8 Terrestrial Ecology

This section describes the terrestrial ecology of the project site, in terms of environmental values and potential impacts and mitigation measures.

8.1 Terrestrial Flora

8.1.1 Description of Environmental Values

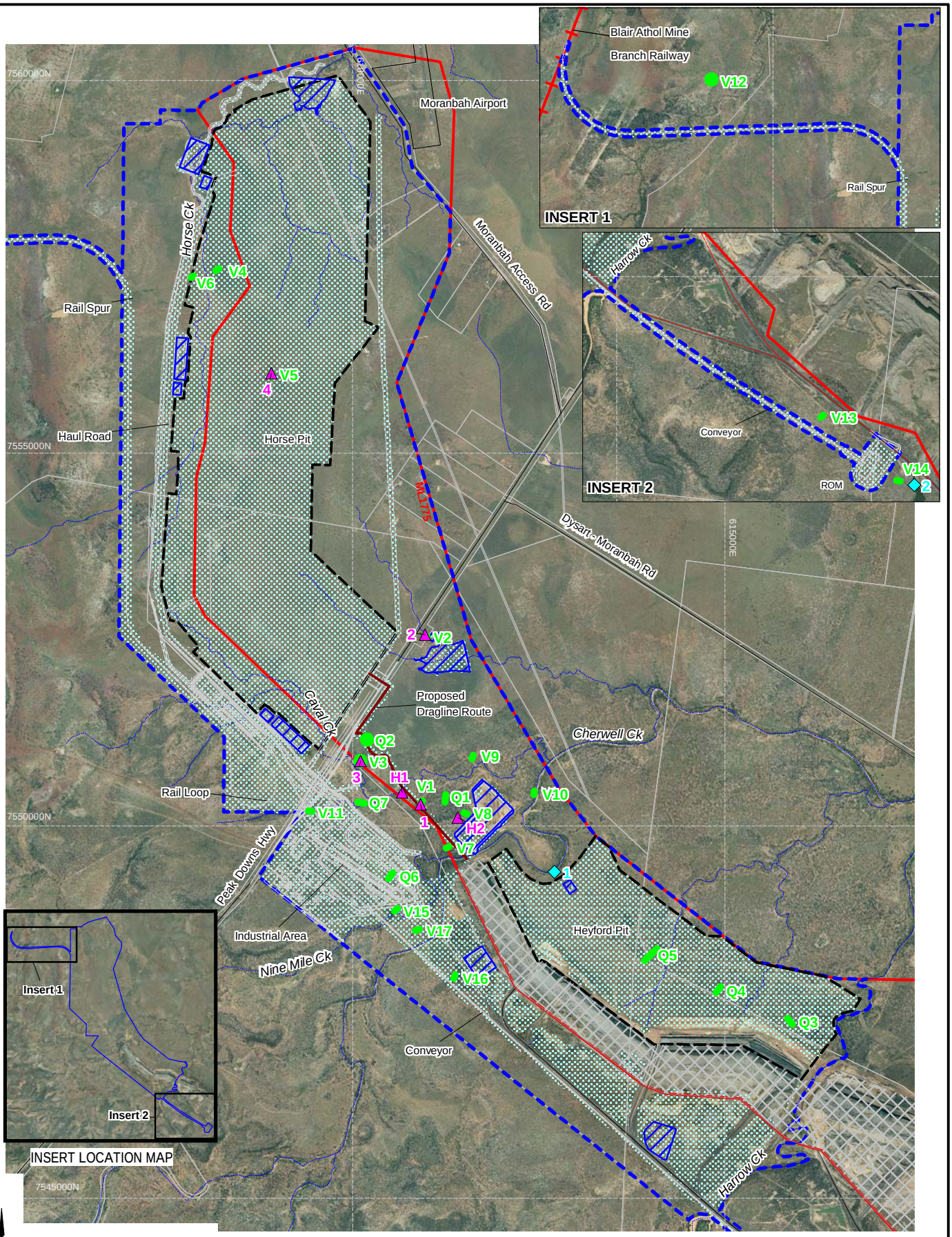
The terrestrial flora values of the project were defined through reference to:

- Species and communities of conservation significance as listed under relevant legislation (i.e. Queensland *Nature Conservation Act 1992* (NC Act) and *Vegetation Management Act 1999* (VM Act); Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).
- Declared pest species as listed under relevant legislation (i.e. Queensland *Lands Protection (Pest and Stock Route Management) Act 2002* (LP Act).
- The Queensland Biodiversity Planning Assessment (BPA) for the Northern Brigalow Belt, produced by the EPA (2003), based on Regional Ecosystem and Essential Habitat mapping under the VM Act and the results of Expert Panel workshops.

The methodology to describe the status of terrestrial flora values in the project area included:

- Searching relevant databases, including the Department of Environment, Water, Heritage and the Arts' (DEWHA) Online Protected Matters Search Tool and the Queensland Environmental Protection Agency's (EPA's) Wildlife Online database.
- Review of existing Queensland Department of Natural Resources and Water (NRW) certified Regional Ecosystem (RE) mapping for the area.
- Review of the results of previous surveys in and around the area of interest (Ecoserve and LAMR 2005).
- Review of aerial photography.
- Ground survey.

A ground survey was undertaken and the detailed methodology is provided in Appendix K, Section 3. Study site locations are indicated on Figure 8.1.



Client: BHP Billiton Mitsubishi Alliance

Project: CAVAL RIDGE PROJECT
ENVIRONMENTAL IMPACT STATEMENT

Title: **LOCATION OF ECOLOGICAL GROUND SURVEY SITES**

Drawn: VH	Approved: RS	Date: 08-05-2009	Figure: **8.1**	Rev:D
Job No: **4262 6158**	File No: 42626158-g-547d.wor			**A4**

8.1.1.1 Biodiversity Planning Assessment

The Biodiversity Planning Assessment (BPA) (EPA 2003a,b) process uses the Biodiversity Assessment and Mapping Methodology (EPA 2002) to determine the biodiversity significance of habitats and landscapes for the various bioregions in Queensland, based largely on remnant vegetation mapping generated by the Queensland Herbarium.

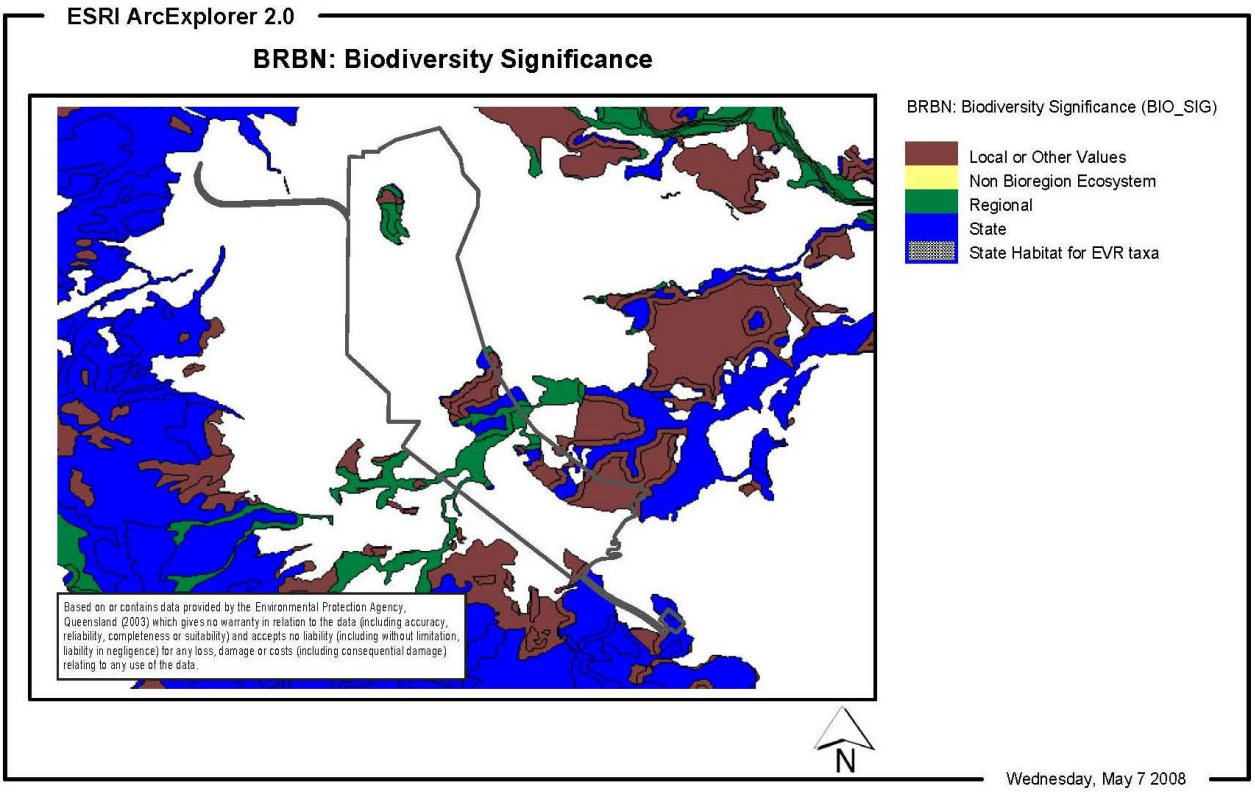
The project site is located within the Brigalow Belt North (BBN) bioregion and, for those criteria relating to the project site, mapping results (BPA Version 1.2) (EPA 2003a,b) are provided in Table 8.1 together with a description of the mapping, the value allocated and the areas to which they are relevant. Maps produced as part of the assessment of the BPA are provided in Appendix K. The overall Biodiversity Significance map, which provides a summary of the preceding criteria, is also included as Table 8.1 and illustrates the broad-scale connections between areas of remnant vegetation occurring around the project site. The results of an assessment of the actual vegetation and habitat values encountered onsite during recent ground survey is provided in the remainder of Section 8.1.1 and Section 8.2.1, respectively.

Table 8.1 BPA Results and Expert Panel Information (EPA 2003a,b)

Criteria	Description of Mapping	Mapping Value	Area affected by the mapping
A Rating Habitat for EVR Taxa	This criterion clarifies areas according to their significance based on the presences of Endangered, Vulnerable and/or Rare (EVR) Taxa. These taxa are protected under the provisions of the NC Act 1992 and/or the EPBC Act 1999.	Low	All REs on site
B1 Rating State Ecosystem Value	This criterion is based on the Biodiversity status of each RE, or the presence of intertidal or nationally important wetlands or the presence of poorly conserved REs.	Very High	Endangered REs – Associated with Brigalow woodland on the flood plain of Cherwell Creek and its tributaries in the central portion of the site, and Harrow Creek in the southern portion of the site
		High	Of Concern REs – associated with Cherwell Creek in the central portion of the site, and with the Bluegrass (Dichanthium spp.) dominant grassland in the central north of the site
		Medium	Not of Concern REs or Subdominant Endangered or Of Concern REs – northern, central and southern portions of the site
B2 Rating Regional Ecosystem Value	This criterion primarily classifies Remnant units according to their biodiversity status as determined for a particular bioregion.	High	Central and southern portions of the site
		Medium	Poorly conserved REs within the BBN bioregion – most REs on the site
C Rating Tract Size	The size of any tract is a major indicator of ecological significance, and is also strongly correlated with the long-term viability of biodiversity values. Larger tracts are less susceptible to ecological edge effects and are more likely to sustain viable populations of native flora and fauna	Low	Bluegrass (Dichanthium spp.) dominant grassland in the central north of the site
		High	All REs located in the central and southern portions of the site

Criteria	Description of Mapping	Mapping Value	Area affected by the mapping
	than smaller tracts.		
E Rating Condition	The quality of remnant units is judged by the extent to which each resembles its natural condition. In the absence of a consistent assessment of vegetation condition across a bioregion, REs mapped by the Queensland Herbarium are taken to represent areas of vegetation in their natural state.	Very High	All mapped REs within the site
F Rating Ecosystem Diversity	Rated using Simpson's Diversity Index – a measure that incorporates both species richness (number) and evenness (relative abundance).	Very High	A Simpson's Diversity index of greater than 75% - REs associated with Cherwell and Harrow Creeks
		High	A Simpson's Diversity index between 50% and 75% - Woodlands in the central northern, south eastern and southern portions of the site
		Medium	A Simpson's Diversity index between 25% to 50% - REs in northern and central portions of the site
G Rating Context and Connection	Connected remnant units are more representative of biodiversity, contribute more to a habitat network and have greater resilience to the effects of disturbance than small isolated remnants.	Very High	REs that adjoin other REs along 75% of their perimeter or borders a water body or waterway – northern, central and southern portions of the site
		High	REs that adjoin other REs along 50% to 70% of their perimeter or borders a water body or waterway – northern, central and southern portions of the site
		Medium	REs that adjoin other REs less than 50% of their perimeter or borders a water body or waterway – northern, central and southern portions of the site
Biodiversity Significance (summary)	The Biodiversity Significance rating of REs as to their State, Regional or Local significance is based on a combination of results from the diagnostic criteria.	State	Central and southern portions of the site
		Regional	Northern and central portions of the site
		Local	Northern, central and southern portions of the site

Figure 8.2 BPA Biodiversity Significance Map for the Project Site



8.1.1.2 Terrestrial Vegetation Communities

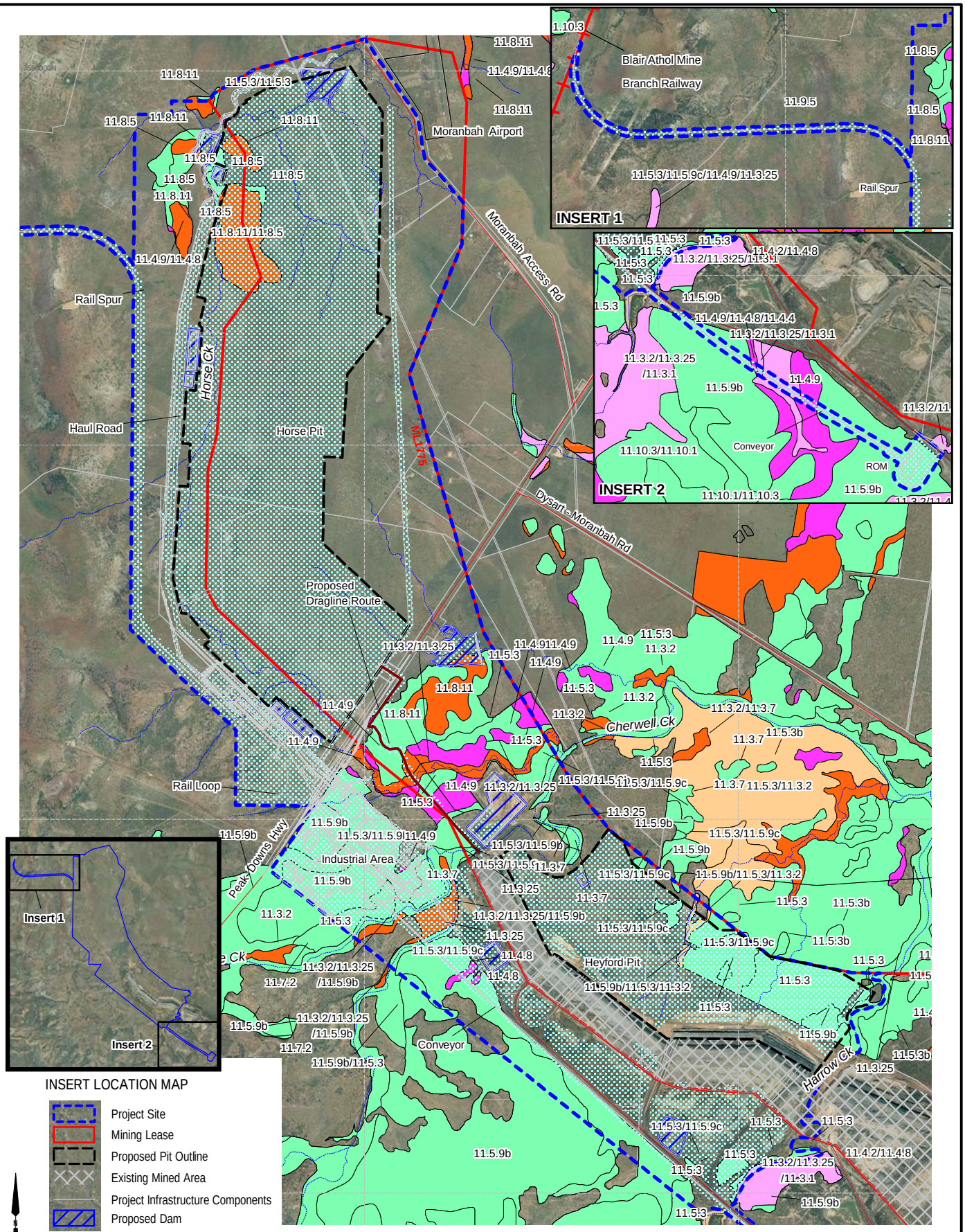
Existing RE Mapping

The existing 1:100,000 NRW certified RE mapping for the project site (Figure 8.3) obtained from the EPA (2008a) indicates that twelve REs are currently mapped as occurring within the project site. These are listed in Table 8.2. Six of these REs have a Not of Concern management status, three have an Of Concern management status and three have an Endangered management status under the provisions of the VM Act, while five are comparable to ecological communities listed as Endangered under the EPBC Act. Extensive ground truthing of vegetation communities has been undertaken to verify existing RE mapping and is commented on in detail below.

Table 8.2 REs within the Project Site identified on the current 1:100,000 RE map

Regional Ecosystem	Management Status	Description (REDD)
11.3.1	Endangered (VM Act and EPBC Act)	*Acacia harpophylla* and/or *Casuarina cristata* open forest on alluvial plains
11.3.2	Of Concern (VM Act)	*Eucalyptus populnea* woodland on alluvial plains
11.3.25	Not Of Concern (VM Act)	*Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines
11.3.7	Not Of Concern (VM Act)	Corymbia spp. woodland on alluvial plains sandy soils
11.4.2	Of Concern (VM Act)	Eucalyptus spp. and/or Corymbia spp. grassy or shrubby woodland on Cainozoic clay plains
11.4.4	Not Of Concern (VM Act) Endangered (EPBC Act)	Dichanthium spp., Astrebla spp. grassland on Cainozoic clay plains
11.4.8	Endangered (VM Act and EPBC Act)	*Eucalyptus cambageana* woodland to open forest with *Acacia harpophylla* or *A. argyrodendron* on Cainozoic clay plains
11.4.9	Endangered (VM Act and EPBC Act)	*Acacia harpophylla* shrubby open forest to woodland with *Terminalia oblongata* on Cainozoic clay plains
11.5.3	Not Of Concern (VM Act)	*Eucalyptus populnea* and/or *E. melanophloia* and/or *Corymbia clarksoniana* on Cainozoic sand plains/remnant surfaces
11.5.9	Not Of Concern (VM Act)	*Eucalyptus crebra* and other Eucalyptus spp. and Corymbia spp. woodland on Cainozoic sand plains/remnant surfaces
11.8.5	Not Of Concern (VM Act)	*Eucalyptus orgadophila* open woodland on Cainozoic igneous rocks
11.8.11	Of Concern (VM Act) Endangered (EPBC Act)	*Dichanthium sericeum* grassland on Cainozoic igneous rocks

The RE mapping also indicates that the project site supports no areas designated as Essential Habitat for species listed as threatened under the provisions of the NC Act.



Datum: AGD84, AMG Zone 55

Source: Qld. Herbarium, EPA - Pre-clearing Vegetation Communities Ecosystems Queensland, Version 5.0 (Dec 2005, amended Aug. 2008); BAAM, Sept 2008

Client: BHP Billiton Mitsubishi Alliance (BMA)	Project: CAVAL RIDGE PROJECT ENVIRONMENTAL IMPACT STATEMENT	Title: **CURRENT NRW CERTIFIED REGIONAL ECOSYSTEM MAP FOR THE PROJECT SITE**
URS	Drawn: VH · Approved: RS · Date: 08-05-2009	Figure: **8.3** · Rev:D
	Job No: **4262 6158** · File No: 42626158-g-548d.wor	A4

The EPBC Act Online Protected Matters Search Tool results indicate that two ecological communities of special conservation significance may occur within the vicinity of the project site, as follows:

- Brigalow (*Acacia harpophylla* dominant and co-dominant) communities - Endangered EPBC Act.
- Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin* – Endangered EPBC Act.

*Note: this recently designated community was formally encompassed within the Bluegrass (Dichanthium spp.) dominant grasslands of the Brigalow Belt bioregions (North and South) community, which is no longer recognised under the EPBC Act.

Ground-Truthed Vegetation Communities

Ground-truthing has confirmed that 19 distinct vegetation communities occur within the project site, as shown on Figure 8.4 and listed in Table 8.3. Representative photos are provided in Appendix K, Table 4.3. Fourteen of these communities are currently mapped as remnant (i.e. as REs) under the provisions of the VM Act, while an additional community (vegetation community 14) is comparable to RE 11.9.5. Of the fifteen ground-truthed remnant communities, eight have a Not of Concern management status, four have an Of Concern management status and three have an Endangered management status under the provisions of the VM Act, while five are comparable to ecological communities listed as Endangered under the EPBC Act. The latter includes:

- Brigalow (*Acacia harpophylla* dominant and co-dominant) communities - (comparable to REs 11.4.8, 11.4.9 and 11.9.5).
- Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin – (comparable to RE 11.8.11).

These communities are comparable to ground-truthed vegetation communities 2 (Natural Grassland), 4 (Brigalow), 14 (Brigalow), 16 (Brigalow) and 18 (Brigalow) and their distribution on site is indicated on Figure 8.5 shows the ground-truthed vegetation communities in relation to existing Surface Area Approvals under the *Mineral Resources Act 1989*. These are discussed further in Section 8.1.2.1.

The ground-truthed vegetation communities show some deviation from the current NRW certified RE mapping for the area. Of particular note is the absence of community 4 south of Cherwell Creek and community 14 from the current NRW certified RE Mapping, both of which are considered Endangered under the VM Act and EPBC Act. Revised RE mapping of the project site is shown Figure 8.6.

8.1.1.3 Terrestrial Flora Species

Previous Records

A search of the Queensland Herbarium's records via the EPA's Wildlife Online database (EPA 2008b) indicates that one terrestrial plant species of special conservation significance, *Bertya pedicellata* (a shrub with no common name listed as Rare under the NC Act), occurs within the locality of the project site.

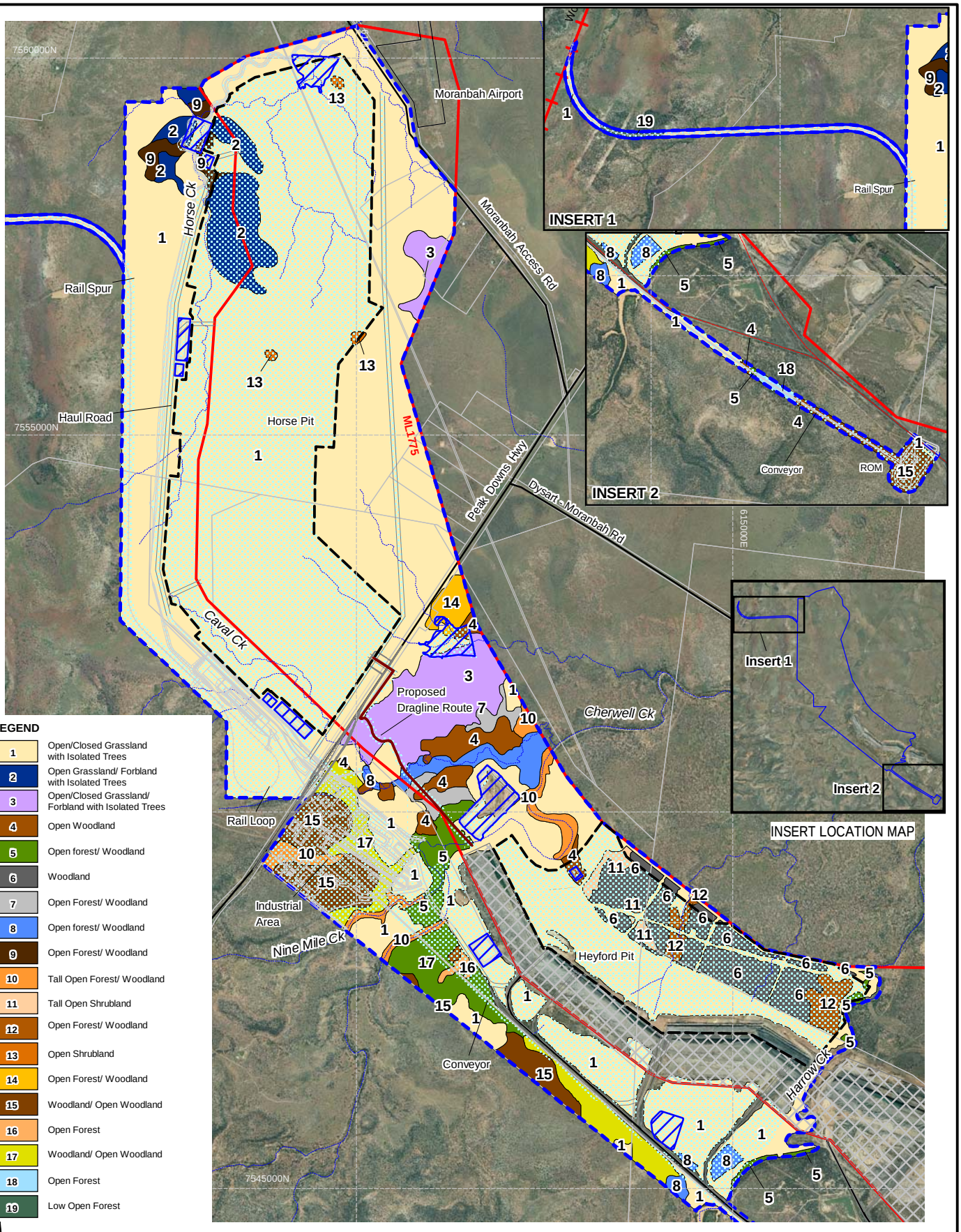
The EPBC Act Online Protected Matters Search Tool results indicate that two species of special conservation significance may occur within the vicinity of the project site, as follows:

- King Blue-grass (*Dichanthium queenslandicum*) - Vulnerable NC Act, Vulnerable EPBC Act.
- Finger Panic Grass (*Digitaria porrecta*) - Rare NC Act, Endangered EPBC Act.

A previous ecological assessment undertaken for the adjacent Peak Downs mining lease (including southern sections of the current project site) by Ecoserve and LAMR (2005) also indicated that, although not recorded during surveys, King Blue-grass and Queensland Blue-grass (*Dichanthium setosum* - Vulnerable EPBC Act, Rare NC Act) both have a "reasonable probability of occurrence on the site in either Regional Ecosystems 11.8.5 or 11.8.11."

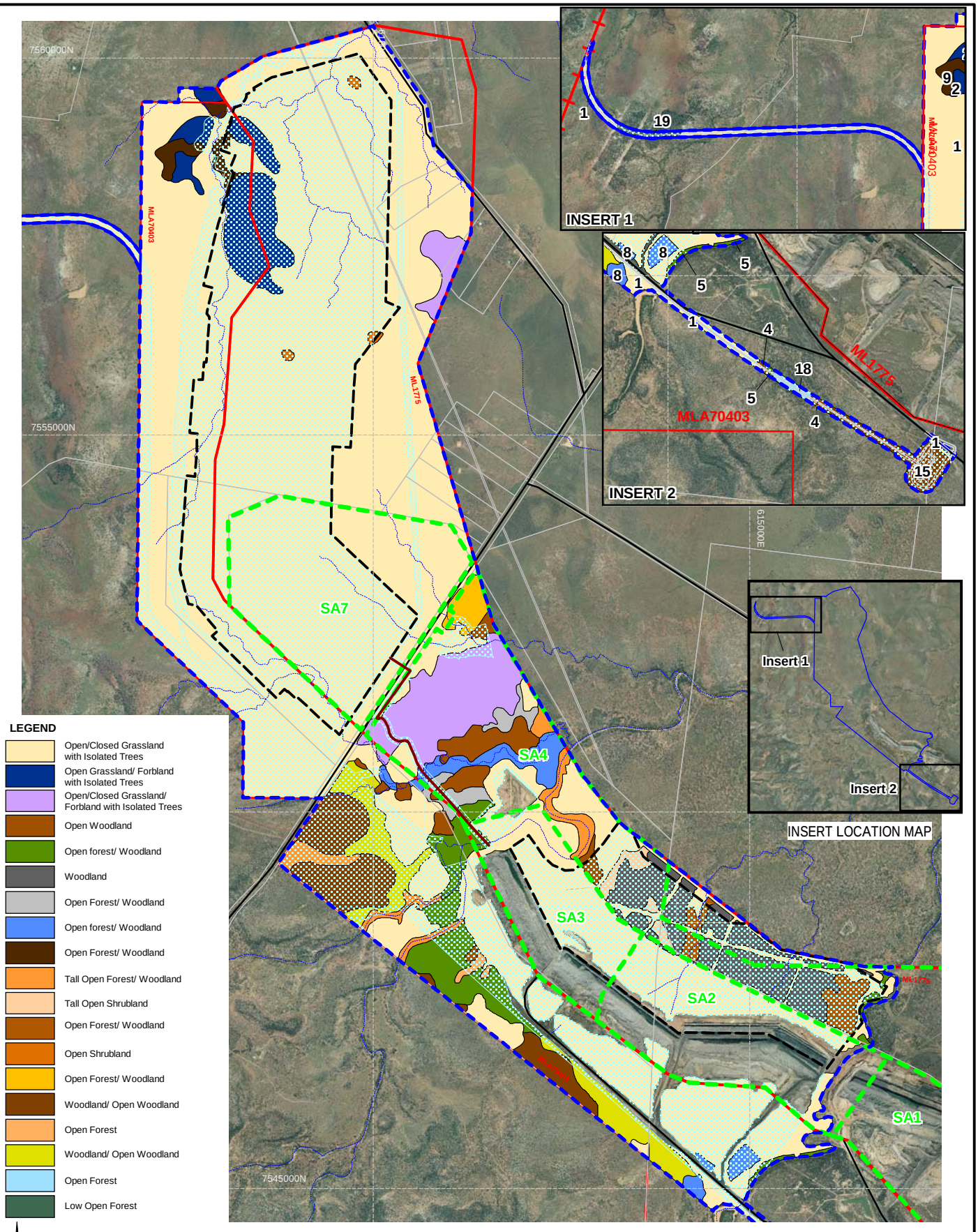
Ground Survey Records

Ground survey by BAAM recorded a total of 176 flora species, of which 157 (89.2%) were native and 19 (10.8%) were exotic. The complete list of flora species recorded during the vegetation survey is provided in Appendix K. This list includes species recorded during formal survey transects, as well as incidental records from across the project site. No flora species listed as significant under the provisions of the NC Act or the EPBC Act were recorded within the project site during ground survey.



Source: Client Supplied Data; BAAM, Sept 2008

Client: BMA / BHP Billiton Mitsubishi Alliance	Project: CAVAL RIDGE PROJECT ENVIRONMENTAL IMPACT STATEMENT	Title: **GROUND-TRUTHED VEGETATION MAP OF THE PROJECT SITE**	
URS	Drawn: VH	Approved: RS	Date: 08-05-2009
	Job No: **4262 6158**	File No: 42626158-g-549d.wor	Figure: **8.4**
			Rev:D A4

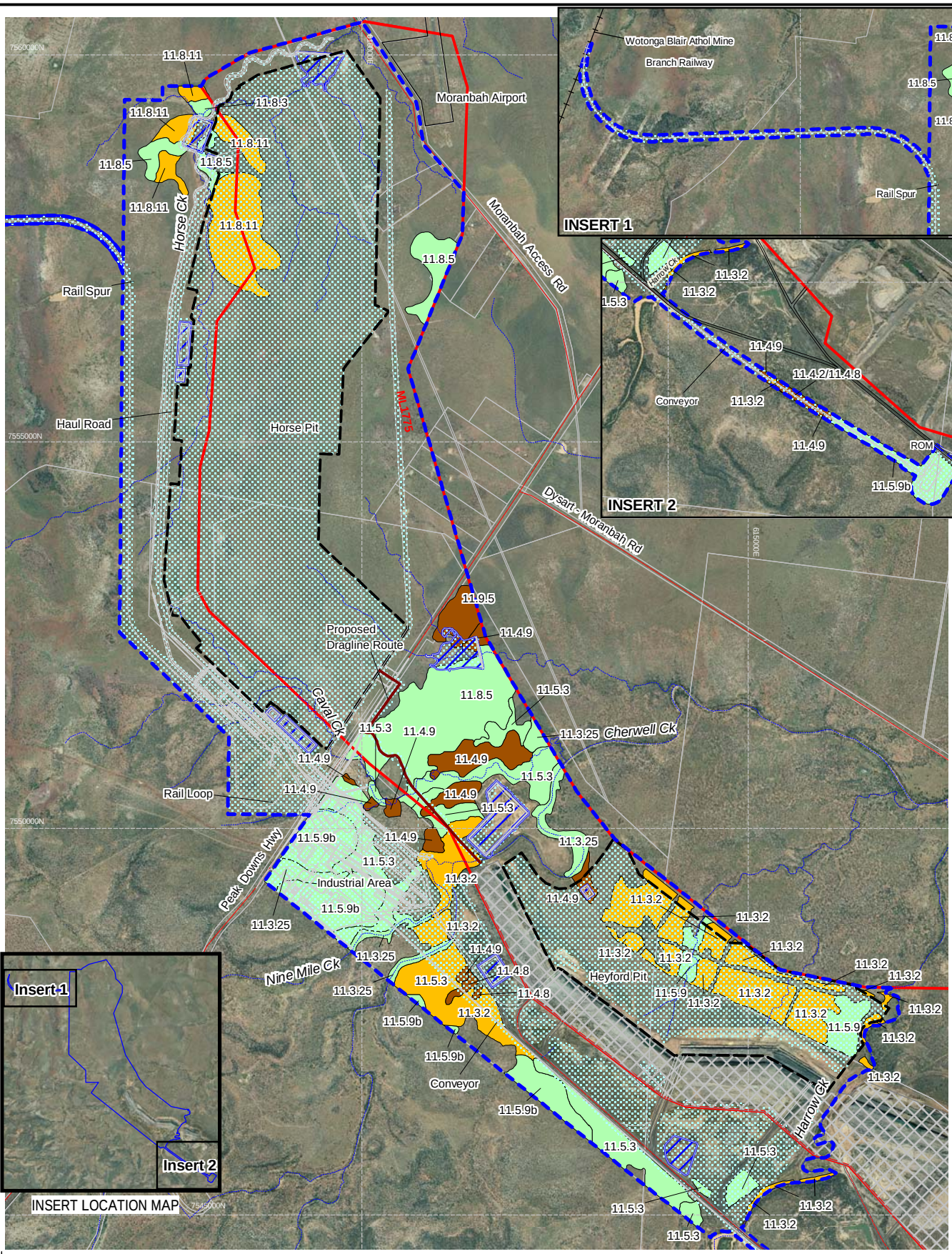


Source: Client Supplied Data, BAAM, Sept 2008

Client: BHP Billiton Mitsubishi Alliance	Project: CAVAL RIDGE PROJECT ENVIRONMENTAL IMPACT STATEMENT	Title: **GROUND-TRUTHED VEGETATION MAP OF THE STUDY AREA (INCLUDING EXISTING pre2000 SURFACE AREA APPLICATIONS)**	
	Drawn: VH	Approved: RS	Date: 08-05-2009
	Job No: **4262 6158**	File No: 42626158-g-604.wor	Figure: **8.5**
			Rev:A
			A4

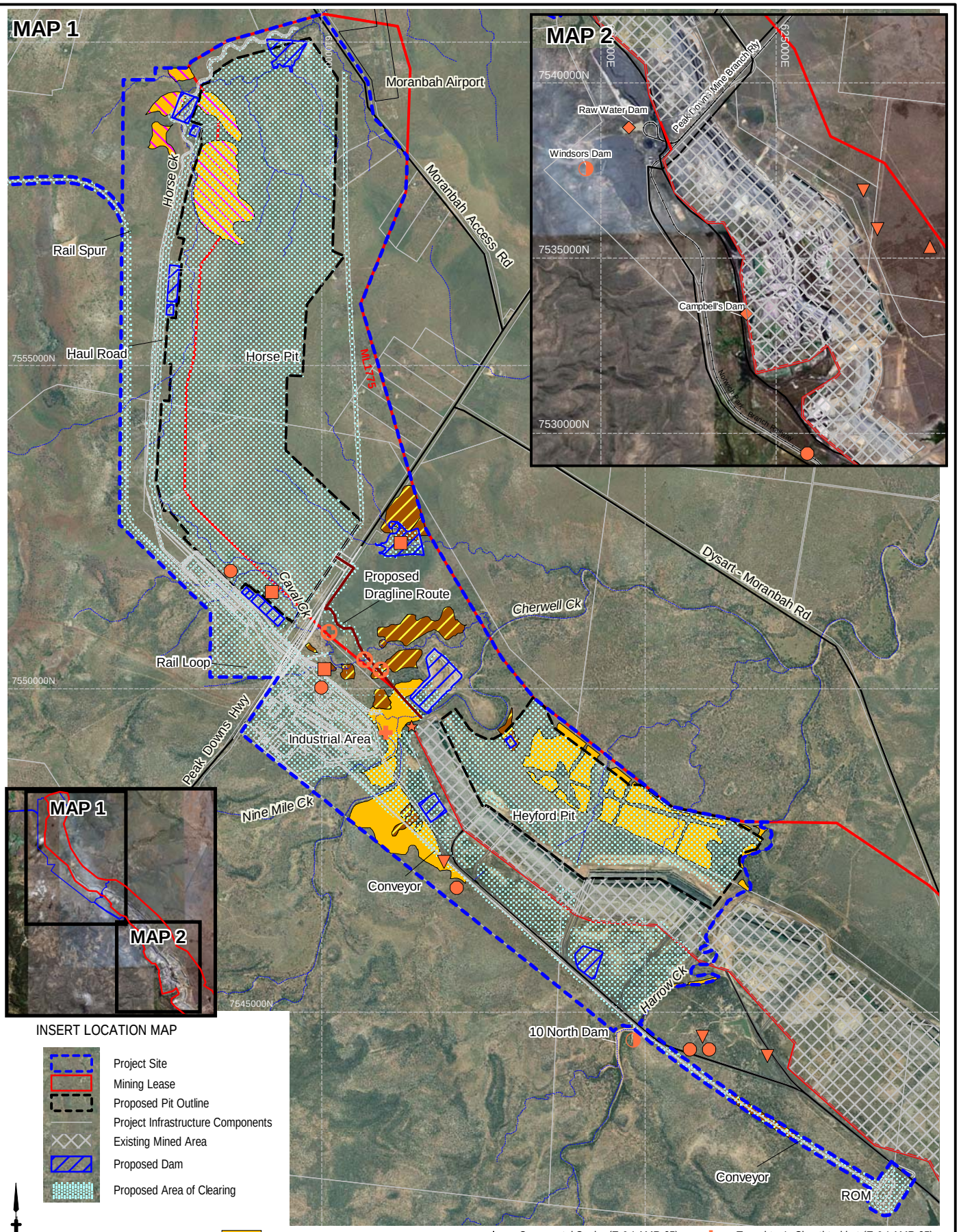
Table 8.3 Vegetation communities recorded across the project site

Vegetation Community	Description	Conservation Significance	
		VM Act	EPBC Act
1	Open/Closed Grassland with Isolated Trees (Height 0.5- 1.5 m)	Non-remnant	-
2	Open Grassland/ Forbland with Isolated Trees (Height: 0.2 – 1.0 m)	RE 11.8.11 - Of Concern	Analogous to Nationally Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin
3	Open/Closed Grassland/ Forbland with Isolated Trees (Height: 0.5 -12 m)	RE 11.8.5 - Not of Concern. Note: portions currently mapped by the EPA as RE 11.8.11 (Of Concern - VM Act)	-
4	Open Woodland (Height 8-14 m)	RE 11.4.9 - Endangered	Analogous to Nationally Endangered Brigalow (*Acacia harpophylla* Dominant and Co-dominant) Community
5	Open forest/ Woodland (Height: 15-18 m)	RE 11.3.2 - Of Concern	-
6	Woodland (Height: 15-18 m)	RE 11.3.2 - Of Concern	-
7	Open Forest/ Woodland (Height: 18-25 m)	RE 11.5.3 - Not of Concern	-
8		RE 11.5.3 - Not of Concern	-
9	Open Forest/ Woodland (Height: 15-18 m)	RE 11.8.5 - Not of Concern	-
10	Tall Open Forest/ Woodland (Height: 25-30 m)	RE 11.3.25 - Not of Concern	-
11	Tall Open Shrubland (Height: 6-8 m)	Non-remnant	-
12 (site 14)	Open Forest/ Woodland (Height: 15-18 m)	RE 11.5.9 - Not of Concern	-
13	Open Shrubland (Height: 1-8 m)	Non-remnant	-
14	Open Forest/ Woodland (Height: 4-6 m)	RE 11.9.5 - Endangered Note: currently mapped by the DERM as Non-remnant	Analogous to the Nationally Endangered Brigalow (*Acacia harpophylla* Dominant and Co-dominant) Community.
15	Woodland/ Open Woodland (Height: 15-18 m)	RE 11.5.9b - Not of Concern	-
16	Open Forest (Height 8-14 m)	RE 11.4.8 - Endangered	Analogous to Nationally Endangered Brigalow (*Acacia harpophylla* Dominant and Co-dominant) Community
17	Woodland/ Open Woodland (Height 14-23 m)	RE 11.5.3 - Not of Concern	-
18	Mixed Eucalypt spp. Open Woodland	11.4.2 / 11.4.8 - Of Concern / Endangered	Analogous to the Nationally Endangered Brigalow (*Acacia harpophylla* Dominant and Co-dominant) Community
19	Low Open Forest (Height 3-6 m)	Non-remnant	-



Source: BAAM, Sept 2008.

Client: BHP Billiton Mitsubishi Alliance	Project: CAVAL RIDGE PROJECT ENVIRONMENTAL IMPACT STATEMENT	Title: **GROUND-TRUTHED REGIONAL ECOSYSTEM MAP**	
URS	Drawn: VH	Approved: RS	Date: 08-05-2009
	Job No: **4262 6158**	File No: 42626158-g-575d.wor	Figure: **8.6**
			Rev:D A4



Client: BHP Billiton Mitsubishi Alliance

Project: CAVAL RIDGE PROJECT
ENVIRONMENTAL IMPACT STATEMENT

Title: **LOCATION OF SIGNIFICANT COMMUNITIES AND EVR SPECIES WITHIN AND AROUND THE PROJECT SITE**

Drawn: VH	Approved: RS	Date: 08-05-2009	Figure: **8.7**	Rev:F
Job No: **4262 6158**	File No: 42626158-g-550f.wor			**A4**

8.1.1.4 Declared Weed Species

Five flora species listed as declared pests under the provisions of the LP Act were recorded from the project site, as follows:

- Mother of Millions (*Bryophyllum delagoense*).
- Harrisia Cactus (*Eriocereus martini*).
- Lantana (*Lantana camara*).
- Velvet Tree-pear (*Opuntia tomentosa*).
- Parthenium Weed (*Parthenium hysterophorus*).

Lantana is currently listed as a Class 3 weed and the remaining species are listed as Class 2 weeds under the provisions of the LP Act.

Of these species, Harrisia Cactus, Mother of Millions and Velvet Tree-pear were distributed throughout the entire site, particularly within vegetation communities 1 and 7, while Parthenium was generally restricted to areas overlying basalt (i.e. vegetation communities 2 and 3) (Figure 8.4). Infestation of Parthenium within these areas was very high, resulting in suppression of native species, particularly grasses.

8.1.2 Potential Impacts and Mitigation Measures

8.1.2.1 Impact Mechanisms

Clearing

During the construction phase, clearing will be required for a range of infrastructure within the project site, along with a number of sediment basins, creek diversions, the initial open-cut mining pit(s), ramps and out of pit waste dump areas. Clearing will also occur progressively during mine operation for the extension of pits and spoil areas. Overall, it is understood that a total area of approximately 3,900 ha will be disturbed over the life of the project. This will incorporate the clearing of remnant vegetation as defined under the provisions of the VM Act as well as non-remnant vegetation. The approximate areas of each RE to be cleared (calculated via aerial photograph interpretation and subsequent geographic information system (GIS) analysis), together with their description under the provisions of the VM Act, their bioregional extent, local extent and area contained in the project site is provided within Table 8.4. These calculations have been undertaken for the purposes of determining the general scale/level of potential impact associated with vegetation removal, and should not be seen as exact areas by which on-ground activities are to be measured or assessed.

Clearing of native vegetation primarily results in the direct loss of plant species and a reduction of the overall amount of habitat and populations of flora, as well as the potential to result in the isolation of habitats and populations.

Secondary impacts are associated with:

- Soil disturbance/exposure and altered water flow patterns, and subsequent erosion and sedimentation, which may expose tree roots and smother vegetation.
- Increases in desiccation, light penetration, wind-throw, herbivory, weed invasion, and parasitism for adjacent flora (Murcia 1995). In particular, introduced weeds can change vegetation community composition and in some cases increase the intensity of fire, leading to further community degradation.

Assessment of the cumulative impacts associated with clearing are taken into account in the assessment of ground-truthed REs relative to their local and bioregional significance status and extent in Table 8.4.

It should be noted that much of the clearing associated with this project will occur on land subject to an existing mining lease (ML 1775), which in its entirety is the subject of an Environmental Authority granted pursuant to the *Environmental Protection Act 1994* for the carrying out of mining activities, and on which all but small areas have the necessary Surface Area Approvals (SA) under the *Mineral Resources Act 1989*. The approved areas would otherwise be cleared as the Peak Downs Mine continues its operation at its current rate. The clearing, disturbance and mining activities proposed as part of the Caval Ridge Mine brings this clearing forward in time. Despite these approvals being in place, a full assessment of the environmental impacts on flora and fauna values of the site has been completed.

Figure 8.5 shows the surface area approvals granted prior to 16 July 2000 (i.e. SAs 1-9), which are consequently excluded from offset calculations in the following impact assessment, in accordance with Section 43A of the EPBC Act.

Vegetation Offsets

A biodiversity offset management plan will be developed and implemented to manage the offsetting of cleared significant vegetation communities. The plan will be developed in keeping with the objectives of the current Commonwealth and State legislation for the offsetting of significant vegetation communities. The plan will also be in keeping with the principles of relevant policies and guidelines such as:

- Draft policy statement 'Use of environmental offsets under the EPBC Act 1999' (DEWHA, 2007)
- Queensland Policy for Vegetation Management Offsets (DNRW, 2007)
- Queensland Government Environmental Offset Policy.

The offset management plan will include criteria for offset suitability which where practicable, would include:

- The acquisition of a remnant/regrowth community that is equal to, or greater in area than that which will be impacted by the project.
- Support a comparable suite of plant species contained in RE types impacted by the project;

- Consider maximising biodiversity gains through site selection, (e.g. habitat requirements for migratory species that will be impacted by loss of foraging trees and water sources).
- Offset locations which are preferentially closer (at least within the locality) to communities impacted by the project.
- Offset sites which are preferentially larger contiguous stands of vegetation with connectivity to other habitat types to increase viability of ecological processes.
- Place potential offset(s) parcels under a secure protection such as a conservation covenant to ensure that protection runs with title.
- Management measures to ensure offset areas remain viable in the long term. Such measures may include the management of supplementary planting, weed, fire, feral animal, livestock management and restriction on access.
- Monitoring and maintenance activities to measure success and viability of the offset activities to measure success and viability of the offset.

Specific components of the offset management plan will include:

- A map detailing the location and extent of the proposed offset(s), the associated vegetation types and any infrastructure (e.g. fencing, vehicle access networks);
- Measures for the long-term management and protection of existing areas of the endangered ecological communities
  - Brigalow (*Acacia harpophylla* dominant and co-dominant) and
  - Natural Grasslands of the Queensland Central Highlands and the Northern Fitzroy basin native grasslands;
- Measures to survey and monitor the occurrence of flora and fauna species including but not limited to squatter pigeon (*Geophaps scrpita*) and brigalow scaly-foot (*Paradelma orientalis*);
- Where appropriate, measures for weed and feral animal control, supplementary fire management, erosion & sediment control, access restriction and livestock exclusion;
- The development of a process to review and report on the effectiveness of the performance of the management plan and on any unplanned events which may impact on the offset.

Table 8.4 Approximate current extent of ground-truthed REs within the Bioregion, Local Government Area and Project Site and extent to be disturbed during the Project

Comparable RE and Description (REDD)	Management Status	Approximate Total Extent (ha)			Approximate Extent to be Disturbed				
		Within BBN Bioregion[1]	Within Local Government Area1	Within Project Site[2]	Area (ha)[2]	% of Bioregional Extent	% of Local Extent	Area with Existing Approval (ha) [3]	Area to be offset (ha)
11.3.2 – *Eucalyptus populnea* woodland on alluvial plains	Of Concern (VM Act)	545265	30830	351.8	248.6	0.05	0.8	140.3	108.3
11.3.25 – *Eucalyptus tereticornis* or *E. camaldulensis* woodland in Cainozoic clay plains	Not of Concern (VM Act)	498414	28566	75.9	31.5	0.01	0.1	0	N/A[3]
11.4.2 – *Eucalyptus spp.* and/or *Corymbia.spp* grassy or shrubby woodland on Cainozoic clay plains	Of Concern (VM Act)	37135	514	4.5	4.5	0.01	0.9	0	4.5
11.4.8 – *Eucalyptus cambageana* woodland to open forest with *Acacia harpophylla* or *A. argyrodendron* on Cainozoic clay plains	Endangered (VM Act and EPBC Act)	80904	30910	10.1	8.2	0.01	0.03	0	8.2
11.4.9 – *Acacia harpophylla* shrubby open forest to woodland with *Terminalia oblongata* on Cainozoic clay plains	Endangered (VM Act and EPBC Act)	105656	39723	92.1	17.8	0.02	0.04	3.1	14.7
11.5.3 – *Eucalyptus populnea* and/or *E. melanophloia* and/or *Corymbia clarksoniana* on Cainozoic sand plains/remnant surfaces	Not of Concern (VM Act)	413237	183023	245.5	100	0.02	0.05	0.5	N/A

Comparable RE and Description (REDD)	Management Status	Approximate Total Extent (ha)			Approximate Extent to be Disturbed				
		Within BBN Bioregion[1]	Within Local Government Area1	Within Project Site[2]	Area (ha)[2]	% of Bioregional Extent	% of Local Extent	Area with Existing Approval (ha) [3]	Area to be offset (ha)
11.5.9 – *Eucalyptus crebra* and other *Eucalyptus spp.* and *Corymbia spp*. woodland on Cainozoic sand plains/remnant surfaces	Not of Concern (VM Act)	251427	31532	259.4	217.3	0.09	0.69	37.9	N/A[3]
11.8.5 – *Eucalyptus orgadophila* open woodland on Cainozoic igneous rocks	Not of Concern (VM Act)	348697	39976	255.0	25.1	0.01	0.06	6.8	N/A[3]
11.8.11 – *Dichanthium sericeeum* grassland on Cainozoic igneous rocks	Of Concern (VM Act), Endangered (EPBC Act)	188169	37194	153.1	124.6	0.07	0.33	0	124.6
11.9.5 – Acacia harpophylla and/or Casuarina cristata open forest to woodland on fine grained sedimentary rock.	Endangered (VM Act and EPBC Act)	149368	499	31.7	3.9	0.003	0.79	3.9	0

Note:

1. Based on most recent data available from the EPA (2004).

2. Approximate areas calculated via aerial photograph interpretation and subsequent GIS analysis.

3. These areas are excluded from the subsequent considerations of proposed offsets under relevant legislation.

4. Based on an indicative breakdown of vegetation community 18 (Section 4.2.2) into 60% comparable RE 11.4.2 and 40% comparable RE 11.4.8.

Construction Activities

In addition to clearing and the associated secondary impacts listed above, the construction phase has the potential to result in on-going disturbance from dust within adjacent habitat due to ground disturbance, the operation and movement of machinery, traffic along haul roads, exposed stockpiles and blasting. Construction vehicles also have the potential to introduce and/or spread weed species and plant pathogens such as root-rot fungus in disturbed soil, while fuels and chemical spills from storage areas, and oils from heavy machinery can enter the environment, affecting habitats where the spill occurs.

Mine Operation

In general, the potential impacts on flora during the construction phase of the project are also applicable during mine operation as a result of progressive open cut mining and spoil dumps, stockpiling, coal transport and processing. In addition, the operation of the proposed mine has the potential to further disrupt natural ecological processes within the local area beyond initial clearing, in terms of both the spatial and temporal scale of impact. This includes:

- Limiting the natural movement and dispersal of ground-dwelling and non-volant (flightless) arboreal fauna (i.e. for breeding and foraging purposes), which also has the potential to limit the natural spread and regeneration of native flora that rely on such fauna for seed dispersal.
- Altering the local surface and groundwater environment due to large-scale landform modification, creek diversions and the creation of dams, and subsequent impacts on downstream wetlands, riparian vegetation and other sensitive vegetation communities. This includes alterations to base flows, as well as to the frequency and extent of flooding.
- Creating long-term edge effects along the borders of the active area and adjacent habitat, as well as isolated habitat patches between disturbed areas.

Areas of Impact

Open Cut Pits

The vast majority of the area proposed to be mined is non-remnant vegetation and is currently grazed. The area north of Peak Downs Highway (Horse Pit) has two patches of Natural Grassland and a number of small jump-ups with species such as Lancewood and Mountain Yapunyah. Generally speaking, however, the dominance of Buffel Grass has led to a reduction of many native flora species and is known to have a competitive advantage over native flora species (Jackson 2005).

From a flora perspective, the greatest impact of the northern pit will be the removal of Natural Grassland, currently recognised as an Endangered Ecological Community under the EPBC Act. Although this community within the project site is currently infested by Parthenium weed, the ecosystem is relatively rare within the BBN bioregion (between 10% and 30% of the preclearing extent currently remains) and

approximately 20% of the remaining extent within the BBN bioregion is contained within the former Belyando Local Government Area (LGA) (EPA 2004).

The Heyford Pit south of Cherwell Creek, supports a mosaic of habitats; some non-remnant regrowth vegetation (primarily *Acacia* spp., woody shrubs and native as well as exotic grasses and forbs), a small patch of Brigalow (currently mapped as non-remnant but comparable to RE 11.4.9), Poplar Box woodland (remnant *Of Concern*) and *Eucalyptus crebra* (ironbark) woodland (remnant *Not of Concern*).

Currently, less than 10% of the pre-clearing extent of Brigalow-dominated RE 11.4.9 remains and, of this, almost 38% is contained within the former Belyando LGA (EPA 2004). It is anticipated that the Heyford Pit will result in the removal of approximately 0.02% of the remaining extent of RE 11.4.9 calculated at the LGA level.

Roads and Dragline Transport Route

The haul road that will service Horse Pit will pass almost entirely through non-remnant vegetation to the north of the Peak Downs Highway, the majority of which is currently highly disturbed grazing land dominated by Buffel Grass.

To the south of the Peak Downs Highway, the haul road will pass through a mosaic of remnants dominated by Poplar Box, Silver-leaved Ironbark, Queensland Blue Gum and Bloodwood communities. In addition, large areas currently supporting *Acacia* spp regrowth (dominated by an understorey of native and exotic grasses) will be disturbed. In general, the proposed route for transporting the dragline between Horse and Heyford pits will minimise fragmentation of the large patch of remnant vegetation between the highway and Cherwell Creek, although will still require the clearing of native riparian vegetation and open woodland/grassland communities, including a small area of Brigalow (RE 11.4.9) listed as Endangered under the EPBC Act.

The construction and utilisation of these transport corridors has some potential to further spread weeds. Of particular concern is the potential spread of Buffel Grass, which has a competitive advantage over native flora species and is known to reduce the recruitment rates of endemic species (Jackson 2005).

Areas of habitat adjacent to all roads will also be altered both physically and chemically. Changes to the physical environment affect soil density and water content, temperature, light penetration, dust, surface waters, runoff patterns and sedimentation. Chemical changes include the addition of heavy metals, salts, ozone and nutrients to roadside habitats. These conditions are often favourable for the growth of weed species that may thrive and spread into adjacent habitat from roadside locations.

Coal Handling and Preparation Plant

The CHPP will be located immediately to the south of the Peak Downs Highway. This location is characterised by woodland communities dominated by Ironbark, Bloodwood, Poplar Box, Moreton Bay Ash

and Queensland Blue Gum and generally comparable to REs 11.3.25, 11.5.9b and 11.5.3. The understory is generally shrubby and dominated by *Acacia* spp., although exotic grasses including Buffel Grass and Red Natal Grass have extensively colonised much of the ground stratum. These ecosystems are well represented throughout the BBN bioregion and local area and it is not expected that clearing associated with the construction of the CHPP or reduced photosynthetic and transpiration rates and associated dieback/reduced recruitment of surrounding vegetation due to particulate emissions (e.g. coal dust) will represent a significant loss of these communities within the broader context.

Overland Conveyor

The overland conveyor will be located between the Southern ROM and the CHPP. This will predominantly pass through areas supporting Poplar Box, Silver-leaved Ironbark and Bloodwood woodland. However, it will also pass directly through an area mapped as RE 11.4.2/11.4.8 (vegetation community 18) and will be directly adjacent to an area of RE 11.4.8 (vegetation community 16). A small area of RE 11.4.8 will be impacted by conveyor construction. This community is currently listed as Endangered under State and Commonwealth legislation as less than 10% of the pre-clearing extent currently remains. Of this, approximately 38% is contained within the former Belyando LGA. Impacts on this community will represent approximately 0.03% of the local extent.

Potential impacts associated with the operation of the overland conveyor are likely to be restricted to particulate emissions (e.g. coal dust) and their effect upon vegetation immediately adjacent to the overland conveyor (e.g. reduced photosynthetic and transpiration rates) and the adoption of standard dust suppression will minimise any such impacts.

Rail Spur and Loop

The rail spur and loop will be located to the north of the Peak Downs Highway primarily within non-remnant vegetation dominated by Buffel Grass and other exotic pasture species. It is therefore expected that the impacts associated with the construction and operation of the rail spur and loop will be negligible in terms of native flora.

Southern ROM

The southern ROM will be located primarily within vegetation community 15 (RE 11.5.9b), located to the south of Cherwell Creek. This area is dominated by Ironbark and Bloodwood woodland with a grassy and shrubby understorey. The eastern portion of the southern ROM is located within an area that is currently mapped as non-remnant under the provisions of the VM Act.

It is not expected that the clearing of these vegetation communities will cause a significant impact on the extent or persistence of RE 11.5.9b within the local context.

Sediment Basins, Dams and Creek Diversions

The creation of additional dams and diversion of creeks during the project will require the clearing of remnant vegetation, including Brigalow (REs 11.4.9 and 11.9.5) and Natural Grassland (RE 11.8.11), both of which are listed as Endangered under the EPBC Act.

8.1.2.2 Impact Assessment

Table 8.5 and Table 8.6 set out each significant flora element present in the project site, summarise the impact mechanisms and their potential effects on each element, provide appropriate mitigation measures, and show the assessed residual impact for the construction and operation phases of the project, respectively. For the purposes of this assessment, significant flora elements refer to those species, communities or processes that have the potential to constrain the proposed activities (e.g. species listed as significant under the provisions of the EPBC Act, NC Act, *Mineral Resource Act 1989* and/or the VM Act).

Assessment of the nature and scale of impacts are based on the known distribution and rarity of the ecosystem and the proportion and absolute area affected, the presence or likely presence of significant species, and the likely environmental (physical, chemical, biological) changes resulting from construction and operational activities.

The tables in Appendix K further clarify the impact assessment process applied to Table 8.5 and Table 8.6.

The following terms are used in Table 8.5 and Table 8.6 to describe impact types and scales:

Direct impact: Any impact that affects a species/community directly, e.g. the actual removal of vegetation due to the project.

Indirect impact: Any impact that affects a species/community indirectly, which may be as a result of a direct impact on another species whose life history is interrelated with the species in question (e.g. the loss of certain hollow-bearing trees directly reduces potential sheltering and breeding sites for arboreal mammals, which in turn reduces prey availability for a predator foraging over a large area).

Preliminary impact: The predicted impact without any mitigation measures in place. While mitigation would be in place should the project proceed, an assessment of unmitigated impact is necessary for the planning phase assessment.

Residual impact: The predicted remaining impact after mitigation measures are implemented. This represents the likely actual impact of the project and should form the basis of discussions regarding compensations for offsets.

Levels of impact are assessed in relation to the following three factors:

- **Impact Likelihood:** The likelihood of an identified impact occurring has been rated as either Certain, Probable, Possible, Unlikely or Very Unlikely.

- **Impact Consequence:** Each impact is categorised as Catastrophic, Significant, Moderate, Minor or Negligible in terms of its effect on the element in question, taking into account the geographic extent of impact (area), the duration and intensity of impacts, and the ability of the impacted element to recover (resilience).
  - **Catastrophic** impacts would result in the extinction of a species.
  - **Significant** impacts may be notably detrimental or beneficial to the species or community on a population scale. Significant negative impacts may result in local extinction or catastrophic declines and a consequent substantial decrease in abundance and population viability at larger scales. Significant negative impacts may also be determined by the conservation status of a species being affected (e.g. NC Act or EPBC Act – listed species). Significant positive impacts may result in substantial increases in local populations, increasing the overall abundance of a species, or in influxes, in the case of more mobile species, into the area from surrounding regions.
  - **Moderate** negative impacts may result in a substantial change to a local population, though which would not lead to extinction at any level. Moderate positive impacts may produce an increase in the local population sufficient, for breeding species, for the local area to act as a source population for nearby areas. This may not necessarily lead to an overall increase in the species' abundance.
  - **Minor** negative impacts may result in small decreases to a local population that would be overcome without mitigation. A minor positive impact may result in small increases that would not facilitate substantive species emigration from nearby areas. Any changes from minor impacts would fall within natural fluctuations of a local population, i.e. within the normal carrying capacity of the area.
  - **Negligible** impacts are those that are likely to be undetectable.
- **Impacts may be negative, neutral or positive.** All impacts listed in the tables should be considered as negative, unless otherwise stated.

Table 8.5 Flora Construction and Clearing[1] Impact Assessment

Element and Protection Objective	Description	Qualification	Source of Impact	Impact Area[2]	Impact Type[3]	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [4]	Residual Impact Assessment
Endangered REs/Ecological Communities (State and/or Commonwealth legislation) Objective: Ensure no long term loss in project site.	RE 11.4.8	Endangered EPBC Act Endangered VM Act	Clearing associated with conveyor	Approximately 0.01% of bioregional extent and 0.03% of local extent	Direct – 1. Loss of vegetation, 2. Dust	Certain	Minor	Only areas absolutely necessary for the construction and the operation of the project will be cleared. Clearance will be controlled by a Permit to Disturb process, and go/no-go areas will be identified on site, and managed through a GIS system. Offset vegetation loss through negotiation with DEWHA. Utilise standard dust suppression techniques to reduce dust leaving the construction area.	Negligible[5]
	RE 11.4.9	Endangered EPBC Act Endangered	Clearing associated with Heyford Pit, the	Approximately 0.02% of bioregional extent and	Direct – 1. Loss of vegetation,	Certain	Minor	Only areas absolutely necessary for the construction and	Minor [5]

Element and Protection Objective	Description	Qualification	Source of Impact	Impact Area[2]	Impact Type[3]	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [4]	Residual Impact Assessment
		VM Act	CHPP, Catchment Dam South and the dragline transport route, and clearing/dust associated with the conveyor	0.04% of local extent	2. Dust			the operation of the project will be cleared. Clearance will be controlled by a Permit to Disturb process, and go/no-go areas will be identified on site, and managed through a GIS system. For those areas not subject to an existing clearing approval (Section 8.1.2.1), offset vegetation loss through negotiation with DEWHA. Utilise standard dust suppression techniques to reduce dust leaving the construction area.	
	RE 11.8.11	Endangered EPBC Act Of Concern VM Act	Clearing associated with Horse Pit and Horse Creek diversion/Sed	More than 100 ha (approximately 0.07% of bioregional extent and	Direct – Loss of vegetation	Certain	Significant	Only areas absolutely necessary for the construction and the operation of the project will be	Moderate[5]

Element and Protection Objective	Description	Qualification	Source of Impact	Impact Area[2]	Impact Type[3]	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [4]	Residual Impact Assessment
			Dam N3	0.33% of local extent)				cleared. Clearance will be controlled by a Permit to Disturb process, and go/no-go areas will be identified on site, and managed through a GIS system. Offset vegetation loss through negotiation with DEWHA.	
	RE 11.9.5	Endangered EPBC Act Endangered VM Act	Clearing associated with Horse Pit and Catchment Dam South	Approximately 0.003% of bioregional extent and 0.79% of local extent	Direct – 1. Loss of vegetation, 2. Dust	Certain	Minor	Only areas absolutely necessary for the construction and the operation of the project will be cleared. Clearance will be controlled by a Permit to Disturb process, and go/no-go areas will be identified on site, and managed through a GIS system. Utilise standard dust suppression techniques to	Minor [5]

Element and Protection Objective	Description	Qualification	Source of Impact	Impact Area[2]	Impact Type[3]	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [4]	Residual Impact Assessment
								reduce dust leaving the construction area.	
Other Remnant Vegetation (REs). Objective: Minimise loss of RE Type	RE 11.3.2	Dominant canopy has greater than 70% of the height and greater than 50% of the cover relative to the undisturbed height and cover of that stratum and dominated by species characteristic of the vegetation's undisturbed canopy.	Clearing associated with Heyford Pit, the CHPP, Mine Water Dam 12 North and the dragline transport route, and clearing/dust associated with the conveyor	Approximately 0.05% of bioregional extent and 0.81% of local extent	Direct – 1. Loss of vegetation, 2. Dust	Certain	Minor	Only areas absolutely necessary for the construction and the operation of the project will be cleared. Clearance will be controlled by a Permit to Disturb process, and go/no-go areas will be identified on site, and managed through a GIS system. Utilise standard dust suppression techniques to reduce dust leaving the construction area.	Minor
	RE 11.3.25		Clearing associated with the CHPP	Approximately 0.01% of bioregional extent and 0.11% of local extent	Direct – Loss of vegetation	Certain	Minor	Only areas absolutely necessary for the construction and the operation of the project will be	Minor

Element and Protection Objective	Description	Qualification	Source of Impact	Impact Area[2]	Impact Type[3]	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [4]	Residual Impact Assessment
								cleared. Clearance will be controlled by a Permit to Disturb process, and go/no-go areas will be identified on site, and managed through a GIS system.	
	RE 11.4.2		Clearing and dust associated with the conveyor	Approximately 0.01% of bioregional extent and 0.88% of local extent	Direct – 1. Loss of vegetation, 2. Dust	Certain	Minor	Only areas necessary for the construction and the operation of the project will be cleared. Clearance will be controlled by a Permit to Disturb process, and go/no-go areas will be identified on site, and managed through a GIS system. Utilise standard dust suppression techniques to reduce dust leaving the construction area.	Minor

Element and Protection Objective	Description	Qualification	Source of Impact	Impact Area[2]	Impact Type[3]	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [4]	Residual Impact Assessment
	RE 11.5.3		Clearing associated with Heyford Pit, the CHPP, Mine Water Dam 12 North and the dragline transport route, and clearing/dust associated with the conveyor	Approximately 0.02% of bioregional extent and 0.05% of local extent	Direct – 1. Loss of vegetation, 2. Dust	Certain	Minor	Only areas absolutely necessary for the construction and the operation of the project will be cleared. Clearance will be controlled by a Permit to Disturb process, and go/no-go areas will be identified on site, and managed through a GIS system. Utilise standard dust suppression techniques to reduce dust leaving the construction area.	Minor
	RE 11.5.9		Clearing associated with the ROM coal stockpile area.	Approximately 0.09% of bioregional extent and 0.69% of local extent	Direct – Loss of vegetation	Certain	Minor	Only areas absolutely necessary for the construction and the operation of the project will be cleared. Clearance will be controlled by a Permit to	Minor

Element and Protection Objective	Description	Qualification	Source of Impact	Impact Area[2]	Impact Type[3]	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [4]	Residual Impact Assessment
								Disturb process, and go/no-go areas will be identified on site, and managed through a GIS system.	
	RE 11.8.5		Clearing of Horse Pit and clearing associated with Horse Creek diversion/Sed Dam N3, Mine Water Dam N3, Catchment Dam South and the dragline transport route.	Approximately 0.01% of bioregional extent and 0.06% of local extent	Direct – Loss of vegetation	Certain	Minor	Only areas absolutely necessary for the construction and the operation of the project will be cleared. Clearance will be controlled by a Permit to Disturb process, and go/no-go areas will be identified on site, and managed through a GIS system.	Minor

Element and Protection Objective	Description	Qualification	Source of Impact	Impact Area[2]	Impact Type[3]	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [4]	Residual Impact Assessment
Exotic Species of State Significance Objective: Manage existing weeds and prevent new introductions.	Mother-of-millions *Bryophyllum delagoense* Harrisia Cactus *Eriocereus martinii* Velvety Tree Pear *Opuntia tomentosa* Parthenium *Parthenium hysterophorus*	Declared Class 2 Pests under the LP Act	Clearing associated with pits will initially remove significant infestations of these species. Works have potential to introduce and spread weeds.	Pits, transport corridors and infrastructure areas	Direct – Destruction of significant weed infestations	Certain	Moderate (positive impact)	Strategies for managing pest and weed species will be maintained in the EM Plan.	Moderate (positive impact)
	Lantana *Lantana camara*	Declared Class 3 Pest under the LP Act			Direct – Potential for weed spread by mechanical means through seeds during clearing and earthworks.	Possible	Moderate	Strategies for managing pest and weed species will be maintained in the EM Plan.	Minor
Other Exotic Species Objective: Manage existing weeds	Invasive Naturalised Plants in the northern Brigalow Belt	Nebo Shire Council (2006)[6]	Clearing and associated pit construction will initially	Pits, transport corridors and infrastructure areas	Direct – Destruction of significant weed infestations	Certain	Moderate (positive impact)		Moderate (positive impact)

Element and Protection Objective	Description	Qualification	Source of Impact	Impact Area[2]	Impact Type[3]	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [4]	Residual Impact Assessment
and prevent new introductions.	E.g., Sesbania Pea *Sesbania cannabina* Captain Cook Tree *Thevetia peruviana* Noogoora Burr *Xanthium pungens* Purple Rubber Vine *Cryptostegia madagascariensis* Rattlepods *Crotalaria mitchellii*		remove infestations of these species. Works have potential to introduce and spread weeds.		Direct – Potential for weed spread by mechanical means through seeds or propagules during clearing and earthworks.	Possible	Moderate	Strategies for managing pest and weed species will be maintained in the EM Plan.	Minor
Plant Pathogens Objective: Manage existing plant pathogens and prevent new introductions	*Phytophthora cinnamomi* (Root-rot fungus)	A root-rot fungus that infects some plant species.	Works have potential to introduce and spread the species via cars and/or earthmoving equipment.	Offset areas	Direct – Dieback of vegetation	Unlikely	Moderate	Strategies for managing pest and weed species will be maintained in the EM Plan.	Negligible

Element and Protection Objective	Description	Qualification	Source of Impact	Impact Area[2]	Impact Type[3]	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [4]	Residual Impact Assessment
Vegetation adjacent to Disturbance Areas Objective: Minimise disturbance to potential habitat	All remnant and non-remnant vegetation types, including riparian vegetation	Integrity of vegetation influences biodiversity	Disturbance to adjacent habitat during construction	Vegetation edges and drainage lines	Direct – damage to adjacent vegetation during construction Indirect – alteration to environmental flows and water quality affecting riparian and instream ecosystem integrity	Certain	Moderate	Strategies for managing uncleared remnant vegetation will be maintained in the EM Plan.A specific Revegetation Plan will be developed for creek diversions subject to the *Water Act 2000*.	Minor

[1] Clearing refers to activities undertaken both during the construction and operational phases.

[2] Calculated via aerial photograph interpretation and subsequent GIS analysis.

[3] All impacts listed in the tables should be considered as negative, unless otherwise stated.

[4] Many of these measures will be prescribed within site management plans for construction and operation (Section 8.1.2.3).

[5] Based on a 1:1 offset scenario, excluding those areas subject to existing onsite clearing approval (Section 8.1.2.1).

[6] Queensland Herbarium has yet to distribute a list of invasive weeds for the Brigalow Belt. The Nebo Shire Pest Management Plan provides a list of plants that are locally significant pest species within Nebo shire and neighbouring shires.

Table 8.6 Flora Operation[1] Impact Assessment

Element and Protection Objective	Description	Qualification	Source of Impact	Impact Area	Impact Type[2]	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [3]	Residual Impact Assessment
Endangered REs/Ecological Communities (State and/or Commonwealth legislation) Objective: Ensure no long term loss in project site.	REs 11.4.8, 11.4.9 and 11.9.5	Endangered EPBC Act Endangered VM Act	Coal extraction, preparation and transport	Adjacent to the pits and infrastructure	Direct – Dust	Probable	Minor	Utilise standard dust suppression techniques to reduce dust leaving the preparation (ROM and CHPP) and transport (conveyor / rail corridor) areas. Strategically rehabilitate available disturbed areas to minimise the net loss of vegetative cover.	Negligible
	RE 11.8.11	Endangered EPBC Act Of Concern VM Act	Coal extraction, preparation and transport	Adjacent to the pits and infrastructure	Direct – Dust	Probable	Minor	Utilise standard dust suppression techniques to reduce dust leaving the preparation (ROM and CHPP) and transport (conveyor / rail corridor) areas. Strategically rehabilitate available disturbed areas to minimise the net loss of vegetative cover.	Negligible

Element and Protection Objective	Description	Qualification	Source of Impact	Impact Area	Impact Type[2]	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [3]	Residual Impact Assessment
Other Remnant Vegetation (REs) Objective: Minimise loss of RE Type	All other REs within project site	Dominant canopy has greater than 70% of the height and greater than 50% of the cover relative to the undisturbed height and cover of that stratum and dominated by species characteristic of the vegetation's undisturbed canopy	Coal extraction, preparation and transport	Adjacent to the pits and infrastructure	Direct – Dust	Probable	Minor	Utilise standard dust suppression techniques to reduce dust leaving the preparation (ROM and CHPP) and transport (conveyor / rail corridor) areas. Strategically rehabilitate available disturbed areas to minimise the net loss of vegetative cover.	Negligible
Exotic Species of State Significance Objective: Manage existing weeds and prevent new introductions.	Mother-of-millions *Bryophyllum delagoense* Harrisia Cactus *Eriocereus martinii*	Declared Class 2 Pests under the LP Act	Mining Coal transport and vehicles have the potential to	Pit area and areas adjacent to the CHPP, rail corridor, roads, dragline transport route and infrastructure	Direct – Destruction of significant weed infestations	Certain	Moderate (positive impact)	Strategies for managing pest and weed species will be maintained in the EM Plan.	Moderate (positive impact)
					Direct – Weed spread	Possible	Moderate	Strategies for managing pest and	Minor

Element and Protection Objective	Description	Qualification	Source of Impact	Impact Area	Impact Type[2]	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [3]	Residual Impact Assessment
	Velvety Tree Pear *Opuntia tomentosa* Parthenium *Parthenium hysterophorus*		introduce and spread weeds.		by mechanical means through seeds or propagules through vehicle movement	Possible	Moderate	weed species will be maintained in the EM Plan.	Minor
	Lantana *Lantana camara*	Declared Class 3 Pest under the LP Act							
Other Exotic Species Objective: Manage existing weeds and prevent new introductions.	Invasive Naturalised Plants in the northern Brigalow Belt E.g., Sesbania Pea *Sesbania cannabina* Captain Cook Tree *Thevetia peruviana* Noogoora Burr *Xanthium*	Nebo Shire Council (2006)[4]	Mining Coal transport and vehicles have the potential to introduce and spread weeds.	Pit area and areas adjacent to the CHPP, rail corridor, roads dragline transport route and infrastructure	Direct – Destruction of significant weed infestations.	Certain	Moderate (positive impact)		Moderate (positive impact)
					Direct – Weed spread by mechanical means through seeds or propagules through vehicle movement	Possible	Moderate	Strategies for managing pest and weed species will be maintained in the EM Plan.	Minor

Element and Protection Objective	Description	Qualification	Source of Impact	Impact Area	Impact Type[2]	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [3]	Residual Impact Assessment
	pungens Purple Rubber Vine *Cryptostegia madagascariensis* Rattlepods *Crotalaria mitchellii*								
Plant Diseases Objective: Manage existing plant diseases and prevent new introductions	*Phytophthora cinnamomi* (Root-rot fungus)	A root-rot fungus that infects some plant species.	Ongoing operational works have potential to introduce and spread the species through vehicle movement	Study area and adjacent lands	Direct – Dieback of vegetation	Unlikely	Minor	Strategies for managing pest and weed species will be maintained in the EM Plan.	Negligible
Vegetation adjacent to Pits, Infrastructure and Transport Corridors	All remnant and non-remnant vegetation types	Integrity of vegetation influences biodiversity	Disturbance to habitat adjacent to construction and dust associated with mining	Vegetation in proximity to pits, infrastructure and transport corridors	Direct – 1. Damage to adjacent vegetation, 2. Dust	Certain	Moderate	Utilise standard dust suppression techniques to reduce dust leaving the processing (ROM and CHPP) and transport (conveyor / rail	Minor

Element and Protection Objective	Description	Qualification	Source of Impact	Impact Area	Impact Type [2]	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [3]	Residual Impact Assessment
Objective: Minimise disturbance			and preparation activities		Indirect – alteration to environmental flows and water quality affects riparian and instream ecosystem integrity.			corridor) areas. Strategically rehabilitate available disturbed areas to minimise the net loss of vegetative cover. Strategies for managing uncleared remnant vegetation will be maintained in the EM Plan.A specific Revegetation Plan will be developed for creek diversions subject to the *Water Act 2000*.	

[1] Clearing activities undertaken during the operational phases are assessed in Table 8.5.

[2]. All impacts listed in the tables should be considered as negative, unless otherwise stated.

[3]. Many of these measures will be prescribed within site management plans for construction and operation (Section 8.1.2.3).

[4]. Queensland Herbarium has yet to distribute a list of invasive weeds for the Brigalow Belt. The Nebo Shire Pest Management Plan provides a list of plants that are locally significant pest species within Nebo shire and neighbouring shires.

8.1.2.3 Impact Mitigation

General Legislative Obligations

Remnant Vegetation

Ten REs were identified from ground truthing, of which three (i.e. REs 11.4.8, 11.4.9 and 11.9.5) have an Endangered status under the provisions of the VM Act and three (i.e. REs 11.3.2, 11.4.2 and 11.8.11) have an Of Concern management status under the provisions of the VM Act. Of the ground truthed REs, nine have been previously mapped for the site, while one (RE 11.9.5 – vegetation community 14) is not currently mapped. In addition, the area of RE 11.4.9 south of Cherwell Creek (vegetation community 4) is not currently mapped. As such, a map amendment request will be submitted to NRW to reflect the ground truthed vegetation communities.

In order to comply with the *Code of Environmental Compliance for Mining Lease Projects* as part of the *Environmental Protection Act 1994* (EP Act), Condition 14 states that the holder of the environmental authority must not carry out activities "*in, or within 1km of, a category B Environmentally Sensitive Area*".

As REs 11.4.8, 11.4.9 and 11.9.5 constitute Category B environmentally sensitive areas, and it is proposed to undertake activities (including clearing) in, or within 1 km of, these areas, the project will be assessed by the DERM as a Level 1 Mining Project. This requires the submission of an EM Plan that provides information on how the impacts on such areas will be managed. Relevant components are provided within the Draft Environmental Management Plan (Appendix Q).

Significant Flora Species/Communities

No significant flora species were identified within the project site. However, five ground truthed vegetation communities (i.e. 2, 4, 14, 16 and 18) are comparable to either the EPBC Act listed Brigalow (*Acacia harpophylla* dominant and co-dominant) communities or the EPBC Act listed Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin. These communities are both listed as *Endangered* under the provisions of the EPBC Act.

As disturbance is proposed to these communities, the project is considered a controlled action that requires assessment and approval under the EPBC Act (Appendix C). One of the BMA's key tasks in this respect is the determination of whether the listed communities will be significantly impacted with regard to a number of official assessment criteria. These criteria have been formally addressed in Appendix C with key aspects discussed in Section 8.1.2.5.

Declared Pest Species

The project site has been extensively invaded by exotic weed species, four of which have been declared as Class 2 weeds and one as a Class 3 weed under the Provisions of the LP Act. By law, landholders are required to control Class 2 weed/pest species to prevent their further spread to surrounding land. The control

of relatively small infestations of Lantana will also be undertaken before the species fully establishes within this locality.

Despite its value as a pasture species, the negative impacts of Buffel Grass upon native biota have been documented (Jackson 2005). This exotic, perennial grass species will be controlled within areas of ecological significance (e.g. areas currently mapped as remnant vegetation) to facilitate the recruitment of native flora.

Mitigation Requirements/Recommendations

Implementation of the following mitigation and compensatory measures is identified in Table 8.5 and Table 8.6 as necessary to reduce identified impacts on flora to levels that will not cause permanent harm to significant ecosystems or flora and fauna populations:

- As much as possible, only areas absolutely necessary for the construction and the operation of the project will be cleared. Clearance will be controlled by a Permit to Disturb process, and go/no-go areas will be identified on site, and managed through a GIS system.
- Utilise standard dust suppression techniques and strategically rehabilitate available disturbed areas to minimise the net loss of vegetative cover.
- For affected ecosystems (e.g. vegetation communities listed as Endangered under the provisions of the VM Act and/or the EPBC Act) not subject to existing surface area approvals for clearing and significant species – offset vegetation loss through negotiation with DEWHA.
- Develop and implement the site environmental management plan, including appropriate:
  - Weed management measures such as cleaning vehicles.
  - Contaminated land management measures.
- Interference with watercourses and flows will be in accordance with the *Water Act 2000*, including the development of a specific Revegetation Plan for creek diversions.

A contractor's construction environmental management plan will manage potential habitat impacts during the construction phase, while the site environmental management plan will manage habitat impacts during operation and decommissioning.

Pest animal and weed management planning is an important component of habitat management for each stage of the project, including measures to control weeds (e.g. Parthenium and Buffel Grass in remnant vegetation), as are measures to control grazing, site access, erosion and sedimentation and fire.

Key components are provided within relevant EM Plan elements in Section 21.

Ecological Monitoring

For the Caval Ridge Mine Project, ecological monitoring will be undertaken during:

Pre-Construction

To determine baseline condition, surveys designed to provide an accurate assessment of the ecological condition and flora and fauna community composition within the project site were carried out.

Standard survey techniques were applied that are replicable, and can be used as a basis for future monitoring. As such, data sets exist for:

- RE/vegetation community composition and condition.
- Fauna community composition for the main habitat types present.
- Fauna occupancy for the main habitat types present.
- The locations of flora and fauna species of special conservation significance.

The results of previous surveys of the project site have also been incorporated into this report (Appendix K, Section 4).

Construction Phase

Monitoring during this period will include:

- Mapping of the distribution of declared and environmental weeds, particularly adjacent to roadway construction.
- Occurrences of erosion and sedimentation influencing vegetation and stream health.
- Pest animal activity.
- Dust effects on native vegetation.
- Native animal injuries during the construction phase.

Operational Phase

Monitoring during this period will include:

- The distribution of declared and environmental weeds around the perimeter of the open pits, CHPP, ROM, overland conveyor, rail route, new sediment basins, creek diversions and adjacent to new roadways and the dragline transport route.
- Habitat rehabilitation/restoration progress.
- Fauna use of rehabilitated areas.
- Downstream riparian habitat.
- Pest animal activity.

The proponent should also undertake water quality and quantity monitoring upstream and downstream of mining operations.

8.1.2.4 Residual Impacts and Opportunities for Positive Impacts

Once appropriate mitigation measures and management plans are implemented, the impacts of the construction and operational phases of the mine and associated infrastructure on terrestrial flora are predicted to be predominantly minor or negligible (Table 8.5 and Table 8.6), with moderate impact predicted to result from the loss of remnant vegetation in the form of approximately 125 ha of Native Grassland Endangered Ecological Community under the commonwealth EPBC Act (analogous to RE 11.8.11 under state VM act classification).

Critical to the predicted scale of residual impacts are restoration, enhancement or offset of Endangered vegetation communities.

The noise, dust and light effects from the pits, roads, rail spur and loop, and CHPP will present a continual management requirement for vegetation and fauna in surrounding areas.

Riparian and in-channel vegetation communities downstream of the diverted sections of Caval and Horse Creeks and additional site dams, and within the path of the proposed dragline transport route, may be affected by alterations in stream morphology, requiring monitoring and the implementation of management actions where required to ensure that the vegetation retains its current ecological function within the local landscape. Monitoring should include bank stability, over-bank flow, and water quality.

In terms of possible positive impacts, the DERM has developed a hierarchy of rehabilitation objectives specifically for mining projects (EPA 2008c). This hierarchy, in order of decreasing capacity to prevent or minimise environmental harm, is:

- Avoid disturbance that will require rehabilitation.
- Reinstate a natural ecosystem as similar as possible to the original ecosystem.
- Develop an alternative outcome with a higher economic value than the previous land use.
- Reinstate previous land use (e.g. grazing or cropping).
- Develop lower value land use.
- Leave the site in an unusable condition or with a potential to generate future pollution or adversely affect environmental values (EPA 2008c: 5).

Rehabilitation of grazing land, as is the case with much of the project site, is sufficient to meet requirements. However, as stated above, a preferred option is reinstatement of habitat as close to the original ecosystem

as possible. Details of original vegetation are obtainable from the Queensland Herbarium. Such rehabilitation is considered the preferred option as it would:

- Reduce the likelihood of invasion by weeds, including Buffel Grass, into adjacent remnant vegetation.
- Recreate habitat suitable for a number of EVR fauna species.
- Improve the visual amenity of the rehabilitated area.
- Improve fauna movement across a highly disturbed landscape by providing a stepping stone.
- Reduce the greenhouse gas burden of the area.

8.1.2.5 Matters of National Environmental Significance

Brigalow

Removal of areas mapped as vegetation communities 4, 14, 16 and 18 (Figure 8.4 and Figure 8.7) will result in the loss of areas mapped during ground survey as REs 11.4.8, 11.4.9 and 11.9.5 that have been listed as Endangered under the provisions of the EPBC Act.

Figure 8.4 and 8.5 show the areas of RE 11.4.8 (vegetation communities 16 and 18), RE 11.4.9 (vegetation community 4) and 11.9.5 (vegetation community 14) that would be subject to clearing as a result of the proposed activities.

Under the EPBC Act Administrative Guidelines on Significance (DEH, 2006), an action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:

- Reduce the extent of a community, or
- Fragment or increase fragmentation of the community, or
- Adversely affect habitat critical to the survival of an ecological community, or
- Modify or destroy abiotic factors necessary for the community's survival, or
- Cause a substantial change in the species composition of an occurrence of an ecological community, or
- Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, or
- Interfere with the recovery of an ecological community.

These criteria have been formerly addressed in Appendix C.

Overall, it was found that much of the Brigalow in this location has been highly disturbed and is in poor condition due primarily to invasion by Buffel Grass and drought stress.

It is proposed that the loss of those areas of Endangered Brigalow communities associated with the proposed open pit and infrastructure that are not subject to existing surface area approvals for vegetation clearing (as shown on Figure 8.5) will be offset, through negotiation with DEWHA.

In addition, areas currently supporting Brigalow will be managed to control the extent of Buffel Grass and other weed species to ensure the continued persistence of the communities within the subject area.

Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin

Removal of vegetation currently mapped as vegetation community 2 (Figure 8.4 and Figure 8.7) will result in the loss of vegetation currently mapped as RE 11.8.11 which is listed as Endangered under the provisions of the EPBC Act.

Figure 8.4 and Figure 8.5 show the areas of RE 11.8.11 (vegetation community 2) that would be subject to clearing as a result of the proposed open pit.

Areas currently mapped as RE 11.8.11 were generally observed to be heavily infested by Parthenium weed. However, as this weed is an annual species, the RE is still considered to be recoverable and therefore meets the definition of remnant under the provisions of the VM Act.

EPBC Act Significant Impact Criteria have been addressed in the EPBC Report (Appendix C).

It is proposed that the loss of those areas of the Endangered Natural Grassland community associated with the proposed pit that are not subject to existing surface area approvals for vegetation clearing (as shown on Figure 8.5) will be offset, through negotiation with DEWHA. In addition, areas currently supporting RE 11.8.11 will be managed to control the extent of exotic species (e.g. *Parthenium*) to ensure the continued persistence of this community within the subject area.

8.2 Terrestrial Fauna

8.2.1 Description of Environmental Values

The terrestrial fauna values of the project were defined through reference to:

- Species of conservation significance as listed under relevant legislation (i.e. NC Act and EPBC Act).
- Declared pest species as listed under relevant legislation (i.e. LP Act).
- The BPA for the Northern Brigalow Belt, produced by the EPA (2003).
- General habitat values, including contributions to faunal movement corridors.

The methodology to describe the status of terrestrial fauna values in the project area included:

- Searching relevant databases, including the DEWHA Online Protected Matters Search Tool, EPA's Wildlife Online database, Queensland Museum's fauna database and Birds Australia's Atlas database.

- Review of the results of previous surveys in and around the area of interest (WBM 1998, GHD 2004, Ecoserve and LAMR 2005, Ecoserve 2006a,b, Ecoserve and Ecoteam 2006).
- Review of aerial photography.
- Ground survey.

The ground survey was undertaken and the detailed methodology is provided in Appendix K, Section 3. Study site locations are indicated on Figure 8.1.

No terrestrial invertebrate species of special conservation significance have been previously recorded from the project site or surrounds, nor were any recorded during recent ground survey or considered likely to occur based on habitat assessment. As such, the following considers terrestrial vertebrate species only.

8.2.1.1 Terrestrial Fauna (Vertebrate) Species

Overview

Ground survey by BAAM recorded a total of 153 terrestrial vertebrate species from the project site or nearby, including 20 species of mammal, 113 birds, 10 reptiles and 10 amphibians (Table 8.7). The complete list of terrestrial vertebrate species recorded during the survey is provided in Appendix K, Section 4. This list includes the results of previous surveys undertaken on the adjacent Peak Downs mining lease (including southern sections of the current project site), which indicate that an additional 136 terrestrial vertebrate species also occur, resulting in an overall total of 289 terrestrial vertebrate species for the project site and surrounds (Table 8.7).

Table 8.7 Terrestrial vertebrate species diversity from survey

Site	Mammals	Birds	Reptiles	Amphibians	Total[1]
1	4	21	4	4	33
2	2	18	6	4	32
3	4	21	0	4	29
4	3	14	0	1	18
H1	5	13	0	0	19
H2	3	0	0	0	3
Incidental	5	69	3	3	80
TOTAL Diversity (current survey)	20	113	10	10	153
Previous Surveys[2]	44	176	42	16	278
TOTAL Diversity (all surveys)	46	182	45	16	289

Note:

1. Totals for specific sites and surveys may include a number of the same species as those for other sites and surveys. As such, totals for the current survey and all surveys are derived from the summation of adjacent cells within the same row, not the summation of totals in preceding rows. Incidental records refer only to species not recorded from a formal survey site.
2. Includes data that may or may not have been recorded on the current project site.

Significant Species

The majority of the terrestrial vertebrate species recorded from the current and previous surveys are currently listed in Queensland's NC Act as Least Concern wildlife (i.e. native animals that are not currently listed as Presumed Extinct, Endangered, Vulnerable or Rare, although are still prescribed as protected wildlife). However, twenty are recognised as species of special conservation significance under Commonwealth (EPBC Act) and/or Queensland Government (NC Act) legislations, while a further nine were not recorded but may occur based on database records from the local area and the presence of suitable habitat within the project site, as listed in Table 8.8. Full profiles are provided in Appendix K, Section 4.3. Those species recorded on databases for the area but not considered likely to occur are addressed in Appendix K, Section 4.3.

The location(s) of EVR species recorded during the current and previous surveys are shown on Figure 8.7.

Declared Pest Species

The feral fauna species noted during the current and previous surveys and database searches were the Cane Toad (*Bufo marinus*), House Sparrow (*Passer domesticus*), House Mouse (*Mus musculus*), Black Rat (*Rattus rattus*), Cat (*Felis catus*), Brown Hare (*Lepus capensis*), Rabbit (*Oryctolagus cuniculus*), Donkey (*Equus asinus*), Pig (*Sus scrofa*) and Goat (*Capra hircus*). Of these, Cat, Rabbit and Pig are listed as Class 2 pests under the LP Act.

None of these species are unexpected and all are commonly found in central Queensland.

Table 8.8 Terrestrial vertebrate species of special conservation significance known or potentially occurring within the project site

Zoological Name	Common Name	NC Act Status	EPBC Act Status	Comments
Reptiles				
Paradelma orientalis	Brigalow Scaly-foot	V	V	Potential occurrence within a patch of Brigalow on a variety of substrates around site V16 (Figure 8.1) that retains areas of leaf litter and coarse woody debris.
Egernia rugosa	Yakka Skink	V	V	Potential occurrence within small areas very close to Site V16 (Figure 8.1).
Denisonia maculata	Ornamental Snake	V	V	Previously recorded on the adjacent Peak Downs Mine (Figure 8.5). Potential occurrence within an area of Brigalow around site V16 (Figure 8.1).
Birds				
Nettapus coromandelianus albipennis	Cotton Pygmy-Goose	R	M	There are previous survey records for this species (Figure 8.5). Potential occurrence on Boomerang Dam, the wetlands adjacent to 7 South fill point, Windsor's Dam and 4 North Dam, subject to the presence of aquatic vegetation.
Ephippiorhynchus asiaticus	Black-necked Stork	R		Potential occurrence on the project site, including shallow margins of wetlands adjacent to 7 South fill point, and may utilise small dams scattered throughout the grazing land north of Cherwell Creek.
Bubulcus ibis	Cattle Egret	S	M	Potential occurrence on the cleared and actively grazed areas of the project site at times.
Ardea alba	Great Egret	S	M	Recorded from artificial waterbodies, including Four North Dam.
Haliaeetus leucogaster	White-bellied Sea-Eagle	S	M	Breeding pair previously recorded from nearby One Mile Dam at Saraji Mine.
Rostratula australis	Australian Painted Snipe	V	V	Potential occurrence on the project site at times, possibly years apart, including One North Dam (to the south of the project site).
Gallinago hardwickii	Latham's Snipe	S	M	Potential occurrence sporadically, including the shallow margins of wetlands adjacent to 7 South fill point and Windsor's Dam to the south of the project site.
Numenius minutus	Little Curlew	S	M	Use of the project site by this species would be sporadic and probably short-term and is likely only in areas either of non-remnant vegetation and/or in areas heavily disturbed by livestock.
Tringa stagnatilis	Marsh Sandpiper	S	M	Previously recorded for the project site from limited suitable habitat such as Boomerang Dam 21.
Actitis hypoleucos	Common Sandpiper	S	M	Previously recorded for the project site from limited suitable habitat such as Boomerang Dam 21.
Calidris ruficollis	Red-necked Stint	S	M	Previously recorded for the project site from limited suitable habitat such as Boomerang Dam 21.

Zoological Name	Common Name	NC Act Status	EPBC Act Status	Comments
Calidris acuminata	Sharp-tailed Sandpiper	S	M	Previously recorded for the project site from limited suitable habitat such as Boomerang Dam 21.
Sterna caspia	Caspian Tern	S	M	Two previous survey records, including Raw Water Dam.
Geophaps scripta scripta	Squatter Pigeon (southern subspecies)	V	V	During the recent ground survey, Squatter Pigeons were observed on a number of occasions, most near a creek (Figure 8.5). Also recorded during previous surveys on the project site and adjacent Peak Downs Mine.
Hirundapus caudacutus	White-throated Needletail	S	M	Previously recorded aerial species that may at times fly over the project site.
Apus pacificus	Fork-tailed Swift	S	M	
Merops ornatus	Rainbow Bee-Eater	S	M	Recorded from wooded and rehabilitated habitats within the project site, but is likely to utilise almost any habitat present. Potential breeding habitat is present on the exposed banks of Cherwell Creek.
Rhipidura rufifrons	Rufous Fantail	S	M	Only one previous survey record and unlikely to be a regular visitor to the area.
Monarcha melanopsis	Black-faced Monarch	S	M	Potential occurrence on the project site on passage during migration, most likely in riparian vegetation.
Myiagra cyanoleuca	Satin Flycatcher	S	M	Only one previous survey record and unlikely to be a regular visitor to the area.
Acrocephalus australis	Australian Reed-Warbler	S	M	Present at Dam 1 North during recent ground survey and previous records both a rehabilitation area and Dam 1 North. It regularly occurs on artificial waterbodies should they have suitable fringing vegetation and may breed in the project site.
Mammals				
Tachyglossus aculeatus	Short-beaked Echidna	S		Short-beaked Echidna has been recorded six times for all surveys combined, suggesting that it is reasonably common in the project site and surrounds.
Phascolarctos cinereus	Koala	S		Over 100 records of the species from previous surveys, indicating that there is a substantial population present, presumably in the areas of better quality habitat south of Cherwell Creek.
Taphozous troughtoni	Troughton's Sheathtail-bat	E		Previous Anabat records for Cherwell Creek (Figure 8.5).
Nyctophilus timoriensis	Greater Long-eared Bat (South-eastern)	V	V	Sporadic use of the site by any individuals possibly present in the local area cannot be discounted.
Chalinolobus picatus	Little Pied Bat	R		Numerous Anabat survey records from recent ground survey and pervious surveys (Figure 8.5), including in or near woodland with Acacia harpophylla, Windsor's Dam, wetlands adjacent to 10 North Fill Point, and within the Brigalow remnant adjacent to the boundary with Saraji mine.

Note:

Special Status abbreviations are as follows:

- Queensland's *Nature Conservation Act 1992* (NC Act Status): E = Endangered, V = Vulnerable, R = Rare, S = Special Least Concern (Migratory), S = Special Least Concern, C = Least Concern wildlife.
- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act Status): E = Endangered, V = Vulnerable, M = Migratory Species. Terrestrial Habitat Values

General Values

The habitats within and immediately surrounding the project site can be assigned to five broad categories:

i. Woodland and Open Forest.

ii. Grasslands – both introduced pasture and native grasslands.

iii. Jump-ups with shrubby vegetation.

iv. Ephemeral creeks and drainage lines.

v. Dams and other artificial waterbodies.

The value of these broad habitat types is briefly discussed individually hereunder. Reference to species of conservation significance includes only those listed as Endangered, Vulnerable or Rare at the National or State level, unless otherwise noted. Migratory (EPBC Act) species are identified where appropriate. More detailed discussions (including photos) are provided in the EPBC Report (Appendix C).

Woodland and Open Forest

The project site supports a variety of Open Woodland, Woodland and Open Forest habitats. The canopy of these habitats is dominated, to varying degrees, by Dawson Gum (*Eucalyptus cambageana*), Narrow-leaved Ironbark (*E. crebra)*, Mountain Coolibah (*E. orgadophila)*, Poplar Box (*E. populnea)* and Brigalow (*Acacia harpophylla)*.

During ground survey, the woodlands and forests north of Cherwell Creek typically had very little understorey and had been severely affected by drought stress, with large numbers of standing dead trees. Ground cover was often highly disturbed by livestock and was dominated by a mixture of native and introduced grasses, such as *Aristida* species, Buffel Grass and some forbs. There was varying amounts of fallen timber potentially providing microhabitats for reptiles and small ground-dwelling mammals, though generally the ground was somewhat smothered with grasses, reducing the suitability. Rocky areas, whether boulders, rock slabs or scree slopes, also act as valuable microhabitat, but were not a local component of the habitat type.

Disturbance at the time of survey was largely limited to active grazing and weed infestations. Human infrastructure and modifications consisted of vehicle tracks, fences, dams and windmills. There was also evidence of some feral species, including Black Rat, Cat, Dog/Dingo, Pig and Cane Toad.

All fifteen frog species recorded in other habitats or during earlier surveys on the project site are likely to occur in this habitat type, although none of these is conservation significant and no unrecorded conservation significant species is expected to occur. The habitat is providing reasonable resources for frog species but these resources are possibly decreased in areas of weed infestation.

All 47 reptile species recorded for the project site during all surveys combined are likely to occur in this habitat type, other than Macquarie Turtle (*Emydura macquarii krefftii*). This includes Ornamental Snake, listed as Vulnerable under both the EPBC and NC Acts, which is largely confined to woodland, especially Brigalow on cracking soils with gilgais, while it is also possible that the conservation significant Brigalow Scaly-foot is present in some areas of Brigalow and other woodland, particularly in areas with substantial leaf litter (Table 8.8).

One hundred and seventeen of the bird species recorded for the project site regularly occur in, or are dependent on, woodlands and forests. Despite the on-going disturbance and the loss of many individual trees due to drought death, the species assemblage included many small insectivorous species and other birds that have declined in woodlands and forests in parts of eastern Australia. These species were, however, typically of low abundance, possibly due to livestock grazing and weed invasion. There were also large numbers of large, aggressive species that invade disturbed habitats and deleteriously affect many woodland and forest bird species.

Nonetheless, the woodlands would be providing resources for Squatter Pigeon, listed as Vulnerable under both the EPBC and NC Acts, which, despite declines and local extinctions in the South East Queensland bioregion and northern New South Wales, remains locally common.

Few native mammals were recorded from woodland and forest habitats during the 2008 surveys, possibly due to the thinning of the canopy due to tree death and a lack of understorey. In terms of arboreal species, only Koala appears at all common on the project site and the relatively intact Poplar Box habitat south of Cherwell Creek may support a substantial population. The Little Pied Bat, listed as Rare under the NC Act, also appears to be widespread in woodlands on the project site based on remote bat call detection (Anabat) records.

Much of the habitat south of Cherwell Creek was dominated by Poplar Box woodland of good quality that included many large trees (both live and dead) with substantial hollows and large amounts of fallen timber, and, generally speaking, appeared to have higher fauna habitat values than other areas. Again, however, the habitat was compromised by the dense grassy understorey, dominated by Buffel Grass and other pasture weeds.

The best habitat areas in the northern section of the project site were immediately north of Cherwell Creek with patches of Open Woodland with some substantial Dawson Gum and Poplar Box and scattered small Brigalow. There were good quantities of coarse woody debris and some areas had a diverse understorey and ground cover with many native species.

Habitat quality generally declined moving northwards, particularly in terms of Buffel Grass and Parthenium dominating the ground cover as dense swards. Dead trees, presumably as a result of drought stress were common, especially to the immediate south of Peak Downs Highway. The creeklines retained some native

vegetation but had no real continuity of substantial vegetation. They also typically became more and more degraded to the north.

Grasslands

The project site would have been dominated by Brigalow and Dawson Gum communities prior to broadscale clearing, which has left less than 10% of the original vegetation cover in the bioregion (EPA 2005). Much of this vegetation has been replaced by pasture. Native grasslands are also present, dominated by species such as Queensland Blue-grass (*Dichanthium sericeum*) and Button Grass (*Dactyloctenium radulans*), but this habitat has been invaded, and in places replaced, by infestations of Parthenium. The grasslands, whether native or exotic, are also affected by livestock grazing, even though they do provide resources for a number of native grassland fauna species, albeit at generally low densities.

Frogs within this habitat are either associated with waterbodies, both permanent and ephemeral, or are burrowing species that respond to rainfall. Native grasslands typically have a small frog species assemblage and infestations of Parthenium and the impacts of livestock have reduced the value of the grasslands to native frogs.

Given the low number of records, disturbance from grazing and Buffel Grass, and their typical association with woody vegetation and fallen timber and/or leaf litter, it is assumed that the reptile species assemblage within grassland habitat throughout the project site would be small and comprised mainly of various snake and certain skink species.

Birds are a conspicuous component of the fauna assemblage of the grasslands, particularly larger species, such as Brolga (*Grus rubicunda*) and Bustard (*Ardeotis australis*). Many respond to weather, season and/or food resources and would move in and out of the project site depending on local conditions. Despite the weed infestations and the effects of livestock, the grassland bird species assemblage is quite good for the project site.

Other than micro-bat species that may forage above the grasslands but roost and breed elsewhere, the mammal assemblage is quite small, including relatively few macropod records, although areas still dominated by native grasses are likely to have some native rodents and dasyurids.

Jump-ups

The project site incorporated a number of jump-ups, which form isolated components of the landscape within exotic pasture. The vegetation on these areas was dominated by Bendee (*Acacia catenulata*), Lancewood (*A. shirleyi*) and/or Mountain Yapunyah (*Eucalyptus thozetiana*) with a shrubby understorey of species such as Dogwood (*Erythroxylon australe*). Some jump-ups had large amounts of fallen timber and/or loose rock. All had a duricrust substrate in part.

The jump-ups were quite poor for fauna, with the exception of birds, including a mixture of open country and/or generalist species. This probably reflects their small total area within the local landscape, their small individual size, their history of being cleared and their isolation within a heavily modified landscape.

Ephemeral Creeks and Drainage Lines

The project site included Cherwell Creek, which at the time of ground survey was almost completely dry, though there appeared to be considerable subsurface flow through the sandy substrate, and a number of smaller creeks and drainage lines, typically highly degraded.

Although creeks will attract a number of frog species when in flow, none of the species recorded for the project site is a species restricted to, or dependent on, lotic waterbodies. Only one water-dependent reptile, Macquarie Turtle, has been recorded on the project site or surrounds, while other species may forage on the banks of creeks.

The creeks provide important watering sites for birds, but given their ephemeral nature locally are probably of less importance than artificial waterbodies, especially dams and troughs providing water for livestock. When in flow creeks may be the preferred option, however, due to water quality and a decreased likelihood for predation by raptors. Squatter Pigeons were recorded a number of times in close proximity to creeks and may have been using them as watering points.

An important function of rivers and creeks is as corridors, particularly in a degraded landscape. Unfortunately, riparian vegetation is usually more complex and often more susceptible to the impacts of grazing by livestock and weed invasion than other nearby habitats. Although riparian vegetation in the project site is degraded and narrow it would still serve as route by which species traverse the landscape or as a stepping stone habitat for some migratory bird species (under the EPBC Act) that require more dense vegetation. Arboreal mammals would also move along the creek lines and probably use some of the larger trees on Cherwell Creek as habitat trees for shelter and breeding hollows, while macropods probably drink from the creeks as well.

Sections of creek with overhanging vegetation act as flyways for foraging micro-bats though activity patterns will vary with season and flying insect activity. Riparian zones are important foraging habitat for micro-bats, even ephemeral creeks. A number of bat species were caught and/or remotely recorded adjacent to creek lines, including Little Pied Bat, listed as Rare under the NC Act. In a landscape that has suffered the loss of many trees, due either to historical clearing or recent drought death, riparian vegetation is likely to be of increased importance for micro-bats.

Dams and other Artificial Waterbodies

There are a substantial number of artificial waterbodies, of varying sizes, within the project site. The larger and more valuable in terms of fauna of these are all located south of Cherwell Creek. North of Cherwell Creek the artificial waterbodies consist of small farm dams and watering points such as troughs. Numerous

species of waterbird have been recorded from these habitats, including the Migratory (EPBC Act) Great Egret, despite the on-going mine activity.

The northern waterbodies would act as watering points for macropods and birds and provide food and breeding resources for a number of waterbirds and frogs. Some snake species would also hunt for frogs and other vertebrates on their fringes. The bird species using these northern dams would be mainly non-migratory species, although Great Egret would also occur and Black-necked Stork, listed as Rare under the NC Act, may also occur in the area sporadically.

Conservation significant waterbirds (including EPBC Act Migratory species) known to, and expected to, occur on the project site are more likely to occur south of Cherwell Creek, including Boomerang Dam, Raw Water Dam, Windsor's Dam and wetlands associated with 7 South fill point.

Habitat Protection for Significant Fauna

The value of habitats within the project site to conservation significant fauna has been discussed under broad headings, each of which encompasses a number of RE types. These headings are intended to reflect structural aspects of habitat which determine likely use by particular species. In order to determine the areas of habitat for significant species that are currently protected, RE mapping has been used to provide some indication of the extent of suitable habitat within reserves, including National Parks.

The likelihood of a species occurring in an RE can be determined based on the description of the RE and the known distribution of the species in question. Table 8.9 lists the REs which are found in Province 6 of the BBN bioregion (Young et al. 1999), which encompasses the project site, and which are most likely to provide appropriate resources of the conservation significant fauna species identified by surveys or by database searches (Table 8.8). The exclusion of an RE in relation to a particular species does not mean that it may not at times occur there, especially for migratory species. Rather, the REs have been chosen to represent the habitats of greatest likelihood of regular occurrence. Waterbirds and wetland species, such as those associated with rank vegetation fringing waterbodies, may use many REs beyond those listed should appropriate waterbodies exist within the area in question. The habitat requirements of White-throated Needletail, Rainbow Bee-eater and Short-beaked Echidna are so broad that they could occur in all REs.

It should also be noted that non-remnant vegetation may provide significant resources for many of the species listed.

Table 8.10 provides the total area of REs listed for each species listed in Table 8.9 and gives the land tenure, indicating the amount of habitat for conservation significant species that is currently conserved. This is, however, a broad scale approach as particular species do not occur in all available and apparently suitable habitat due to a variety of patch characteristics including connectivity and habitat condition. An area mapped as remnant may be highly degraded, particularly in terms of its ground cover, and may not be suitable for ground-dwelling species, especially herpetofauna (reptiles and amphibians) and ground-nesting

birds. An actual habitat assessment is required to accurately identify the likelihood of a species occurring in a habitat patch.

EVR Species (EPBC Act and NC Act)

Brigalow Scaly-foot, Yakka Skink and Ornamental Snake have 16,778; 20,032 and 3,675 ha of reserved habitat (i.e. within National Parks and Forest Reserves) respectively. These species are susceptible to disturbance and the loss of suitable ground cover such as coarse woody debris and leaf litter. Non-reserved remnant vegetation may be grazed or otherwise disturbed and is less likely to provide suitable resources for these species, though Yakka Skink can occupy degraded areas with log piles or rabbit warrens to provide shelter. Due to the possible consequences of grazing the extent of reserved land is of much greater importance for these species than for many other conservation significant species.

The Australian Painted Snipe is not particularly restricted to any RE types in the BBN bioregion. It requires terrestrial shallow wetlands and will use inundated grasslands, saltmarsh, dams, rice crops, sewage farms and bore drains. Therefore the area of conserved REs for this species gives little indication of the amount of suitable habitat as this species is often recorded from non-remnant vegetation.

The Squatter Pigeon occurs in open woodlands with a grassy understorey with permanent water nearby. The 23,330 ha of reserved habitat would include some areas where the understorey is too dense for this species. Given a tolerance of low to medium intensity cattle grazing and a willingness to eat some pasture grasses much of the freehold and leasehold land and state forest may actually provide better resources. The species probably also benefits from artificial waterbodies in non-remnant vegetation.

The 6,869 ha of reserved habitat for Greater Long-eared Bat may be considerable under-estimation given that the species occurs in a variety of habitats. The lack of knowledge of its biology makes it difficult to make accurate assessments of its habitat use. It is likely, however, to require large, intact remnants (Turbill et al. 2008) and hence may be dependent on reserved lands.

EVR Species (NC Act)

Cotton Pygmy-goose and Black-necked Stork are similar to Australian Painted Snipe in that their habitat requirements are not well reflected by REs.

Little Pied Bat occurs in a wide variety of habitats and, based on Anabat records, is often found in non-remnant, highly modified landscapes. It does require caves, tunnels, other similar subterranean structures or hollow-bearing trees as roosts, which may be just as common in non-reserved remnant vegetation as in forest reserves and National Parks. The sparseness of this species is not indicated by the amount of apparently suitable remnant vegetation in the BBN bioregion.

Non-EVR Migratory Species (EPBC Act)

White-bellied Sea-eagle, Latham's Snipe, Marsh Sandpiper, Common Sandpiper, Red-necked Stint, Sharp-tailed Sandpiper Caspian Tern and, to a lesser degree, Great Egret and Little Curlew, are dependent on waterbodies, including artificial ones. Cattle Egret is an open country species that most often occurs in highly modified non-remnant habitats such as pasture. RE extent does not indicate the amount of suitable habitat for these species in the BBN bioregion.

Rufous Fantail and Black-faced Monarch prefer areas with intact mid-strata. This is more likely to be the case in reserved remnants not subject to grazing. The extent of reserved suitable habitats, <3% of the relevant REs in the BBN bioregion, is hence more significant than for many other conservation significant species. These species will appear in a much greater variety of habitats, including non-remnant vegetation, during passage.

Table 8.9 Conservation significant species known or predicted from the vicinity of the Project Site and surrounding lands – Regional Ecosystem use

Genus Species	Common Name	Regional Ecosystems	NC Act	EPBC Act
Paradelma orientalis	Brigalow Scaly-foot	11.3.2, 11.3.4, 11.3.21, 11.4.9, 11.11.13, 11.11.19	V	V
Egernia rugosa	Yakka Skink	11.3.2, 11.3.4, 11.4.2, 11.4.9, 11.5.3, 11.11.13	V	V
Denisonia maculata	Ornamental Snake	11.3.21, 11.4.9	V	V
Nettapus coromandelianus	Cotton Pygmy-goose	11.3.27	R	M
Ephippiorhynchus asiaticus	Black-necked Stork	11.3.27	R	
Ardea alba	Great Egret	11.3.25, 11.3.27	S	M
Bubulcus ibis	Cattle Egret	11.3.21, 11.4.4, 11.11.17	S	M
Haliaeetus leucogaster	White-bellied Sea-Eagle	11.3.25, 11.3.27	S	M
Rostratula australis	Australian Painted Snipe	11.3.27	V	V
Gallinago hardwickii	Latham's Snipe	11.3.27	S	M
Numenius minutus	Little Curlew	11.3.27	S	M
Tringa stagnatilis	Marsh Sandpiper	11.3.27	S	M
Actitis hypoleucos	Common Sandpiper	11.3.27	S	M
Calidris ruficollis	Red-necked Stint	11.3.27	S	M
Calidris acuminata	Sharp-tailed Sandpiper	11.3.27	S	M
Sterna caspia	Caspian Tern	11.3.27	S	M

Genus Species	Common Name	Regional Ecosystems	NC Act	EPBC Act
Geophaps scripta scripta	Squatter Pigeon (southern)	11.3.2, 11.3.4, 11.3.7, 11.3.9, 11.3.25, 11.3.36, 11.5.12, 11.8.11, 11.8.14, 11.9.12, 11.11.10, 11.11.17, 11.11.19	V	V
Hirundapus caudacutus	White-throated Needletail	all	S	M
Apus pacificus	Fork-tailed Swift	all	S	M
Merops ornatus	Rainbow Bee-eater	all	S	M
Rhipidura rufifrons	Rufous Fantail	11.3.25, 11.8.3, 11.8.13, 11.10.8, 11.11.18	S	M
Monarcha melanopsis	Black-faced Monarch	11.3.25, 11.8.3, 11.8.13, 11.10.8	S	M
Myiagra cyanoleuca	Satin Flycatcher	11.3.9, 11.3.25	S	M
Acrocephalus australis	Australian Reed-Warbler	11.3.27	S	M
Tachyglossus aculeatus	Short-beaked Echidna	all	CS	
Phascolarctos cinereus	Koala	11.3.2, 11.3.4, 11.3.7, 11.3.9, 11.3.25, 11.3.36, 11.4.2, 11.5.3, 11.5.9, 11.8.5, 11.8.14, 11.10.12, 11.11.1, 11.11.2, 11.11.10	CS	
Taphozous troughtoni	Troughton's Sheathtail-bat	unknown in this province	E	
Chalinolobus picatus	Little Pied Bat	11.3.2, 11.3.4, 11.3.7, 11.3.9, 11.3.21, 11.3.25, 11.3.36, 11.4.9, 11.5.3, 11.11.10, 11.11.13, 11.11.17, 11.11.19	R	
Nyctophilus timoriensis	Greater Long-eared Bat	11.4.9, 11.5.3, 11.10.12, 11.11.13	V	V

* Regional Ecosystems of Province 6 of the BBN bioregion

Status Abbreviations

Queensland's Nature Conservation Act 1992 (NC Act): E = Endangered, V = Vulnerable, R = Rare, S = Special Least Concern (Migratory), CS = Least Concern (Culturally Significant), C = Least Concern wildlife.

Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act): E = Endangered, V = Vulnerable, M = Migratory Species

Table 8.10 Project site conservation significant fauna species – relevant Regional Ecosystem extent and tenure

Scientific Name	Common Name	Extent of habitat remaining and Land Tenure (ha) – Queensland*						Grand Total (ha)
		Forest Reserve	Freehold Land	Leasehold Land	National Park	Other	State Forest	
Paradelma orientalis	Brigalow Scaly-foot	199	355044	523789	16579	23375	54951	973937
Egernia rugosa	Yakka Skink	199	469684	777333	19833	26764	62160	1355973
Denisonia maculata	Ornamental Snake	0	71184	79440	3675	2834	851	157984
Nettapus coromandelianus	Cotton Pygmy-goose	1	9868	4886	704	2940	182	18581
Ephippiorhynchus asiaticus	Black-necked Stork	1	9868	4886	704	2940	182	18581
Ardea alba	Great Egret	12	234197	201054	8401	52636	20695	516995
Bubulcus ibis	Cattle Egret	0	42525	37042	152	449	43	80211
Haliaeetus leucogaster	White-bellied Sea-Eagle	12	234197	201054	8401	52636	20695	516995
Rostratula australis	Australian Painted Snipe	1	9868	4886	704	2940	182	18581
Gallinago hardwickii	Latham's Snipe	1	9868	4886	704	2940	182	18581
Numenius minutus	Little Curlew	1	9868	4886	704	2940	182	18581
Tringa stagnatilis	Marsh Sandpiper	1	9868	4886	704	2940	182	18581
Actitis hypoleucos	Common Sandpiper	1	9868	4886	704	2940	182	18581
Calidris ruficollis	Red-necked Stint	1	9868	4886	704	2940	182	18581
Calidris acuminata	Sharp-tailed Sandpiper	1	9868	4886	704	2940	182	18581
Sterna caspia	Caspian Tern	1	9868	4886	704	2940	182	18581
Geophaps scripta scripta	Squatter Pigeon (southern)	210	729955	808980	23120	85655	78558	1726478
Hirundapus caudacutus	White-throated Needeltail	211	1319344	1704780	73689	118755	162232	3379011

Scientific Name	Common Name	Extent of habitat remaining and Land Tenure (ha) – Queensland*						Grand Total (ha)
		Forest Reserve	Freehold Land	Leasehold Land	National Park	Other	State Forest	
Apus pacificus	Fork-tailed Swift	211	1319344	1704780	73689	118755	162232	3379011
Merops ornatus	Rainbow Bee-eater	211	1319344	1704780	73689	118755	162232	3379011
Rhipidura rufifrons	Rufous Fantail	11	241358	214295	11348	49718	21684	538414
Monarcha melanopsis	Black-faced Monarch	11	241358	214295	11348	49718	21684	538414
Myiagra cyanoleuca	Satin Flycatcher	11	255472	219306	8004	58334	21538	562665
Acrocephalus australis	Australian Reed-Warbler	1	9868	4886	704	2940	182	18581
Tachyglossus aculeatus	Short-beaked Echidna	211	1319344	1704780	73689	118755	162232	3379011
Phascolarctos cinereus	Koala	210	1050149	1428697	64550	111767	159225	2814598
Chalinolobus picatus	Little Pied Bat	210	771919	1127065	29387	90672	85773	2105026
Nyctophilus timoriensis	Greater Long-eared Bat	0	182269	428263	6869	8554	10847	636802

*Data from EPA (2004).

Fauna Movement Opportunities

No corridors are mapped for the project site at the state, regional or local levels under the BPA (EPA 2003) and, overall, the project site contains little by way of movement opportunities for terrestrial fauna. Cherwell Creek and Nine Mile Creek probably provide the only corridors of note, with arboreal mammals and birds, including some listed as Migratory under the EPBC Act, likely to use the riparian vegetation to traverse the local landscape. The degraded and thin nature of the riparian vegetation means that this function has lost much of its likely original value to fauna.

8.2.2 Potential Impacts and Mitigation Measures

8.2.2.1 Impact Mechanisms

Clearing

In addition to the impacts on vegetation and habitat described in Section 8.1.2.1, clearing of native vegetation results in a reduction of populations of fauna, and has the potential to result in isolation of populations, changes to remaining vegetation that cause the loss of food and shelter resources for fauna, and exposure to introduced species that are either competitors or predators (Bennett et al. 2000). Removal of vegetation can also result in the mortality of certain fauna present at the time of clearing, while there may also be indirect impacts such as the loss of large, live and dead, trees suitable for nesting, and secondary impacts associated with increases in nest predation.

While the majority of the area to be cleared consists of pasture and regrowth vegetation, the results of the proposed clearing have the potential to affect fauna movement and dispersal opportunities. These impacts will be greatest during the operational phase of the project, when the open cut pits are progressively established.

Construction Activities

In addition to the impacts on vegetation and habitat described in Section 8.1.2.1, the construction phase has the potential to result in on-going disturbance from noise (see Section 12.10). Working past daylight hours may cause light pollution, which may affect behaviour of both nocturnal and diurnal fauna, both vertebrate and invertebrate; including interfering with birds that migrate at night; altering reproductive behaviour of frogs; disrupting communication between individual mammals and birds; focusing the foraging activities of insectivores; and increasing the likelihood of predation (Longcore and Rich 2004).

Another potential impact associated with fauna, particularly reptiles and small mammals, becoming trapped in any trenches or other excavations that remain open for any period of time. This may lead to mortality either by exposure, starvation, thirst or predation by other species.

An increase in traffic during the construction phase, both heavy vehicles and construction workers in light vehicles, could contribute to increased animal/vehicle collisions on local roads, and general waste and land disturbance has the potential to attract highly competitive and/or predatory exotic fauna species.

Mine Operation

In general, the potential impacts on fauna during the construction phase of the Project are also applicable during mine operation as a result of progressive open cut mining and spoil dumps, stockpiling, coal transport and processing. In addition, the operation of the proposed mine has the potential to further disrupt natural ecological processes within the local area beyond initial clearing, in terms of both the spatial and temporal scale of impact. This includes:

- Limiting the natural movement and dispersal of ground-dwelling and non-volant (flightless) arboreal fauna (i.e. for breeding and foraging purposes), which are unable to traverse the mined landscape, and/or have difficulty traversing other barriers such as roads.
- Altering the local surface and ground water environment due to large-scale landform modification, creek diversions and the creation of dams, and subsequent impacts on downstream ecosystems and dependent fauna.
- Creating long-term edge effects along the borders of the active area and adjacent habitat, as well as isolated habitat patches between disturbed areas.
- Altering behaviour and movement of fauna through light pollution at night.

8.2.2.2 Areas of Impact

Open Cut Pits

The vast majority of the area proposed to be mined is non-remnant vegetation and is currently grazed. The area north of Peak Downs Highway (Horse Pit) has two patches of Natural Grassland (RE 11.8.11) and a number of small jump-ups with species such as Lancewood and Mountain Yapunyah. The jump-ups were relatively lacking in fauna, with the exception of birds. This is most likely due to their small area, isolation and historical clearing. The grasslands, including areas of pasture, also provided resources mainly for birds, typically common and widespread species. Both Red and Eastern Grey Kangaroos were present.

One EVR species, Squatter Pigeon, was recorded in this area. Two pairs were observed in close proximity just north of the highway, the species being more frequently sighted between the highway and north of Cherwell Creek. This probably reflects increased tree cover and more suitable watering points, namely creeks as opposed to farm dams. When the ephemeral creeks are completely dry there are dams as alternative drinking locations. Some birds were close to human habitation and other infrastructure. This species is often found around cattle yards and other disturbed areas.

Generally speaking, the area north of the highway provides very poor resources for fauna, especially for conservation significant species. Once operating, the greatest impact of the open pit will be as a barrier to non-volant fauna.

The future open cut pit area south of Cherwell Creek (Heyford Pit) supports a mosaic of habitats, including some non-remnant regrowth vegetation, a small patch of Brigalow, Ironbark woodland and Poplar Box woodland. Habitat mosaics increase the resources available to some fauna species (Law and Dickman 1998). For example, micro-bats may roost in woodland and forage in open areas or along riparian zones. Similarly, macropods may shelter in cover during the day and feed in open areas at night. It is proposed that the Heyford Pit will result in the removal of a small area of Brigalow-dominated RE 11.4.9, which may also provide suitable resources for Brigalow Scaly-foot (Vulnerable under both EPBC and NC Acts), while the culturally significant Short-beaked Echidna and Koala are both likely to occur in the Ironbark and Poplar Box woodlands. The Ironbark woodland is good habitat for small nectivorous birds and, where coarse woody debris is reasonably common, often has a rich assemblage of reptile species.

As with the northern area, the greatest impact of the southern open pit component of the operating mine will be as a barrier to non-volant fauna.

Roads and Dragline Transport Route

The construction and operation of the haul road will increase the likelihood of fauna coming into contact with the road thereby increasing the likelihood of vehicle strike. This will especially be the case for slow-moving species such as Short-beaked Echidna, Koala and various reptiles and amphibians. The width of the haul road and dragline transport route also act as a barrier to movement for many non-volant species, limiting dispersal and reducing access to resources. Roads, particularly narrow, little-used tracks, also function as movement corridors for exotic species such as foxes and cats, which act as competitors or predators for native species (Trombulak and Frissell 2000).

Coal Handling and Preparation Plant

As noted in Section 8.1.2.1, ecosystems impacted by the construction of the CHPP are well represented throughout the BBN bioregion and local area and it is not expected that clearing or other potential impacts (e.g. coal dust) will represent a significant loss of these communities within the broader context. There will be some loss of habitat and some exclusion from watering points for Squatter Pigeons due to construction of the CHPP and other infrastructure but any impacts are expected to be minor given that there are a large number of watering sites, both natural and artificial, within the local landscape and the species, despite being listed as Vulnerable, is tolerant of human modification and habitat degradation.

Overland Conveyor, Rail Spur and Loop

It is anticipated that operation of the conveyor would have limited deleterious impacts on native fauna. Furthermore, while the rail link may act as a barrier to local movement for some fauna species, this should

be at an insignificant level. However, the route does pass through a large stand of regrowth dominated by Lancewood, which contains a very large amount of coarse woody debris. This debris may be providing valuable resources for reptiles and there may be some mortality from vehicle strike if the reptile fauna have access to the rail line at this location.

Sediment Basins, Dams and Creek Diversions

The creeks and drainage lines of the project site, when containing water, are valuable watering points for Squatter Pigeons and other fauna species, and act as fly paths for foraging micro-bats such as Little Pied Bat.

However, with the exception of the artificial dams and the dammed section of Harrow Creek to the west of the haul road, all of these systems are ephemeral, and impacts on Nine-Mile Creek and Harrow Creek are expected to be minimal as they are likely to be limited to disturbance for creek crossings for the conveyor system, haul road and rail corridor.

Conversely, it is proposed that a section of Horse Creek and a section of Caval Creek will be diverted as they currently traverse areas that will be incorporated into Horse Pit. There will be some loss of habitat and some exclusion from watering points for Squatter Pigeons because of creek diversion but any impacts are expected to be minor given that there are a large number of watering sites, both natural and artificial, within the local landscape and the species, despite being listed as Vulnerable, is tolerant of human modification and habitat degradation. The diversions should only be temporary disturbance.

There will also be the creation of additional dams during the project, which may provide additional watering points and habitat for a range of species, including Squatter Pigeon and a number of wetland bird species listed as Migratory under the EPBC Act. However, in combination with the proposed creek diversions, this will also require the clearing of remnant vegetation and associated habitat for other species.

Southern ROM

It is not expected that the clearing of vegetation communities due to the Southern ROM will cause a significant impact on their extent or persistence within the local context, and, providing that standard dust suppression methods are utilised, it is not anticipated that operation of the southern ROM will significantly impact upon surrounding vegetation or fauna.

8.2.2.3 Impact Assessment

Table 8.11 and Table 8.12 set out each significant fauna element present in the project site, summarise the impact mechanisms and their potential effects on each element, provide appropriate mitigation measures, and show the assessed residual impact for the construction and operation phases of the Project, respectively. For the purposes of this assessment, significant fauna elements refer to those species, communities or processes that have the potential to constrain the proposed activities (e.g. species and

habitat listed as significant under the provisions of the EPBC Act, NC Act, *Mineral Resource Act 1989* and the VM Act).

Assessment of the nature and scale of predicted impacts are based on known or likely occurrence, fecundity, dispersal abilities, home range, habitat specialisation, resilience to disturbance, and mobility.

The tables in Appendix K further clarify the impact assessment process applied to Table 8.11 and Table 8.12. The terms used in Table 8.11 and Table 8.12 to describe impact types and scales are discussed in Section 8.1.2.2.

Table 8.11 Fauna Construction and Clearing[1] Impact Assessment

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type [2]	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [3]	Residual Impact Assessment
Nationally Significant Fauna (Endangered or Vulnerable) Objective: Minimise long term loss of habitat in project site.	Brigalow Scaly-foot (*Paradelma orientalis*) (species not recorded - reasonable possibility of occurrence in project site)	Vulnerable EPBC Act and NC Act	Pits	Direct – Loss of habitat	Possible	Minor	Fauna spotter/catcher during clearing of remnant woodland. Consideration of vegetation offset areas will take into account habitat for significant fauna species.	Minor
			Infrastructure [4]	Direct – Loss of habitat	Possible	Minor		Minor
	Yakka Skink (*Egernia rugosa)* (species not recorded - low possibility of occurrence in project site)		Pits	Direct – Loss of habitat	Very Unlikely	Negligible – marginal habitat	Fauna spotter/catcher during clearing of remnant woodland. Retention of log piles where practical.	Negligible
			Infrastructure [4]	Direct – Loss of habitat	Unlikely	Minor – marginal habitat		Negligible
	Ornamental Snake (*Denisonia maculata)* (species present)		Pits	Direct – Loss of habitat	Unlikely	Minor – marginal habitat	Fauna spotter/catcher during clearing of remnant woodland.	Negligible
			Infrastructure [4]	Direct – Loss of habitat	Possible	Negligible – marginal habitat		
	Australian Painted Snipe (*Rostratula australis*) (species not recorded, but predicted to occur occasionally)		Pits	None – No habitat within area of disturbance	Not applicable	Not applicable	None provided – no loss of important foraging habitat and no loss of potential breeding habitat.	None
			Infrastructure [4]	None – No habitat within area of disturbance	Not applicable	Not applicable		
	Squatter Pigeon		Pits	Direct – Loss of	Certain	Minor	Consideration of vegetation	Minor

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type [2]	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [3]	Residual Impact Assessment
	(southern subspecies) (*Geophaps scripta scripta)* (species present)			breeding habitat			offset areas will take into account habitat for significant fauna species.	
			Infrastructure [4]	Direct – Loss of breeding habitat	Certain	Minor	Consideration of vegetation offset areas will take into account habitat for significant fauna species.	Minor
	Greater Long-eared Bat (*Nyctophilus timoriensis*) (species not recorded – low possibility of occurrence in project site)		Pits	Direct – Loss of foraging and roosting habitat	Unlikely	Minor	Retention of hollow-bearing trees where practical.	Negligible
			Infrastructure [4]	Direct – Loss of foraging and roosting habitat	Unlikely	Negligible		Negligible
State Significant Fauna Objective: Minimise long term loss of habitat in project site.	Black-necked Stork *Ephippiorhynchus asiaticus* (species not recorded, but predicted to occur occasionally)	Rare NC Act	Pits	Direct – Loss of foraging habitat: farm dams and pasture (when inundated)	Certain	Negligible – marginal habitat	None provided – no loss of important foraging habitat and no loss of potential breeding habitat.	Negligible
			Infrastructure [4]	None – No suitable habitat within area of disturbance	Not applicable	Not applicable		
	Short-beaked Echidna (*Tachyglossus aculeatus)* (species present)	Special Least Concern (Culturally Significant)	Pits	Direct – 1. Loss of habitat, 2. Predation by feral predators when fleeing disturbance, 3. Mortality from vehicle strike	1. Certain 2. Possible 3. Possible	Moderate	Fauna spotter/catcher during clearing of remnant woodland. Strategies for managing pest	Minor

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type [2]	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [3]	Residual Impact Assessment
		NC Act	Infrastructure [4]	Direct – 1. Loss of habitat. 2. Predation by feral predators when fleeing disturbance	1. Certain 2. Possible	Minor	species will be maintained in the EM Plan. Appropriate speed limits for construction vehicles. Awarenss of wildlife matters will be incorporated in the site induction.	Negligible
	Koala (*Phascolarctos cinereus*) (species present)		Pits	Direct – 1. Loss of habitat, 2. Predation by feral predators when fleeing disturbance, 3. Mortality from vehicle strike	1. Certain 2. Possible 3. Possible	Minor	Fauna spotter/catcher during clearing of remnant woodland. Strategies for managing pest species will be maintained in the EM Plan. Appropriate speed limits for construction vehicles. Awarenss of wildlife matters will be incorporated in the site induction.	Minor
			Infrastructure [4]	Direct – 1. Loss of habitat, 2. Predation by feral predators when fleeing disturbance, 3. Mortality from vehicle strike	1. Certain 2. Possible 3. Possible	Minor		Negligible
	Troughton's Sheathtail-bat (*Taphozous troughtoni)* (species present)	Endangered NC Act	Pits	Direct – Loss of foraging habitat	Possible	Not appropriate – there is uncertainty concerning the validity of this species	None provided.	Not applicable

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type [2]	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [3]	Residual Impact Assessment
						and of the reliability of Anabat as a means of identification (see Section 4.3.4).		
			Infrastructure [4]	Direct – Loss of foraging habitat	Possible	Not appropriate		
	Little Pied Bat *Chalinolobus picatus* (species present)	Rare NC Act	Pits	Direct - Loss of foraging habitat and potential roosting habitat	Certain	Moderate	Consideration of vegetation offset areas will take into account habitat for significant fauna species.. Retention of hollow-bearing trees where practical.	Minor
			Infrastructure [4]	Direct – Loss of foraging habitat and potential roosting habitat	Certain	Minor		
Nationally Significant Fauna (Migratory) Objective: Minimise long term loss of habitat in project site.	Australian Cotton Pygmy-goose *(Nettapus coromandelianus albipennis)* Also listed as Rare under the NC Act (species present)	Migratory EPBC Act	Pits	None – No suitable habitat within area of disturbance	Not applicable	Not applicable	None provided – no loss of important foraging habitat and no loss of potential breeding habitat.	None
			Infrastructure [4]	None – No suitable habitat within area of disturbance	Not applicable	Not applicable		
	Great Egret (*Ardea alba)* (species present)		Pits	Direct – Loss of foraging habitat: farm dams and pasture (when inundated)	Certain	Minor	None provided – no loss of important habitat and no constraints to movement across the landscape.	Minor

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type [2]	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [3]	Residual Impact Assessment
			Infrastructure [4]	None – No suitable habitat within area of disturbance	Not applicable	Not applicable		
	Cattle Egret (*Bubulcus ibis)* (species not recorded, but predicted to occur sporadically)		Pits	Direct – Loss of foraging habitat: pasture and native grasslands	Certain	Negligible	None provided – no loss of important habitat and no constraints to movement across the landscape.	Negligible
			Infrastructure [4]	None – No suitable habitat within area of disturbance	Not applicable	Not applicable		
	White-bellied Sea-eagle (*Haliaeetus leucogaster*) (species present)		Pits	None – No habitat within area of disturbance	Not applicable	Not applicable	None provided – no loss of habitat and no constraints to movement across the landscape.	Negligible
			Infrastructure [4]	None – No habitat within area of disturbance	Not applicable	Not applicable		
	Painted Snipe (*Rostratula benghalensis s. lat).* and Latham's Snipe (*Gallinago hardwickii*) (species not recorded, but predicted to occur occasionally)		Pits	None – No habitat within area of disturbance	Not applicable	Not applicable	None provided – no loss of habitat and no constraints to movement across the landscape.	None
			Infrastructure [4]	None – No habitat within area of disturbance	Not applicable	Not applicable		
	Little Curlew (*Numenius minutus)* (non-breeding wader,		Pits	Direct – Loss of foraging habitat: pasture and native grasslands	Unlikely	Negligible	None provided – no loss of important habitat and no constraints to movement across the landscape.	Negligible

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type [2]	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [3]	Residual Impact Assessment
	not recorded but may occur sporadically)		Infrastructure [4]	None – No suitable habitat within area of disturbance	Not applicable	Not applicable		
	Marsh Sandpiper (*Tringa stagnatilis)*, Common Sandpiper *(Actitis hypoleucos*), Red-necked Stint (*Calidris ruficollis)* and Sharp-tailed Sandpiper *(Calidris acuminata)* (non-breeding waders, species present)		Pits	Direct – Loss of foraging habitat: farm dams	Possible	Minor – marginal habitat	None provided – no loss of important habitat and no constraints to movement across the landscape.	Minor
			Infrastructure [4]	None – No habitat within area of disturbance	Not applicable	Not applicable		
	Caspian Tern (*Sterna caspia)* (species present)		Pits	None – No habitat within area of disturbance	Not applicable	Not applicable	None provided – no loss of habitat and no constraints to movement across the landscape.	None
			Infrastructure [4]	None – No habitat within area of disturbance	Not applicable	Not applicable		
	White-throated Needletail (*Hirundapus caudacutus)* and Fork-tailed Swift (*Apus pacificus*)		Pits	Indirect – Disturbance of flying invertebrates (prey)	Probable	Negligible (possibly positive – provision of foraging opportunity)	None provided – no loss of habitat and no constraints to movement across the landscape.	Negligible

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type [2]	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [3]	Residual Impact Assessment
	(non-breeding aerial species – species present)		Infrastructure [4]	Indirect – Disturbance of flying invertebrates (prey)	Probable	Negligible (possibly positive – provision of foraging opportunity)		
	Rainbow Bee-eater (*Merops ornatus*) (species present)		Pits	Direct – Loss of foraging habitat, loss of potential breeding habitat Indirect impact – disturbance of flying invertebrates (prey)	Certain	Negligible	None provided – no loss of important habitat and no constraints to movement across the landscape.	Negligible
			Infrastructure [4]	Direct – Loss of foraging habitat, Indirect – Disturbance of flying invertebrates (prey)	Certain	Negligible		
	Rufous Fantail (*Rhipidura rufifrons)* (breeding passerine – species present)		Pits	Direct – Loss of passage habitat	Certain	Negligible	None provided – no loss of important habitat and no constraints to movement across the landscape.	Negligible
			Infrastructure [4]	None – no habitat within area of disturbance	Not applicable	Negligible		
	Black-faced Monarch		Pits	Direct – Loss of passage habitat	Certain	Negligible	None provided – no loss of important habitat and no	Negligible

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type [2]	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [3]	Residual Impact Assessment
	(*Monarcha melanopsis)* (breeding passerine – not recorded but predicted to occur occasionally)		Infrastructure [4]	None – No habitat within area of disturbance	Not applicable	Not applicable	constraints to movement across the landscape.	
	Satin Flycatcher (*Myiagra cyanoleuca)* (non-breeding passerine – species present)		Pits	Direct – Loss of passage habitat	Certain	Negligible	None provided – no loss of important habitat and no constraints to movement across the landscape.	Negligible
			Infrastructure [4]	None – No habitat within area of disturbance	Not applicable	Not applicable		
	Australian Reed-Warbler (*Acrocephalus australis)* (breeding passerine – species present)		Pits	None – No habitat within area of disturbance	Not applicable	Not applicable	None provided – no loss of habitat and no constraints to movement across the landscape.	None
			Infrastructure [4]	None – No habitat within area of disturbance	Not applicable	Not applicable		
Feral Species of State Significance Objective: Manage existing pests and prevent new introductions.	(feral) Cat (*Felis catus),* Dingo/dog (*Canis lupus dingo/familiaris)* (feral predators – species present)	Declared Class 2 Pest under the LP Act	Areas disturbed for Project infrastructure [4]	Direct – Predation on native fauna	Probable	Moderate	Strategies for managing pest species will be maintained in the EM Plan.	Minor
	Red Fox (*Vulpes vulpes)* (feral predator – not recorded but predicted to occur sporadically)		Areas disturbed for Project infrastructure [4]	Direct – Predation on native fauna	Possible	Moderate	Strategies for managing pest species will be maintained in the EM Plan.	Minor

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type [2]	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [3]	Residual Impact Assessment
	Rabbit (*Oryctolagus cuniculus*) (species present)		Areas disturbed for Project infrastructure [4]	Indirect – Destruction of native vegetation	Possible	Minor	Strategies for managing pest species will be maintained in the EM Plan.	Negligible
	(feral) Pig (*Sus scrofa*) (species present)		Areas disturbed for Project infrastructure [4]	Direct – Predation on native fauna. Indirect – 1. Destruction of native vegetation, 2. Disturbance of waterbodies	Probable	Moderate	Strategies for managing pest species will be maintained in the EM Plan.	Minor
	(feral) Goat (*Capra hircus)* (species present)		Areas disturbed for Project infrastructure [4]	Indirect – Destruction of native vegetation	Unlikely	Minor	Strategies for managing pest species will be maintained in the EM Plan.	Negligible
Other Feral Species Objective: Manage existing pests and prevent new	Cane Toad (*Bufo marinus*) (species present)	Non-native animal	Areas disturbed for Project infrastructure [4]	Direct – 1. Predation of native fauna, 2. Competition with native fauna around waterbody edges	Possible	Minor	Strategies for managing pest species will be maintained in the EM Plan.	Minor
	House Sparrow (*Passer domesticus)* (species present)		Areas disturbed for Project infrastructure [4]	None	Not applicable	Not applicable	Strategies for managing pest species will be maintained in the EM Plan.	None

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type [2]	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [3]	Residual Impact Assessment
introductions.	House Mouse (*Mus musculus)* (species present)		Areas disturbed for Project infrastructure [4]	Direct – Competition with native fauna	Possible	Minor	Strategies for managing pest species will be maintained in the EM Plan.	Negligible
	Black Rat (*Rattus rattus)* (species present)		Areas disturbed for Project infrastructure [4]	Direct – Competition with native fauna	Possible	Minor	Strategies for managing pest species will be maintained in the EM Plan.	Minor
	Brown Hare (*Lepus capensis*) (species present)		Areas disturbed for Project infrastructure [4]	Direct – Competition with native fauna Indirect – Destruction of native vegetation	Possible	Negligible	Strategies for managing pest species will be maintained in the EM Plan.	Negligible
	(feral) Donkey (*Equus asinus)* (species present)		Areas disturbed for Project infrastructure [4]	Indirect – Destruction of native vegetation	Unlikely	Minor	Strategies for managing pest species will be maintained in the EM Plan.	Negligible

[1] Clearing refers to activities undertaken both during the construction and operational phases.

[2] All impacts listed in the tables should be considered as negative, unless otherwise stated.

[3]. Many of these measures will be prescribed within site management plans for construction and operation (Section 8.2.2.3).

[4]. During the construction phase all infrastructure, other than for the pits, is combined.

Table 8.12 Fauna Operation[1] Impact Assessment

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [2]	Residual Impact Assessment
Nationally Significant Fauna (Endangered or Vulnerable) Objective: Minimise fauna injury and disturbance to natural processes and behaviour.	Brigalow Scaly-foot (*Paradelma orientalis)* (species not recorded - reasonable possibility of occurrence in project site	Vulnerable EPBC Act and NC Act	Pits	Direct – 1. Constraint to local movements, 2. Mortality from vehicle strike	Unlikely	Minor	Appropriate speed limits for vehicles. Awareness of wildlife matters will be incorporated in the site induction.	Negligible
			Coal preparation infrastructure	None	Not applicable	Not applicable		
			Transport infrastructure	None	Not applicable	Not applicable		
	Yakka Skink (*Egernia rugosa)* (species not recorded - low possibility of occurrence in project site)		Pits	Direct – 1. Constraint to local movements, 2. Mortality from vehicle strike	Very Unlikely	Negligible	Appropriate speed limits for vehicles. Awareness of wildlife matters will be incorporated in the site induction.	Negligible
			Coal preparation infrastructure	None	Not applicable	Negligible		
			Transport infrastructure	None	Not applicable	Negligible		
	Ornamental Snake (*Denisonia maculata*) (species present)		Pits	Direct – 1. Constraint to local movements, 2. Mortality from vehicle strike	Very Unlikely	Negligible	Appropriate speed limits for vehicles. Awareness of wildlife matters will be incorporated in the site induction.	Negligible
			Coal preparation infrastructure	None	Not applicable	Not applicable		

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [2]	Residual Impact Assessment
			Transport infrastructure	None	Not applicable	Not applicable		
	Australian Painted Snipe (*Rostratula australis*) (species not recorded, but predicted to occur occasionally)		Pits	Direct – Light pollution (may affect movements at night)	Unlikely	Negligible	None provided.	Negligible
			Coal preparation infrastructure	Direct – Light pollution (may affect movements at night)	Unlikely	Negligible		
			Transport infrastructure	None	Not applicable	Not applicable		
			New Dams	Direct – creation of additional habitat.	Probable	Minor (positive impact)		Minor (positive impact)
	Squatter Pigeon (southern subspecies) (*Geophaps scripta scripta)* (species present)		Pits	Direct – Noise, dust and light pollution (on individuals in adjacent habitats)	Possible	Minor	Standard dust suppression techniques.	Negligible
			Coal preparation infrastructure	Direct – Noise, dust and light pollution (on individuals in adjacent habitats)	Possible	Negligible		
			Transport infrastructure	None	Not applicable	Not applicable		
			New Dams	Direct – creation of additional watering points	Probable	Minor (positive impact)		Minor (positive impact)
	Greater Long-eared Bat (*Nyctophilus timoriensis)*		Pits	Direct – Noise, dust and light pollution (on individuals in adjacent habitats)	Unlikely	Negligible	Standard dust suppression techniques.	Negligible

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [2]	Residual Impact Assessment
	(species not recorded – low possibility of occurrence in project site)		Coal preparation infrastructure	Direct – Noise, dust and light pollution (on individuals in adjacent habitats)	Unlikely	Negligible		
			Transport infrastructure	None	Not applicable	Not applicable		
State Significant Fauna Objective: Minimise fauna injury and disturbance to natural processes and behaviour.	Black-necked Stork (*Ephippiorhynchus asiaticus)* (species not recorded, but predicted to occur occasionally)	Rare NC Act	Pits	None	Not applicable	Not applicable		None
			Coal preparation infrastructure	None	Not applicable	Not applicable		
			Transport infrastructure	None	Not applicable	Not applicable		
			New Dams	Direct – creation of additional habitat.	Probable	Minor (positive impact)		Minor (positive impact)
	Short-beaked Echidna (*Tachyglossus aculeatus*) (species present)	Special Least Concern (Culturally Significant) NC Act	Pits	Direct – 1. Constraint to local movements, 2. Mortality from vehicle strike, 3. Noise, dust and light pollution (on individuals in adjacent habitats)	Probable	Moderate	Liaison with local Wildlife Carer for treatment of injured animals or young rescued from adults killed or injured by vehicles or activities associated with the Project. Appropriate speed limits for vehicles. Awareness of wildlife matters will be incorporated in the site induction. Standard dust suppression	Moderate
			Coal preparation infrastructure	Direct – Noise, dust and light pollution (on individuals in adjacent habitats)	Possible	Minor		
			Transport infrastructure	Direct – 1. Constraint to local movements (if rail corridor fenced),	Possible	Minor		

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [2]	Residual Impact Assessment
				2. Mortality from vehicle strike			techniques.	
	Koala (*Phascolarctos cinereus*) (species present)		Pits	Direct – 1. Constraint to local movements, 2. Mortality from vehicle strike, 3. Noise, dust and light pollution (on individuals in adjacent habitats)	Probable	Minor	Liaison with local Wildlife Carer for treatment of injured animals or young rescued from adults killed or injured by vehicles or activities associated with the Project. Appropriate speed limits for vehicles. Awarenss of wildlife matters will be incorporated in the site induction. Standard dust suppression techniques.	Minor
			Coal preparation infrastructure	Direct – Noise, dust and light pollution (on individuals in adjacent habitats)	Possible	Minor		
			Transport infrastructure	Direct – 1. Constraint to local movements (if rail corridor fenced), 2. mortality from vehicle strike	Possible	Minor		
	Troughton's Sheathtail-bat *(Taphozous troughtoni)* (species present)	Endangered NC Act	Pits	Direct – Noise, dust and light pollution (on individuals in adjacent habitats)	Possible	Not appropriate – there is uncertainty concerning the validity of this species and of the reliability of		Not applicable

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [2]	Residual Impact Assessment
						Anabat as a means of identification.		
			Coal preparation infrastructure	Direct – Noise, dust and light pollution (on individuals in adjacent habitats)	Possible	Not appropriate		
			Transport infrastructure	None	Not applicable	Not appropriate		
	Little Pied Bat *(Chalinolobus picatus*) (species present)	Rare NC Act	Pits	Direct – Noise, dust and light pollution (on individuals in adjacent habitats)	Possible	Minor	Standard dust suppression techniques.	Minor
			Coal preparation infrastructure	Direct – Noise, dust and light pollution (on individuals in adjacent habitats)	Possible	Minor		
			Transport infrastructure	None	Not applicable	Not applicable		
Nationally Significant Fauna (Migratory) Objective: Minimise fauna injury and	Australian Cotton Pygmy-goose (*Nettapus coromandelianus albipennis)* Also listed as Rare under the NC Act (species present)	Migratory EPBC Act	Pits	None	Not applicable	Not applicable		None
			Coal preparation infrastructure	None	Not applicable	Not applicable		
			Transport infrastructure	None	Not applicable	Not applicable		
			New Dams	Direct – creation of additional habitat.	Probable	Minor (positive impact)		Minor (positive impact)

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [2]	Residual Impact Assessment
disturbance to natural processes and behaviour.	Great Egret (*Ardea alba)* (species present)		Pits	Direct – Noise and dust pollution (on individuals in adjacent habitats)	Possible	Minor	Standard dust suppression techniques.	Negligible
			Coal preparation infrastructure	Direct – Noise and dust pollution (on individuals in adjacent habitats)	Possible	Negligible		
			Transport infrastructure	None	Not applicable	Not applicable		
			New Dams	Direct – creation of additional habitat.	Probable	Minor (positive impact)		Minor (positive impact)
	Cattle Egret (*Bubulcus ibis*) (species not recorded, but predicted to occur sporadically)		Pits	Direct – Noise and dust pollution (on individuals in adjacent habitats)	Unlikely	Negligible	Standard dust suppression techniques.	Negligible
			Coal preparation infrastructure	None	Not applicable	Not applicable		
			Transport infrastructure	None	Not applicable	Not applicable		
			New Dams	Direct – creation of additional habitat.	Probable	Minor (positive impact)		Minor (positive impact)
	White-bellied Sea-eagle *(Haliaeetus leucogaster*) (species present)		Pits	Direct – Noise and dust pollution (on individuals in adjacent habitats)	Possible	Minor	Standard dust suppression techniques.	Negligible
			Coal preparation infrastructure	Direct – Noise and dust pollution (on individuals in adjacent habitats)	Possible	Negligible		
			Transport infrastructure	None	Not applicable	Not applicable		

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [2]	Residual Impact Assessment
	Painted Snipe *(Rostratula benghalensis s. lat.*) and Latham's Snipe (*Gallinago hardwickii*) (species not recorded, but predicted to occur occasionally)		Pits	Direct – Light pollution (may affect movements at night)	Unlikely	Negligible	Standard dust suppression techniques.	Negligible
			Coal preparation infrastructure	Direct – Light pollution (may affect movements at night)	Unlikely	Negligible		
			Transport infrastructure	None	Not applicable	Not applicable		
			New Dams	Direct – creation of additional habitat.	Probable	Minor (positive impact)		Minor (positive impact)
	Little Curlew *Numenius minutus* (non-breeding wader, not recorded but may occur sporadically)		Pits	Direct impact – noise and dust pollution (on individuals in adjacent habitats).	Unlikely	Negligible	Standard dust suppression techniques.	Negligible
			Coal preparation infrastructure	None	Not applicable	Not applicable		
			Transport infrastructure	None	Not applicable	Not applicable		
			New Dams	Direct – creation of additional habitat.	Probable	Minor (positive impact)		Minor (positive impact)
	Marsh Sandpiper *Tringa stagnatilis*, Common		Pits	Direct – Noise and dust pollution (on individuals in adjacent habitats)	Possible	Negligible	Standard dust suppression techniques.	Negligible
			Coal preparation infrastructure	None	Not applicable	Not applicable		

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [2]	Residual Impact Assessment
	Sandpiper *Actitis hypoleucos*, Red-necked Stint *Calidris ruficollis*, and Sharp-tailed Sandpiper *Calidris acuminata* (non-breeding waders, species present)		Transport infrastructure	None	Not applicable	Not applicable		
			New Dams	Direct – creation of additional habitat.	Probable	Minor (positive impact)		Minor (positive impact)
	Caspian Tern *Sterna caspia* (species present)		Pits	None	Not applicable	Not applicable	None provided	None
			Coal preparation infrastructure	None	Not applicable	Not applicable		
			Transport infrastructure	None	Not applicable	Not applicable		
			New Dams	Direct – creation of additional habitat.	Probable	Minor (positive impact)		Minor (positive impact)

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [2]	Residual Impact Assessment
	White-throated Needletail *Hirundapus caudacutus* and Fork-tailed Swift *Apus pacificus* (non-breeding aerial species – species present)		Pits	Direct – Noise and dust pollution (on individuals foraging above and over adjacent habitats)	Probable	Negligible	Standard dust suppression techniques.	Negligible
			Coal preparation infrastructure	Direct – Noise and dust pollution (on individuals foraging above and over adjacent habitats)	Probable	Negligible		
			Transport infrastructure	None	Not applicable	Not applicable		
	Rainbow Bee-eater *Merops ornatus* (species present)		Pits	Direct – Noise and dust pollution (on individuals in adjacent habitats)	Probable	Minor	Standard dust suppression techniques.	Negligible
			Coal preparation infrastructure	Direct – Noise and dust pollution (on individuals in adjacent habitats)	Possible	Negligible		
			Transport infrastructure	None	Not applicable	Not applicable		
	Rufous Fantail *Rhipidura rufifrons* (breeding passerine – species present)		Pits	Direct – Noise and dust pollution (on individuals in nearby riparian habitats)	Possible	Minor	Standard dust suppression techniques.	Minor
			Coal preparation infrastructure	Direct – Noise and dust pollution (on individuals in nearby riparian habitats)	Possible	Minor		
			Transport infrastructure	None	Not applicable	Not applicable		

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [2]	Residual Impact Assessment
	Black-faced Monarch *Monarcha melanopsis* (breeding passerine – not recorded but predicted to occur occasionally)		Pits	Direct – Noise and dust pollution (on individuals in nearby riparian habitats)	Unlikely	Negligible	Standard dust suppression techniques.	Negligible
			Coal preparation infrastructure	Direct – Noise and dust pollution (on individuals in nearby riparian habitats)	Unlikely	Negligible		
			Transport infrastructure	None	Not applicable	Not applicable		
	Satin Flycatcher *Myiagra cyanoleuca* (non-breeding passerine – species present)		Pits	Direct – Noise and dust pollution (on individuals in nearby riparian habitats)	Unlikely	Negligible	Standard dust suppression techniques.	Negligible
			Coal preparation infrastructure	Direct – Noise and dust pollution (on individuals in nearby riparian habitats)	Unlikely	Negligible		
			Transport infrastructure	None	Not applicable	Not applicable		
	Australian Reed-Warbler *Acrocephalus australis* (breeding passerine –		Pits	Direct impact – noise and dust pollution (on individuals in adjacent habitats).	Unlikely	Negligible	Standard dust suppression techniques.	Negligible
			Coal preparation infrastructure	None	Not applicable	Not applicable		
			Transport infrastructure	None	Not applicable	Not applicable		

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [2]	Residual Impact Assessment
	species present)		New Dams	Direct – creation of additional habitat.	Probable	Minor (positive impact)		Minor (positive impact)
Feral Species of State Significance Objective: Manage existing pests and prevent new introductions.	(feral) Cat *Felis catus,* Dingo/dog *Canis lupus dingo/familiaris* (feral predators – species present)	Declared Class 2 Pest under the LP Act	Roads and tracks	Direct – Increased access to surrounding vegetation and resultant predation on native fauna	Probable	Moderate	Strategies for managing pest species will be maintained in the EM Plan.	Minor
	Red Fox *Vulpes vulpes* (feral predator – not recorded but predicted to occur sporadically)		Roads and tracks	Direct – Increased access to surrounding vegetation and resultant predation on native fauna	Possible	Minor	Strategies for managing pest species will be maintained in the EM Plan.	Minor
	Rabbit *Oryctolagus cuniculus* (species present)		Areas disturbed for Project infrastructure	None	Not applicable	Not applicable	Strategies for managing pest species will be maintained in the EM Plan.	None

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [2]	Residual Impact Assessment
	(feral) Pig *Sus scrofa* (species present)		Areas disturbed for Project infrastructure	None	Not applicable	Not applicable	Strategies for managing pest species will be maintained in the EM Plan.	None
	(feral) Goat *Capra hircus* (species present)		Areas disturbed for Project infrastructure	None	Not applicable	Not applicable	Strategies for managing pest species will be maintained in the EM Plan.	None
Other Feral Species Objective: Manage existing pests and prevent new introductions.	Cane Toad *Bufo marinus* (species present)	Non-native animal	Areas disturbed for Project infrastructure	None	Not applicable	Not applicable	Strategies for managing pest species will be maintained in the EM Plan.	None
	House Sparrow *Passer domesticus* (species present)		Areas disturbed for Project infrastructure	None	Not applicable	Not applicable	Strategies for managing pest species will be maintained in the EM Plan.	None
	House Mouse *Mus musculus* (species present)		Areas disturbed for Project infrastructure	Direct – Source area for dispersal into adjacent native vegetation and resultant competition with native fauna	Possible	Minor	Strategies for managing pest species will be maintained in the EM Plan.	Negligible
	Black Rat		Areas disturbed for	Direct – Source area for dispersal into adjacent	Possible	Minor	Strategies for managing pest species will be maintained in	Negligible

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [2]	Residual Impact Assessment
	Rattus rattus (species present)		Project infrastructure	native vegetation and resultant competition with native fauna			the EM Plan.	
	Brown Hare *Lepus capensis* (species present)		Areas disturbed for Project infrastructure	None	Not applicable	Not applicable	Strategies for managing pest species will be maintained in the EM Plan.	None
	(feral) Donkey *Equus asinus* (species present)		Areas disturbed for Project infrastructure	None	Not applicable	Not applicable	Strategies for managing pest species will be maintained in the EM Plan.	None
Nationally Significant Fauna (Endangered or Vulnerable) Objective: Minimise fauna injury and disturbance to natural processes	Brigalow Scaly-foot (*Paradelma orientalis)* (species not recorded - reasonable possibility of occurrence in project site	Vulnerable EPBC Act and NC Act	Pits	Direct – 1. Constraint to local movements, 2. Mortality from vehicle strike	Unlikely	Minor	Appropriate speed limits for vehicles. Awarenss of wildlife matters will be incorporated in the site induction.	Negligible
			Coal preparation infrastructure	None	Not applicable	Not applicable		
			Transport infrastructure	None	Not applicable	Not applicable		
	Yakka Skink (*Egernia rugosa)* (species not recorded - low possibility of		Pits	Direct – 1. Constraint to local movements, 2. Mortality from vehicle strike	Very Unlikely	Negligible	Appropriate speed limits for vehicles. Awarenss of wildlife matters will be incorporated in the	Negligible

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [2]	Residual Impact Assessment
and behaviour.	occurrence in project site)		Coal preparation infrastructure	None	Not applicable	Negligible	site induction.	
			Transport infrastructure	None	Not applicable	Negligible		
	Ornamental Snake (*Denisonia maculata*) (species present)		Pits	Direct – 1. Constraint to local movements, 2. Mortality from vehicle strike	Very Unlikely	Negligible	Appropriate speed limits for vehicles. Awarenss of wildlife matters will be incorporated in the site induction.	Negligible
			Coal preparation infrastructure	None	Not applicable	Not applicable		
			Transport infrastructure	None	Not applicable	Not applicable		
	Australian Painted Snipe (*Rostratula australis*) (species not recorded, but predicted to occur occasionally)		Pits	Direct – Light pollution (may affect movements at night)	Unlikely	Negligible	None provided.	Negligible
			Coal preparation infrastructure	Direct – Light pollution (may affect movements at night)	Unlikely	Negligible		
			Transport infrastructure	None	Not applicable	Not applicable		
			New Dams	Direct – creation of additional habitat.	Probable	Minor (positive impact)		Minor (positive impact)
	Squatter Pigeon (southern subspecies) (*Geophaps scripta*		Pits	Direct – Noise, dust and light pollution (on individuals in adjacent habitats)	Possible	Minor	Standard dust suppression techniques.	Negligible

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [2]	Residual Impact Assessment
	scripta) (species present)		Coal preparation infrastructure	Direct – Noise, dust and light pollution (on individuals in adjacent habitats)	Possible	Negligible		
			Transport infrastructure	None	Not applicable	Not applicable		
			New Dams	Direct – creation of additional watering points	Probable	Minor (positive impact)		Minor (positive impact)
	Greater Long-eared Bat (*Nyctophilus timoriensis)* (species not recorded – low possibility of occurrence in project site)		Pits	Direct – Noise, dust and light pollution (on individuals in adjacent habitats)	Unlikely	Negligible	Standard dust suppression techniques.	Negligible
			Coal preparation infrastructure	Direct – Noise, dust and light pollution (on individuals in adjacent habitats)	Unlikely	Negligible		
			Transport infrastructure	None	Not applicable	Not applicable		
State Significant Fauna Objective: Minimise fauna injury and disturbance to natural processes and behaviour.	Black-necked Stork (*Ephippiorhynchus asiaticus)* (species not recorded, but predicted to occur occasionally)	Rare NC Act	Pits	None	Not applicable	Not applicable		None
			Coal preparation infrastructure	None	Not applicable	Not applicable		
			Transport infrastructure	None	Not applicable	Not applicable		
			New Dams	Direct – creation of additional habitat.	Probable	Minor (positive impact)		Minor (positive impact)
	Short-beaked Echidna (*Tachyglossus*	Special Least Concern (Culturally	Pits	Direct – 1. Constraint to local movements, 2. Mortality from vehicle	Probable	Moderate	Liaison with local Wildlife Carer for treatment of injured animals or young rescued	Moderate

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [2]	Residual Impact Assessment
	aculeatus) (species present)	Significant) NC Act		strike, 3. Noise, dust and light pollution (on individuals in adjacent habitats)			from adults killed or injured by vehicles or activities associated with the Project. Appropriate speed limits for vehicles. Awarenss of wildlife matters will be incorporated in the site induction. Standard dust suppression techniques.	
			Coal preparation infrastructure	Direct – Noise, dust and light pollution (on individuals in adjacent habitats)	Possible	Minor		
			Transport infrastructure	Direct – 1. Constraint to local movements (if rail corridor fenced), 2. Mortality from vehicle strike	Possible	Minor		
	Koala (*Phascolarctos cinereus*) (species present)		Pits	Direct – 1. Constraint to local movements, 2. Mortality from vehicle strike, 3. Noise, dust and light pollution (on individuals in adjacent habitats)	Probable	Minor	Liaison with local Wildlife Carer for treatment of injured animals or young rescued from adults killed or injured by vehicles or activities associated with the Project. Appropriate speed limits for vehicles. Awarenss of wildlife matters will be incorporated in the site induction. Standard dust suppression techniques.	Minor
			Coal preparation infrastructure	Direct – Noise, dust and light pollution (on individuals in adjacent habitats)	Possible	Minor		
			Transport infrastructure	Direct – 1. Constraint to local movements (if rail corridor fenced),	Possible	Minor		

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [2]	Residual Impact Assessment
				2. mortality from vehicle strike				
	Troughton's Sheathtail-bat *(Taphozous troughtoni)* (species present)	Endangered NC Act	Pits	Direct – Noise, dust and light pollution (on individuals in adjacent habitats)	Possible	Not appropriate – there is uncertainty concerning the validity of this species and of the reliability of Anabat as a means of identification.		Not applicable
			Coal preparation infrastructure	Direct – Noise, dust and light pollution (on individuals in adjacent habitats)	Possible	Not appropriate		
			Transport infrastructure	None	Not applicable	Not appropriate		
	Little Pied Bat *(Chalinolobus picatus*) (species present)	Rare NC Act	Pits	Direct – Noise, dust and light pollution (on individuals in adjacent habitats)	Possible	Minor	Standard dust suppression techniques.	Minor
			Coal preparation infrastructure	Direct – Noise, dust and light pollution (on individuals in adjacent habitats)	Possible	Minor		
			Transport infrastructure	None	Not applicable	Not applicable		

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [2]	Residual Impact Assessment
Nationally Significant Fauna (Migratory) Objective: Minimise fauna injury and disturbance to natural processes and behaviour.	Australian Cotton Pygmy-goose (*Nettapus coromandelianus albipennis)* Also listed as Rare under the NC Act (species present)	Migratory EPBC Act	Pits	None	Not applicable	Not applicable		None
			Coal preparation infrastructure	None	Not applicable	Not applicable		
			Transport infrastructure	None	Not applicable	Not applicable		
			New Dams	Direct – creation of additional habitat.	Probable	Minor (positive impact)		Minor (positive impact)
	Great Egret (*Ardea alba)* (species present)		Pits	Direct – Noise and dust pollution (on individuals in adjacent habitats)	Possible	Minor	Standard dust suppression techniques.	Negligible
			Coal preparation infrastructure	Direct – Noise and dust pollution (on individuals in adjacent habitats)	Possible	Negligible		
			Transport infrastructure	None	Not applicable	Not applicable		
			New Dams	Direct – creation of additional habitat.	Probable	Minor (positive impact)		Minor (positive impact)
	Cattle Egret (*Bubulcus ibis*) (species not recorded, but predicted to occur sporadically)		Pits	Direct – Noise and dust pollution (on individuals in adjacent habitats)	Unlikely	Negligible	Standard dust suppression techniques.	Negligible
			Coal preparation infrastructure	None	Not applicable	Not applicable		
			Transport infrastructure	None	Not applicable	Not applicable		

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [2]	Residual Impact Assessment
			New Dams	Direct – creation of additional habitat.	Probable	Minor (positive impact)		Minor (positive impact)
	White-bellied Sea-eagle *(Haliaeetus leucogaster*) (species present)		Pits	Direct – Noise and dust pollution (on individuals in adjacent habitats)	Possible	Minor	Standard dust suppression techniques.	Negligible
			Coal preparation infrastructure	Direct – Noise and dust pollution (on individuals in adjacent habitats)	Possible	Negligible		
			Transport infrastructure	None	Not applicable	Not applicable		
	Painted Snipe *(Rostratula benghalensis s. lat.*) and Latham's Snipe (*Gallinago hardwickii*) (species not recorded, but predicted to occur occasionally)		Pits	Direct – Light pollution (may affect movements at night)	Unlikely	Negligible	Standard dust suppression techniques.	Negligible
			Coal preparation infrastructure	Direct – Light pollution (may affect movements at night)	Unlikely	Negligible		
			Transport infrastructure	None	Not applicable	Not applicable		
			New Dams	Direct – creation of additional habitat.	Probable	Minor (positive impact)		Minor (positive impact)
	Little Curlew *Numenius minutus* (non-breeding wader, not recorded but may occur sporadically)		Pits	Direct impact – noise and dust pollution (on individuals in adjacent habitats).	Unlikely	Negligible	Standard dust suppression techniques.	Negligible
			Coal preparation infrastructure	None	Not applicable	Not applicable		
			Transport infrastructure	None	Not applicable	Not applicable		

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [2]	Residual Impact Assessment
			New Dams	Direct – creation of additional habitat.	Probable	Minor (positive impact)		Minor (positive impact)
	Marsh Sandpiper *Tringa stagnatilis*, Common Sandpiper *Actitis hypoleucos*, Red-necked Stint *Calidris ruficollis*, and Sharp-tailed Sandpiper *Calidris acuminata* (non-breeding waders, species present)		Pits	Direct – Noise and dust pollution (on individuals in adjacent habitats)	Possible	Negligible	Standard dust suppression techniques.	Negligible
			Coal preparation infrastructure	None	Not applicable	Not applicable		
			Transport infrastructure	None	Not applicable	Not applicable		
			New Dams	Direct – creation of additional habitat.	Probable	Minor (positive impact)		Minor (positive impact)
	Caspian Tern		Pits	None	Not applicable	Not applicable	None provided	None

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [2]	Residual Impact Assessment
			Coal preparation infrastructure	None	Not applicable	Not applicable		
			Transport infrastructure	None	Not applicable	Not applicable		
			New Dams	Direct – creation of additional habitat.	Probable	Minor (positive impact)		Minor (positive impact)
	White-throated Needletail *Hirundapus caudacutus* and Fork-tailed Swift *Apus pacificus* (non-breeding aerial species – species present)		Pits	Direct – Noise and dust pollution (on individuals foraging above and over adjacent habitats)	Probable	Negligible	Standard dust suppression techniques.	Negligible
			Coal preparation infrastructure	Direct – Noise and dust pollution (on individuals foraging above and over adjacent habitats)	Probable	Negligible		
			Transport infrastructure	None	Not applicable	Not applicable		
	Rainbow Bee-eater *Merops ornatus* (species present)		Pits	Direct – Noise and dust pollution (on individuals in adjacent habitats)	Probable	Minor	Standard dust suppression techniques.	Negligible
			Coal preparation infrastructure	Direct – Noise and dust pollution (on individuals in adjacent habitats)	Possible	Negligible		
			Transport infrastructure	None	Not applicable	Not applicable		

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [2]	Residual Impact Assessment
	Rufous Fantail *Rhipidura rufifrons* (breeding passerine – species present)		Pits	Direct – Noise and dust pollution (on individuals in nearby riparian habitats)	Possible	Minor	Standard dust suppression techniques.	Minor
			Coal preparation infrastructure	Direct – Noise and dust pollution (on individuals in nearby riparian habitats)	Possible	Minor		
			Transport infrastructure	None	Not applicable	Not applicable		
	Black-faced Monarch *Monarcha melanopsis* (breeding passerine – not recorded but predicted to occur occasionally)		Pits	Direct – Noise and dust pollution (on individuals in nearby riparian habitats)	Unlikely	Negligible	Standard dust suppression techniques.	Negligible
			Coal preparation infrastructure	Direct – Noise and dust pollution (on individuals in nearby riparian habitats)	Unlikely	Negligible		
			Transport infrastructure	None	Not applicable	Not applicable		
	Satin Flycatcher *Myiagra cyanoleuca* (non-breeding passerine –		Pits	Direct – Noise and dust pollution (on individuals in nearby riparian habitats)	Unlikely	Negligible	Standard dust suppression techniques.	Negligible
			Coal preparation infrastructure	Direct – Noise and dust pollution (on individuals in nearby riparian habitats)	Unlikely	Negligible		

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [2]	Residual Impact Assessment
	species present)		Transport infrastructure	None	Not applicable	Not applicable		
	Australian Reed-Warbler *Acrocephalus australis* (breeding passerine – species present)		Pits	Direct impact – noise and dust pollution (on individuals in adjacent habitats).	Unlikely	Negligible	Standard dust suppression techniques.	Negligible
			Coal preparation infrastructure	None	Not applicable	Not applicable		
			Transport infrastructure	None	Not applicable	Not applicable		
			New Dams	Direct – creation of additional habitat.	Probable	Minor (positive impact)		Minor (positive impact)
Feral Species of State Significance Objective: Manage existing pests and prevent new introductions.	(feral) Cat *Felis catus,* Dingo/dog *Canis lupus dingo/familiaris* (feral predators – species present)	Declared Class 2 Pest under the LP Act	Roads and tracks	Direct – Increased access to surrounding vegetation and resultant predation on native fauna	Probable	Moderate	Strategies for managing pest species will be maintained in the EM Plan.	Minor
	Red Fox *Vulpes vulpes* (feral predator –		Roads and tracks	Direct – Increased access to surrounding vegetation and resultant predation on native fauna	Possible	Minor	Strategies for managing pest species will be maintained in the EM Plan.	Minor

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [2]	Residual Impact Assessment
	not recorded but predicted to occur sporadically)							
	Rabbit *Oryctolagus cuniculus* (species present)		Areas disturbed for Project infrastructure	None	Not applicable	Not applicable	Strategies for managing pest species will be maintained in the EM Plan.	None
	(feral) Pig *Sus scrofa* (species present)		Areas disturbed for Project infrastructure	None	Not applicable	Not applicable	Strategies for managing pest species will be maintained in the EM Plan.	None
	(feral) Goat *Capra hircus* (species present)		Areas disturbed for Project infrastructure	None	Not applicable	Not applicable	Strategies for managing pest species will be maintained in the EM Plan.	None
Other Feral Species Objective: Manage existing pests and prevent new introductions.	Cane Toad *Bufo marinus* (species present)	Non-native animal	Areas disturbed for Project infrastructure	None	Not applicable	Not applicable	Strategies for managing pest species will be maintained in the EM Plan.	None
	House Sparrow *Passer domesticus* (species present)		Areas disturbed for Project infrastructure	None	Not applicable	Not applicable	Strategies for managing pest species will be maintained in the EM Plan.	None

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [2]	Residual Impact Assessment
	House Mouse *Mus musculus* (species present)		Areas disturbed for Project infrastructure	Direct – Source area for dispersal into adjacent native vegetation and resultant competition with native fauna	Possible	Minor	Strategies for managing pest species will be maintained in the EM Plan.	Negligible
	Black Rat *Rattus rattus* (species present)		Areas disturbed for Project infrastructure	Direct – Source area for dispersal into adjacent native vegetation and resultant competition with native fauna	Possible	Minor	Strategies for managing pest species will be maintained in the EM Plan.	Negligible
	Brown Hare *Lepus capensis* (species present)		Areas disturbed for Project infrastructure	None	Not applicable	Not applicable	Strategies for managing pest species will be maintained in the EM Plan.	None
	(feral) Donkey *Equus asinus* (species present)		Areas disturbed for Project infrastructure	None	Not applicable	Not applicable	Strategies for managing pest species will be maintained in the EM Plan.	None

[1] Clearing activities undertaken during the operational phases are assessed in Table 8.11.

[2] Many of these measures will be prescribed within site management plans for construction and operation (Section 8.2.2.3).

8.2.2.4 Impact Mitigation

General Legislative Obligations

Significant Terrestrial Vertebrate Species and Habitat

Two species listed as Vulnerable under the EPBC Act, Ornamental Snake *Denisonia maculata* and Squatter Pigeon (southern subspecies) *Geophaps scripta scripta*, have been recorded on the project site and/or the adjacent Peak Downs Mine, while another four, Brigalow Scaly-foot *Paradelma orientalis*, Yakka Skink *Egernia rugosa*, Australian Painted Snipe *Rostratula australis*, and Greater Long-eared Bat (South-eastern) *Nyctophilus timoriensis*, are predicted to occur or it is considered possible that they may occur. These species are considered as part of the assessment of significance of impacts for these and other Matters of National Environmental Significance in Appendix K with key aspects discussed in Section 8.2.2.5.

Fourteen bird species listed as Migratory under the EPBC Act have also been recorded. These species are considered as part of the assessment of significance of impacts for these and other Matters of National Environmental Significance in Appendix K- Section 5.6 with key aspects discussed in Section 8.2.2.5.

Terrestrial Vertebrate Movement Corridors

No corridors are mapped for the project site at the State, Regional or Local levels under the BPA (EPA 2003). No legislative constraints for any proposed activities are anticipated in regards to movement corridors.

Declared Pest Species

There are a number of pest animal species known or considered likely to be present within the project site. By law, landholders are required to control Class 2 pest species.

Mitigation Requirements/Recommendations

Implementation of the following mitigation and compensatory measures is identified in Table 8.11 and Table 8.12 as necessary to reduce identified impacts on fauna to levels that will not cause permanent harm to significant ecosystems or fauna populations:

- As much as possible, only areas absolutely necessary for the construction and the operation of the project will be cleared. Clearance will be controlled by a Permit to Disturb process, and go/no-go areas will be identified on site, and managed through a GIS system.
- Take into account habitat for significant fauna species when considering vegetation offset areas.
- Utilise standard dust suppression techniques and strategically rehabilitate available disturbed areas to minimise the net loss of vegetative cover.
- Develop and implement the site Environmental Management Plan, including appropriate pest animal management measures.

- Fauna spotter/catchers present during clearing operations in areas of high ecological value, such as remnant woodland.
- Interference with watercourses and flows will be in accordance with the *Water Act 2000* (Section 6), inlcuding the development of a specific Revegetation Plan for creek diversions.
- Implement measures to reduce fauna mortality on roads and ensure appropriate treatment of injured/orphaned animals.
- Retention (or provision in surrounding habitat), where practical, of important habitat features such as large hollow-bearing trees (live or dead), nest boxes and log piles.

A contractor's construction environmental management plan will manage potential habitat impacts during the construction phase, while the site environmental management plan will manage habitat impacts during operation and decommissioning.

Key components are provided within relevant EM Plan elements in Section 21.

In terms of maintaining natural fauna movement, focus will be on roads that traverse areas of significant fauna habitat, including the haul road crossing of drainage lines (e.g. Cherwell, Nine Mile, Harrow and Horse Creeks) and any areas associated with Brigalow. Measures to be implemented include the provision of fauna crossing signs to warn drivers and reduction of speed limits in these areas.

Ecological Monitoring

For the Caval Ridge Mine Project, ecological monitoring will be undertaken during: (i) pre-construction; (ii) clearing; (iii) construction phase; and (iv) operational phase, as outlined in Section 8.1.2.3.

8.2.2.5 Residual Impacts and Opportunities for Positive Impacts

Once appropriate mitigation measures and management plans are implemented, the impacts of the construction and operational phases of the mine and associated infrastructure on terrestrial fauna and habitat are predicted to be predominantly minor or negligible (Table 8.11 and Table 8.12).

Critical to the predicted scale of residual impacts are restoration, enhancement or offset of Endangered vegetation communities, including consideration of habitat for significant fauna species.

The noise, dust and light effects from the pits, roads, rail spur and loop, and CHPP will present a continual management requirement for vegetation and fauna in surrounding habitats.

As outlined in Section 8.1.2.4, there are also opportunities for positive impacts to result from the reinstatement of habitat as close to the original ecosystem as possible, following mining activities.

8.2.2.6 Matters of National Environmental Significance

Vulnerable Species

Two species listed as Vulnerable under the EPBC Act, Ornamental Snake and Squatter Pigeon, have been recorded from the project site and/or adjacent Peak Downs Mine. The Ornamental Snake (2 records at the one location) was actually outside of the project site, while Squatter Pigeon was recorded at a number of locations within the project site, including highly modified areas.

Under the EPBC Act Administrative guidelines on significance (DEH 2006), an action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

- Lead to a long-term decrease in the size of an important population of a species; or
- Reduce the area of occupancy of an important population; or
- Fragment an existing important population into two or more populations; or
- Adversely affect habitat critical to the survival of a species; or
- Disrupt the breeding cycle of an important population; or
- Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline; or
- Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat; or
- Introduce disease that may cause the species to decline; or
- Interfere with the recovery of the species.

These criteria have been addressed in the EPBC Report (Appendix C).

In summary, despite the proposed loss of habitat, mitigation through the establishment and management of vegetation offset areas to replace ecosystems and habitat lost, and the management of habitat remaining on-site to control pest species and fire, would ensure that significant ecosystems and habitat values for significant species are retained and enhanced within the local area.

Migratory Birds

Under the EPBC Act Administrative guidelines on significance (DEH 2006), an action is likely to have a significant impact on migratory species if there is a real chance or possibility that it will:

- Substantially modify, destroy or isolate an area of important habitat of the migratory species, or
- Result in invasive species that are harmful to the migratory species becoming established in an area of important habitat of the migratory species, or

- Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of the species.

These criteria have been addressed in the EPBC Report (Appendix C).

Overall, there is no evidence to suggest that the project site provides an area of important habitat for, or supports an ecologically significant proportion of a population of, any of the recorded migratory birds. Most are wetland species and the project site is surrounded by properties with many small dams for many kilometres. These, including the dams and other large waterbodies on the project site, form a multitude of isolated waterbodies that comprise a large, regional wetland resource for mobile species. These species will be moving throughout this larger 'wetland' and not just reliant on the waterbodies on the project site.

In the context of regional resources, including nearby farm dams and water storage areas associated with the existing Peak Downs Mine, the loss of the habitat is very unlikely to be significant. Most of the birds are using artificial waterbodies in the area and of the larger region of which the project site is a part and no long-term impacts on local populations of the observed migratory species are expected as a result of the Project. Overall, the creation of additional dams within the project site may provide a net increase in habitat for these species.

In terms of non-wetland migratory species, only Rainbow Bee-eater is likely to suffer any substantial loss of habitat. However, this species is not dependent specifically on habitat occurring on the site and utilises highly modified lands as well as remnant vegetation. Overall, the proposed action is not expected to detract from a safe future for Migratory Birds in the region.

- Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of the species.

These criteria have been addressed in the EPBC Report (Appendix C).

Overall, there is no evidence to suggest that the project site provides an area of important habitat for, or supports an ecologically significant proportion of a population of, any of the recorded migratory birds. Most are wetland species and the project site is surrounded by properties with many small dams for many kilometres. These, including the dams and other large waterbodies on the project site, form a multitude of isolated waterbodies that comprise a large, regional wetland resource for mobile species. These species will be moving throughout this larger 'wetland' and not just reliant on the waterbodies on the project site.

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In terms of non-wetland migratory species, only Rainbow Bee-eater is likely to suffer any substantial loss of habitat. However, this species is not dependent specifically on habitat occurring on the site and utilises highly modified lands as well as remnant vegetation. Overall, the proposed action is not expected to detract from a safe future for Migratory Birds in the region.