493012788
Australian Painted Snipe	*Rostratula australis*	V	V	1552	310092.63	0.50049561
Common Greenshank	*Tringa nebularia*	-	Mi	1552	310092.63	0.50049561
Marsh Sandpiper	*Tringa stagnatilis*	-	Mi	1552	310092.63	0.50049561
Northern Quoll	*Dasyurus hallucatus*	-	E	1277	271594.56	0.470186148
Coastal Sheathtail-Bat	*Taphozous australis*	V	-	0	5390.07	0

Table 16. Potential impacts and significance of impacts on Threatened, Near Threatened and listed migratory fauna species likely to occur within the rail corridor

COMMON NAME	SCIENTIFIC NAME	STATUS		POTENTIAL TO BE IMPACTED	MITIGATION MEASURES
		NC ACT	EPBC ACT		
Reptiles					
Common Death Adder	*Acanthophis antarcticus*	NT	-	Likely to result in removal of suitable habitat but minor consequence as species able to use adjacent habitats.	See **Section 6.6** of this report.
Striped-tailed Delma	*Delma labialis*	V	V	Likely to result in removal of suitable habitat but minor consequence as species able to use adjacent habitats.	See **Section 6.6** of this report.
Ornamental Snake	*Denisonia maculata*	V	V	Likely to result in removal of suitable habitat but minor consequence as species able to use adjacent habitats.	See **Section 6.6** of this report.
Yakka Skink	*Egernia rugosa*	V	V	Likely to result in removal of suitable habitat but minor consequence as species able to use adjacent habitats.	See **Section 6.6** of this report.
Brigalow Scaly-foot	*Paradelma orientalis*	V	V	Likely to result in removal of suitable habitat but minor consequence as species able to use adjacent habitats.	See **Section 6.6** of this report.
Birds					
Fork-tailed Swift	*Apus pacificus*	-	Mi	No or negligible impacts predicted.	No Mitigation required.
Great Egret	*Ardea alba*	-	Mi	No or negligible impacts predicted.	No Mitigation required.
Cattle Egret	*Ardea ibis*	-	Mi	No or negligible impacts predicted.	No Mitigation required.
Red Goshawk	*Erythrotriorchis radiatus*	E	V	Unlikely to be impacted as no extensive stands of suitable habitat occur along the line.	No Mitigation required.
Black-necked Stork	*Ephippiorhynchus asiaticus*	NT	-	No or negligible impacts predicted.	No Mitigation required.
Beach Stone-curlew	*Esacus magnirostris (neglectus)*	V	-	No or negligible impacts predicted.	No Mitigation required.
Latham's Snipe	*Gallinago hardwickii*	-	Mi	No or negligible impacts predicted.	No Mitigation required.
Squatter Pigeon (southern)	*Geophaps scripta scripta*	V	V	No or negligible impacts predicted.	No Mitigation required.
Sarus Crane	*Grus antigone*	-	Mi	No or negligible impacts predicted.	No Mitigation required.

COMMON NAME	SCIENTIFIC NAME	STATUS		POTENTIAL TO BE IMPACTED	MITIGATION MEASURES
		NC ACT	EPBC ACT		
White-throated Needletail	*Hirundapus caudacutus*	-	Mi	No or negligible impacts predicted.	No mitigation required.
Square-tailed Kite	*Lophoictinia isura*	NT	-	No or negligible impacts predicted.	No mitigation required.
Black-chinned Honeyeater	*Melithreptus gularis*	NT	-	No or negligible impacts predicted.	No mitigation required.
Rainbow Bee-eater	*Merops ornatus*	-	Mi	No or negligible impacts predicted.	No mitigation required.
Spectacled Monarch	*Monarcha trivirgatus*	-	Mi	No or negligible impacts predicted.	No mitigation required.
Satin Flycatcher	*Myiagra cyanoleuca*	-	Mi	No or negligible impacts predicted.	No mitigation required.
Little Curlew	*Numenius minutus*	-	Mi	No or negligible impacts predicted.	No mitigation required.
Eastern Curlew	*Numenius madagascariensis*	NT	-	No or negligible impacts predicted.	No mitigation required.
Black-throated Finch (southern)	*Poephila cincta cincta*	E	E	Possible occurrence. Moderate consequence if breeding, minor consequence if not breeding. Highly mobile species able to use adjacent habitats.	See Section 6.6 of this report.
Australian Painted Snipe	*Rostratula australis*	V	V	No or negligible impacts predicted.	No mitigation required.
Common Greenshank	*Tringa nebularia*	-	Mi	No or negligible impacts predicted.	No mitigation required.
Marsh Sandpiper	*Tringa stagnatilis*	-	Mi	No or negligible impacts predicted.	No mitigation required.
Mammals					
Northern Quoll	*Dasyurus hallucatus*	-	E	Likely to result in removal of suitable habitat but minor consequence as species able to use adjacent habitats.	See Section 6.6 of this report
Coastal Sheathtail-Bat	*Taphozous australis*	V	-	No or negligible impacts predicted.	No mitigation required.

Such alterations have potential affect both terrestrial and aquatic ecosystems and species. The potential impacts on the aquatic values associated with wetlands are detailed in a separate technical report for the EIS. Some degree of impact on terrestrial species is likely and without adequate mitigation the consequence of such impacts could be major. This equates to a high impact on terrestrial flora and fauna. Mitigation measures such as designing rail infrastructure so that it does not significantly alter hydrological characteristics of watercourses and floodplains, could reduce the likelihood of such impacts to possible and the consequences of any impacts to moderate, equating to a medium impact on terrestrial communities and species.

6.4.12 SUMMARY OF IMPACTS ASSESSMENT DURING CONSTRUCTION

Table 17 summarises the impacts of construction activities on the terrestrial ecology of the area. It also provides an assessment of the risks before and after mitigation measures.

6.5 POTENTIAL IMPACTS DURING RAIL OPERATIONS

The ongoing operation of the rail infrastructure to transport coal from the mine to the coal terminal has the potential to impact terrestrial flora and fauna values. The potential impacts are described in the following sub-sections. In many cases the potential impacts associated with the operation of the rail infrastructure will be the same as those identified for its construction. To avoid repetition, such impacts are provided in a brief format where they have been discussed in more detail in Section 6.4.

6.5.1 SIGNIFICANCE OF RAIL OPERATIONS IN A STATE, BIOREGIONAL AND LOCAL CONTEXT

The ongoing operation of the rail infrastructure has the potential to cause indirect impacts Medium impacts on:

- 2 TECs;
- 3 Endangered REs;
- 12 Of Concern REs; and
- 48 Least Concern REs.

There is also potential for the rail operations to have a medium impact on one Threatened flora species (black ironbox), and any of 34 other Threatened and Near Threatened flora species.

Operation of the rail also has the potential to cause medium impacts to Category B ESAs, consisting of seven REs listed as Endangered under DERM Biodiversity Status. REs listed as Endangered (DERM biodiversity status) in the study area do not affect any exemptions or consent requirements under the VM Act for the project.

The operation of the rail infrastructure also has the potential for:

- medium impacts upon Least Concern fauna as a group;
- medium impacts upon a number of Regionally Significant fauna species; and
- medium impacts upon a number of Threatened and Near Threatened fauna species.

6.5.2 POTENTIAL IMPACTS OF RAIL OPERATIONS ON FLORA IN GENERAL

Potential impacts to flora associated with the ongoing operation of the rail include:

- edge effects, including the potential to increase:
  - the abundance of buffel grass (through altering fire regime);
  - the abundance of other weeds (through altering fire regime and increased risk of weed spread by maintenance crews, etc.); and
  - altered fire regime through increased fire risk (e.g. welding crews) and the rail corridor acting as a fire break; and
- potential for accidental and inappropriate release of pollutants at rail stockyard which could contaminate soil and water, reducing the health of riparian and other flora and fauna.

6.5.3 POTENTIAL IMPACTS OF RAIL OPERATIONS ON ECOLOGICAL COMMUNITIES / RES

Potential impacts of operation on Ecological Communities / REs are related to those identified in Section 6.4 (particularly potential alteration of weed densities and fire frequency). These impacts are possible and their consequence could potentially be minor for all Ecological Communities / REs. As such, the impacts upon the Ecological Communities / REs from operation of the rail are Medium.

Mitigation measures to help minimise these impacts are provided in Section 6.6.

Table 17. Risk Ratings for construction phase impacts before and after mitigations

ACTIVITY	IMPACT	MITIGATION MEASURES
Clearing of vegetation	Loss of habitat and resources Approx. 2,688 ha of native vegetation will be cleared.	Infrastructure should be located away from remnant vegetation areas whenever possible. Ensure only rail infrastructure footprint is cleared.
	Loss of Threatened, Near Threatened and listed Migratory species At least some individuals of Black Ironbox and preferred habitat for some Threatened, Near Threatened and listed Migratory species will be removed.	Detailed surveys prior to alignment finalisation. Develop Significant Species Management Plan. Provision of offsets for those Threatened species where the impact is considered significant and unavoidable
	Loss of Environmentally Sensitive Area Approx. 95 ha of EREs will be cleared.	Provision of offsets for unavoidable clearing
	Direct mortality of wildlife Low mobility, nocturnal, tree hollows-dependant and / or burrowing species have the potential to be injured or killed during clearing activities.	Employ a fauna handler to check all vegetation prior to clearing. Develop Significant Species Management Plan. Enforce speed limits. Educate personnel about environmental responsibilities.
	Restricted fauna movement Clearing of vegetation will result in increased barrier effect, edge effect and loss of connectivity, in particular for species with low mobility.	Provision of suitable underpasses at watercourse crossings. Restoration of some areas to improve connectivity after rail construction.
Potential introduced and / or spread of pests and weeds	Weeds and feral pests are typically associated with increased human activity. The rail construction activities could potentially spread declared and environmental weeds and favour pest species.	Develop a Weed and Pest Management Plan. Vehicle and machinery wash downs. Control movement of machinery and trucks.
Potential alterations to the hydrological characteristics for adjoining and downstream areas	The rail infrastructure has the potential to alter hydrological regimes upstream and downstream of the corridor particularly where it crosses several freshwater palustrine and lacustrine wetlands (mostly ephemeral watercourses as well as some large, braided river systems including the Suttor River, Mistake Creek and Belyando River).	Monitor adjoining wetland areas for water quality and hydrology impacts.

6.5.4 POTENTIAL IMPACTS OF RAIL OPERATIONS ON THREATENED AND NEAR THREATENED FLORA SPECIES

Potential impacts associated with operation of the rail on Threatened and Near Threatened flora species (including black ironbox) include potential impacts on the health and viability of plants outside the clearance footprint through the:

- potential to increase the abundance of buffel grass and other weeds and fire; and
- potential for accidental and inappropriate release of pollutants at rail stockyard which could contaminate soil and water and subsequently affect Threatened or Near Threatened species..

These impacts are unlikely, assuming widely accepted standards of environmental practice. Their consequences could potentially be major so the impacts associated with these indirect impacts have been determined to be Medium. Mitigation measures to help minimise these impacts are provided in Section 6.6.

6.5.5 POTENTIAL IMPACTS OF OPERATIONS ON ENVIRONMENTALLY SENSITIVE AREAS

During operation, there is a potential that ESAs (consisting of seven REs classified as Endangered under the DERM Biodiversity Status Classification) will be affected by operational activities. Potential impacts may include those identified in Section 6.4 as well as the potential for noise and light (at night) to reduce the value of transected habitat areas for some fauna species.

These impacts are possible and there consequence could potentially be minor for these REs. As such, the impact upon these REs from the operation of the rail is medium.

Mitigation measures to help minimise these impacts are provided in Section 6.6.

6.5.6 POTENTIAL IMPACTS OF RAIL OPERATIONS ASSOCIATED WITH SIGNIFICANT AND OTHER WEEDS

The operation of the rail has the potential to spread existing significant, environmental and other weeds and introduce new weed species to the area through earthworks, train movements, movement of maintenance vehicles, machinery, equipment, materials and fill.

These impacts are possible and their social and economic consequences could potentially be severe so these impacts have been determined to be high. Recommendations aimed at controlling the introduction and spread of weed species are provided in Section 6.6.

6.5.7 POTENTIAL IMPACTS OF RAIL OPERATIONS ON FAUNA IN GENERAL

Potential impacts on fauna associated with rail operations are likely to include those presented in Table 18.

Mitigation measures to help minimise these impacts are provided in Section 6.6.

Table 18. Potential impacts of rail operations on fauna

POTENTIAL IMPACTS	MITIGATION MEASURES
Potential reduction in habitat values and general health and viability through edge effects such as potential increase in noise and light pollution.	General mitigation measures provided in Section 6.6.
Mortality through potential collisions with trains and maintenance vehicles.	General mitigation measures provided in Section 6.6.
Altered fire frequency and intensity.	General mitigation measures provided in Section 6.6.
Barrier effects (associated with the rail corridor).	General mitigation measures provided in Section 6.6.

6.5.8 POTENTIAL IMPACTS OF RAIL OPERATIONS ON THREATENED, NEAR THREATENED AND LISTED MIGRATORY FAUNA SPECIES

The operation of the rail has the potential to be of moderate consequence for a number of Threatened and Near Threatened fauna species through the following potential impacts:

- potential reduction in habitat values and general health and viability through edge effects such as potential increase in noise and light pollution;
- mortality through potential collisions with trains and maintenance vehicles;
- altered fire frequency and intensity; and
- barrier effects (associated with the rail corridor).

The potential impact on these species has been identified as medium. Mitigation measures to further reduce the potential for any such impacts are presented in Section 6.6.

6.5.9 POTENTIAL IMPACTS OF RAIL OPERATIONS ON REGIONALLY SIGNIFICANT FAUNA SPECIES

The operation of the rail has the potential to be of moderate consequence for a number of Regionally Significant fauna species through the following potential impacts:

- potential reduction in habitat values and general health and viability through edge effects such as potential increase in noise and light pollution;
- mortality through potential collisions with trains and maintenance vehicles;
- altered fire frequency and intensity; and
- barrier effects (associated with the rail corridor).

The operation of the rail has the potential to be of moderate consequence for a number of these species and the potential impact on these species has been identified as medium. Mitigation measures to further reduce the potential for any such impacts are presented in Section 6.6.

6.5.10 POTENTIAL IMPACTS OF RAIL OPERATIONS ASSOCIATED WITH PEST FAUNA SPECIES

The main impacts will occur during construction activities. It is unlikely that the operation of the rail will cause any additional impacts.

6.5.11 SUMMARY OF IMPACTS ASSESSMENT DURING OPERATION

Table 19 summarises the impacts of operation activities on the terrestrial ecology of the area. It also provides an assessment of the risks before and after mitigation measures.

Table 19. Risk ratings for operating phase impacts before and after mitigation

ACTIVITY	MITIGATION MEASURES
Increase in light and noise The rail activities will cause a localised increase in noise and light. This has the potential to disrupt local wildlife behaviour.	Implement Significant Species Management Plans.
Accidental or inappropriate release of pollutants	Install Gross Pollutant Traps, detention tanks and filters to capture oil / hydrocarbons, fines and heavy metals at rail depots. Regular machinery and vehicle maintenance.
Animal death and / or injury due to collision with trains and maintenance vehicles	Enforce safe speed limits. Educate personnel about environmental responsibilities.
Weeds and feral pests typically associated with increased human activity The rail activities could spread declared and environmental weeds in the adjoining woodlands and riparian areas and could also favour pest species.	Develop a Weed and Pest Management Plan. Maintenance vehicle washdowns. Control movement of machinery equipment and fill.

6.6 MITIGATION AND MANAGEMENT

6.6.1 MITIGATION AND MANAGEMENT COMMITMENTS FOR FLORA

The following measures should be implemented during the construction phase to mitigate impacts on flora within and adjacent to the project area:

Objectives

- no unnecessary removal of remnant vegetation;
- limit the clearing of threatened species or large mature trees wherever possible;
- rehabilitation of areas required only for construction; and
- ensure compliance with licenses and approvals.

6.6.1.1 Construction

- detailed flora surveys will be conducted of all remnant vegetation areas within the corridor prior to finalisation of the alignment;
- minimise the clearance of remnant vegetation to that necessary for construction;
- ensure all necessary permits and approvals are in place prior to removal of native vegetation;
- all vegetation clearing boundaries will be clearly identified in the field to avoid inadvertent clearing of native vegetation;
- clearly mark designated revegetation / rehabilitation zones and other no go areas (including large sign cant trees) prior to any vegetation clearing. High visibility tape, barricade webbing or similar will be used to avoid inadvertent clearing of native vegetation;
- clearing along the proposed rail corridor should be limited to the amount necessary to undertake earthworks and will aim to minimise the construction corridor width where possible;
- when working in and around remnant vegetation, a suitably qualified person will inspect the area for threatened species;
- any additional clearing of native vegetation outside the approved area of disturbance will not be carried out without the necessary approvals;
- felled vegetation should be mulched and reused on site. Hollow logs and large debris will be salvaged for the use of habitat enhancement within areas designated for rehabilitation;
- a detailed Weed Management Plan that addresses the construction, rehabilitation and operation phases of the project should be prepared prior to construction. This Plan should include hygiene protocols to minimise the likelihood of introduction and spread of environmental, agricultural and declared weeds, including:
  - the implementation of sediment control mechanisms to reduce the potential for the spread of weed species into sensitive areas;
  - vehicle wash down procedures to avoid the potential to spread weed spread;
  - monitoring and weed inspections (monitoring across disturbed areas on a monthly basis during construction);
- detailed Soil and Erosion Management Plans will be developed prior to construction to minimise sediment runoff. The plan will include a requirement to rehabilitate disturbed areas as soon as possible after disturbance;
- dust monitoring should be undertaken and dust reduction measures should be implemented where necessary. These measures could include:
  - the regular maintenance and wetting down of tracks to minimise dust generation;
  - the implementation and enforcement of a site speed limit to minimise dust generation;
- cleared areas will be rehabilitated as soon as practicable;
- exclude the parking of heavy vehicles, stockpiling and the storage of plant and equipment from the drip zone of trees to avoid damage to the root system and lower branches;
- where practical use existing and designated access tracks, avoiding unnecessary clearing of large mature remnant trees where possible;
- fire fuel loads will be monitored and vehicle activities should be restricted to roads, access tracks and hardened surfaces to reduce the possibility of wildfire. Vehicles will be fitted with spark arrestors and firefighting equipment should be available at construction sites;
- a Fire Management Plan will be developed and implemented;
- all construction personnel will be educated of environmental responsibilities during inductions;

- a detailed Rehabilitation Plan will be developed that includes a detailed rehabilitation monitoring and evaluation plan including monitoring schedule (e.g. quarterly monitoring of areas under rehabilitation). Suitable completion criteria and indicators to measure the progress of rehabilitation may include 70 % of cover of native and introduced species within each stratum as occurring on adjoining reference sites of the same land type. At least two reference sites within the same sub-catchment should be established within each RE being rehabilitated to provide benchmarking of rehabilitation progress and completion;
- a Significant Community / Species Management Plans will be developed for Brigalow and Natural Grassland Communities, black ironbox and any other significant flora species which may potentially be impacted by the proposed rail (including those identified in Section 6.4. These plans will include:
  - proposed management measures including those identified for construction and operation of the rail infrastructure;
  - a monitoring and evaluation program for the community / species; and
  - offset commitments relating to the community / species.
- Where impacts are unavoidable to significant biodiversity values these will be compensated for through delivery of offsets (refer to Section 6.6.3);

6.6.1.2 Operation

The following measures will be implemented to mitigate impacts on flora within and adjacent to the project area:

- the Weed Management Plan will be implemented and the regular monitoring of the prevalence of weed species in disturbed and adjacent areas should be undertaken;
- areas necessary for construction, but not required for the operational phase will be progressively be rehabilitated. Rehabilitation should include the re-establishment of original REs where possible;
- the rehabilitation program will incorporate a wide variety of species endemic to the area and typical of the RE being rehabilitated;
- where practical, maintenance workers will remain on designated tracks at all times to minimise the disturbance of surrounding vegetation; and
- control and / or removal of any weeds that have been introduced or exacerbated as a result of the works.

6.6.2 MITIGATION AND MANAGEMENT COMMITMENTS FOR FAUNA

The following mitigation measures should be implemented during the construction phase to mitigate adverse impacts on the fauna assemblages associated with or adjacent to the rail corridor:

6.6.2.1 Objectives:

- no unnecessary clearing of threatened species habitat;
- to comply with all licences and approvals ensuring protection of fauna habitat and rehabilitation of disturbed areas; and
- no death or serious injury to native fauna during construction activities.

6.6.2.2 Construction

- detailed fauna habitat surveys will be conducted of all remnant vegetation areas within the corridor prior to finalisation of the alignment;
- removal of vegetation in a staggered sequence to allow fauna species to relocate off site;
- minimised clearing of large trees in riparian areas to protect potential nesting trees of raptors;
- staff, including contractors, will be informed that all native wildlife is protected and shall not be intentionally harmed as a result of works or workers actions;
- any injured fauna will be taken to the nearest vet or reported to the DERM;
- recognised fauna spotter / catcher (DERM certified) to inspect the corridor immediately prior to clearing vegetation;
- contact details for qualified animal carers and vets within the areas will be outlined and provided to relevant staff;
- development and implementation of protocols for any displaced fauna to be relocated to more suitable similar habitat within the surrounding area;
- observation of tree hollows for sign of activity;
- site works, such as trenches and excavations, will be designed to ensure fauna are not trapped or likely to be impacted by construction activities (e.g. install trench ramps at 15 degree slope every 30 m or place branches or suitable material for fauna to climb and escape from trenches);

- inspection of culverts and other structures prior to works within the area to determine whether there are any trapped or injured fauna species present and action as appropriate (eg contact spotter / catcher to relocate animal);
- where temporary fencing is required consideration will be given to fauna movement, current land uses and construction staff safety requirements;
- watercourse crossings will consider fauna movement across the rail corridor;
- implementation of waste management measures to minimise increased numbers of introduced animal and opportunistic native fauna in the project area;
- where possible rehabilitation of disturbed areas associated with construction works with suitable endemic vegetation to enhance their potential for fauna movement;
- appropriate strategies will be developed and implemented to minimise the risk of road kill including (reduced speed zones, minimise vehicle movement during times of high fauna activity, for example dawn, dusk and at night);
- Significant Species Management Plans will be developed for any significant fauna species which may potentially be impacted by the proposed rail (including those identified as having potential medium impacts in Section 6.4). These plans will include:
  - proposed management measures including those identified for construction and operation of the rail infrastructure;
  - a monitoring and evaluation program for the community / species; and
  - offset commitments relating to the community / species.
- Where impacts are unavoidable to Threatened fauna species habitat under the EPBC Act and they are likely to have a significant impact on the species this loss will be compensated for through delivery of offsets (refer to Section 6.6).

6.6.2.3 Operation

The following mitigation measures will be implemented during the operational phase to minimise any adverse impacts on fauna associated with or adjacent to the rail corridor:

- maintenance works to be carried out within designated areas to minimise impact on surrounding undisturbed areas;
- vehicular traffic will be restricted to constructed access tracks;
- implementation of fauna and pest management procedures. This will include procedures to manage the removal of native fauna where required, including contact details for local animal carers and vets; and
- where maintenance of fencing is required, consideration should be given to fauna movement, current land uses and safety / security requirements.

6.6.3 ENVIRONMENTAL OFFSETS

Whilst the proposed rail corridor has been selected to avoid significant areas of remnant vegetation the nature of the topography, construction constraints in relation to the rail width and maximum slope and extensive vegetation areas mean that clearing of approximately 2,688 ha of remnant vegetation will be unavoidable. As such, it is proposed that offsets be established to compensate for unavoidable impacts to particular significant biodiversity values as required under existing offset policies at the State and Commonwealth level (such as Endangered REs, Of Concern REs, TECs and EVR flora).

Both the Commonwealth and Queensland Governments' offsets policies, including the 'Draft Policy Statement: Use of environmental offsets under the *Environment Protection and Biodiversity Conservation Act 1999*' and the *Queensland Government's Environmental Offsets Policy (QGEOP)* (EPA 2008) require that unavoidable impacts to Threatened flora, fauna and ecological communities be compensated for through the provision of offsets.

The estimated biodiversity offset requirements of the Project, including the rail corridor, and Waratah Coal's proposed approach to offset delivery is detailed in the Galilee Coal Biodiversity Offset Strategy (Unidel, 2011).

The key offset principles adopted for the project are as follows:

- offsets will only be proposed after all attempts have been made to avoid, minimise and mitigate the environmental impacts;
- the offset should directly relate to the environmental values being impacted, often referred to as the "like for like" principle;
- offset values will be co-located to the greatest extent possible and strategically located adjacent to existing protected areas or within biodiversity corridors to maximise biodiversity outcomes and long-term viability of the offset;
- the offset should 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 should 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 should be legally secured; and
- mechanisms will be put in place to ensure that the offset is enforceable, monitored and audited.

The main offset requirements associated with the rail component of the Project include:

- TECs including Brigalow and Natural Grasslands;
- Endangered REs and Of Concern REs
- Threatened fauna species habitat under the EPBC Act including reptiles such as the yakka skink, striped-tailed delma and ornamental snake as well as the northern quoll and black-throated finch; and
- Threatened flora species *Eucalyptus raveretiana*.

Based on results of the offset analysis, spatial analysis has been undertaken to determine the potential availability of suitable offsets. This included a desktop exercise to identify potential offset sites that contain as many of the offset values as possible, will deliver strategic conservation outcomes such as expanding existing protected areas or enhancing biodiversity corridors, and also deliver real benefit to those species and ecological communities at greatest risk. Large areas of potential offsets have been identified within 50 km of the rail corridor that are mapped as containing the regional ecosystems and biodiversity values Waratah Coal are seeking to offset.

The next phase is to prioritise offset areas, commence landholder engagement and undertake preliminary site inspections to verify the biodiversity values on the ground. In consultation with the CG, DERM and DSEWPaC an Offset Package will then be prepared that details the proposed offset sites, mechanisms to secure the areas and management requirements.

Further detail on the offset requirements, spatial analysis, offset availability and future steps is provided within the Galilee Coal Biodiversity Strategy.

6.7 CONCLUSION

With the implementation of appropriate mitigations measures, including undertaking detailed on-ground flora and fauna surveys through all remnant vegetation areas prior to alignment finalisation and the provision of compensatory offsets for unavoidable impacts, the proposed rail infrastructure has the potential to have medium impacts upon:

- three Brigalow REs listed as Endangered under the EPBC Act and VM Act;
- three Natural Grassland REs listed as Endangered under the EPBC Act;
- 13 Of Concern REs;
- 45 Least Concern REs;
- Wetland habitats;
- Black Ironbox;
- five reptiles and one bird listed under the EPBC Act and / or VM Act;
- 48 regionally significant fauna species; and
- Social and economic values through spreading declared weeds.

It is considered that the proposed rail corridor is generally well located in relation to minimising impacts on terrestrial flora and fauna values. It is likely that additional avoidance and minimisation will be achievable based on detailed on-ground surveys.

6.8 COMMITMENTS

To manage potential impacts on terrestrial ecology associated with the construction and operation of the rail, Waratah Coal commits to:

- finalising a Biodiversity Offset Strategy in consultation with DERM and DSEWPC;
- develop a Fire Management Plan in accordance with the relevant local planning policies, the relevant State planning policy and in consultation with the Rural Fire Service;
- develop and a Weed and Pest Management Plan in consultation with Biosecurity Queensland and the various regional council's;
- conduct a detailed flora and fauna survey of all remnant vegetation areas within the corridor prior to finalising the alignment with the purpose of identifying the presence of significant flora and fauna species as listed under Commonwealth and State legislation. Where significant species are identified, all practicable measures will be implemented to avoid or limit impacts;
- develop a Species Management Plan in accordance with Commonwealth and State requirements for vegetation offsets, DERM's Back on Track Species Prioritisation Framework and other relevant management and / recovery plans to reduce the impacts on significant fauna species. Where habitat for significant fauna species is identified, all practicable measures will be implemented to limit the impact;
- develop a Significant Community / Species Management Plans in accordance with Commonwealth and State legislation for those values or species where unavoidable impacts will have a significant impact on their habitat; and
- develop and implement a Soil and Erosion Management Plan in accordance with the relevant local planning policies and the relevant State planning policy.