# 8 Terrestrial Ecology

## 8.1 Introduction

This assessment describes terrestrial flora and fauna values of the Project Site, potential impacts on those values and suggested mitigation strategies. In assessing the terrestrial ecology of the Project Site, the assessment considered a wider Study Area ('the Study Area'), which includes the Project Site and its vicinity. The tasks and objectives of the assessment were to:

- consult with relevant State agencies to obtain existing information;
- review relevant background information and data;
- complete a field survey program to census terrestrial flora and fauna communities within the Project Site, with an emphasis on targeted searches for rare or threatened species potentially present;
- compile a description of the vegetation assemblages and fauna habitats of the Study Area, including an inventory of species recorded in the Study Area;
- confirm the occurrence of rare or threatened flora and fauna species within the Study Area (as listed under Commonwealth and Stage legislation);
- confirm the extent of remnant native vegetation occurring within the Study Area; assess the potential impact of the Project on rare and threatened species, ecological communities and regional ecosystems in the context of relevant legislation, in particular the *Environment Protection and Biodiversity Conservation Act 1999*, *Nature Conservation Act 1992* and *Vegetation Management Act 1999*; and
- provide recommendations for measures to avoid or mitigate adverse impacts on significant terrestrial flora and fauna at the design,-construction and operational phases of the Project.

The findings of the assessment are presented within this section and include a review of previous flora and fauna investigations (Sinclair Knight Merz 2004 and Housten *et al* 1996), and the results of the supplementary site field surveys conducted in April 2008. The implications of the findings and potential impacts are discussed, followed by recommended mitigation measures.

## 8.2 Overall Methodology

The methods adopted for the terrestrial flora and fauna assessment involved three stages:

- literature review;
- aerial photo interpretation; and
- field surveys.

### 8.2.1 Literature Review

The first stage of the assessment involved a review of relevant databases and ecological literature pertaining to the Study Area and wider locality. The data sources used in this review included:

- results of previous flora and fauna surveys undertaken in the vicinity of the Study Area by the University of Central Queensland (Housten *et al* 1996) and Sinclair Knight Merz (2004);
- Environmental Protection Agency (EPA) and Queensland Parks and Wildlife Service (QPWS) for details concerning regional ecosystems (RE's) and flora and fauna of conservation significance;
- records published in scientific journals, reports and general flora and fauna distribution texts;

- results of local environmental studies, including studies prepared by consultants, government authorities, biological organisations, universities and other sources; and
- other relevant databases including the Queensland Herbarium and Birds Australia Atlas.

### 8.2.2 Aerial Photograph Interpretation

Preliminary appraisal of the Project Site and adjacent areas was conducted using aerial photographs (dated July 2004) and topographic maps. This provided a broad overview of the Project Site boundaries, extent and type of vegetation and enabled the identification of areas of potential importance for flora and fauna to be targeted during the field investigations, in particular, in the vicinity of the proposed mining footprint.

### 8.2.3 Field Surveys

Field surveys had previously been conducted in the vicinity of the Project Site and the results are presented and discussed in this assessment. The first survey was conducted on the Poitrel Mine site by the Central Queensland University in September and October of 1996 (Housten *et al* 1996). Results of this survey are relevant to the Project Site because they provide useful background information on the flora and fauna assemblages present in the locality.

Sinclair Knight Merz completed a flora and fauna survey in 2004 (published in the Poitrel Coal Mine Project EIS 2005). This survey covered both the Poitrel Mine site and a portion of the current Project Site.

The 2004 survey was conducted from 20 to 27 August 2004 for a total of 18 person days. Specific details of the flora and fauna field survey methods including weather conditions at the time of the survey are presented in **Appendix I.2**. Locations of the 2004 surveys sites and details of survey effort at each site are provided in **Appendix I.2.** A supplementary survey was conducted in April 2008 which further focused upon assessing vegetation and fauna within the Daunia, Daunia East and Red Mountain Mining Leases (see **Figure 8-1**).

Detailed flora and fauna surveys were carried out at pre-selected and opportunistic sites. Sites were selected to sample the diversity of habitat types present and the extent of potential disturbance areas. Details of the flora and fauna survey techniques are provided in **Section 8.4** and **Section 8.5**.

## 8.3 Legislation

The key biodiversity and nature conservation legislation and policy relevant to the Project is described below.

### 8.3.1 Commonwealth Legislation

The *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) prescribes the Commonwealth's role in environmental assessment, biodiversity conservation and the management of protected areas. Under the environmental provisions of the EPBC Act, actions that are likely to have a significant impact on a matter of National Environmental Significance (NES) are identified as "controlled actions" and cannot be undertaken without approval under the EPBC Act.

The Project was referred to the Commonwealth Minister for Department of Environment, Water, Heritage, and the Arts (DEWHA) in August 2008. The Proponent nominated the Project as a "controlled action" under Section 75 of the EPBC Act on the basis of its potential impact on listed threatened and migratory species. In September 2008, The DEWHA determined the Project to be a controlled action. The Commonwealth Government will assess the Project under the Bilateral Agreement and in accordance with the Queensland impact assessment process. A description of the impact of the Project on the seven matters of National Environmental Significance is presented in **Table 8-1**.

**Table 8-1 Impact of the Project on Matters of National Environmental Significance**

| Matter of National Environmental Significance | Impact of Project |
|---|---|
| World Heritage Properties | There are no World Heritage Properties within the Project Site. |
| National Heritage Places | There are no National heritage places within the Project Site. |
| Wetlands of International Importance (Ramsar wetlands) | There are no listed Ramsar wetlands located within close proximity to the Project Site. The nearest Ramsar wetland is approximately 80km north of Rockhampton (Shoalwater and Corio Bays) and more than 200 km away from the Project Site. Due to the nature of the proposed project and the distance to Shoalwater and Corio Bays, it is unlikely that the proposed project will have a significant impact on Ramsar wetlands. |
| Threatened Ecological Communities | One listed Threatened Ecological Community is found within the Project Site – Brigalow (*Acacia harpophylla*) dominated and co-dominated community. The Project will not have a significant impact on this community. |
| Listed Threatened Species | No Commonwealth-listed threatened flora species have been identified in the Project Site.<br>One Commonwealth-listed threatened fauna species (Squatter Pigeon (*Geophaps scripta*)) has been identified within the vicinity of the Project Site. |
| Migratory Species | Several listed migratory species have been identified on the Project Site including (but not restricted to) the Great Egret (*Ardea alba*), Cattle Egret (*Ardea ibis*), Whistling Kite (*Haliastur sphenurus)* and the Straw-necked Ibis (*Threskiornis spinicollis)*.<br>These species are relatively common and widespread across the regional landscape, and the Project is not considered to have a significant impact on these species, their habitat or breeding/feeding resources. |
| Commonwealth Marine Areas | There are no Commonwealth marine areas located in the vicinity of the Project Site. |
| Commonwealth Lands and Heritage Places | There are no Commonwealth lands or heritage places located within the Project Site. |
| Places on the Register of the National Estate (RNE) | There are no places listed on the RNE located within the Project Site. |
| State and Territory Reserves | There are no State or Territory Reserves within the Project Site. |
| Nuclear Action | The Project does not involve any nuclear actions. |

### 8.3.2 Queensland Legislation

The *Nature Conservation Act 1992* (Qld) (NC Act) provides for the conservation and management of Queensland's native animal and plants. The NC Act prohibits the taking or destruction, without authorisation, of certain listed flora and fauna species.

The *Nature Conservation (Wildlife) Regulation 2006* (NCWR) lists the plants and animals considered presumed extinct, endangered, vulnerable, rare, common, international and prohibited. It states the declared management intent and the principles to be observed in any taking of or destruction for each group.

The *Land Protection (Stock and Pest Route Management) Act 2002* and the *Land Protection (Pest and Stock Route Management) Regulation 2003* provides for pest management in Queensland.

The *Vegetation Management Act 1999* (Qld) (VM Act) regulates the clearing of mapped remnant vegetation on freehold and leasehold land in Queensland. For the purposes of assessing significant projects, the VM Act is supported by the Regional Vegetation Management Code for Southeast Queensland Bioregion (RVMC) and Policy for Vegetation Offsets (the Offset Policy). A mining activity or a petroleum activity as defined under the *Environmental Protection Act 1994* is exempt from assessment under this Code on all land tenures through Schedule 8 of IPA (RVMC 2006).

The *Nature Conservation (Koala) Conservation Plan 2006* provides for the conservation of Koala (*Phascolarctos cinereus*) in Queensland and includes provisions for the assessment and management of Koalas during the development approval processes and implementation of projects. Differentiated levels of provisions apply to the three different Koala areas that have been delineated across Queensland. The Project is situated in Koala District C. Koala District C is the described in Schedule 1, Section 3 of the *Nature Conservation (Koala) Conservation Plan 2006* which comprises 77 local government authorities where koalas are found. Although there is evidence of decline in this district, koalas are classified as *of least concern wildlife* under the NC Act in this area due to a generally lower perceived threat to their survival (EPA & QPWS 2006).

## 8.4 Terrestrial Flora Assessment

### 8.4.1 Methodology

Flora field surveys involved the classification of broad vegetation communities identified by the aerial photograph interpretation. More detailed flora surveys involving transect and quadrat sampling were conducted at specific locations as shown in **Appendix I.2**. During the 2004 surveys, 26 quadrants were established in addition to several transects and general traverses on foot. Eighteen quaternary vegetation sites and numerous general traverses were conducted during the 2008 survey. Also, numerous vehicle-based traverses were carried out as part of both studies. Specific details of flora survey methods, effort and localities are provided in **Appendix I.2**. The vegetation survey work also considered the results of previous works undertaken on the Poitrel Mine and adjacent areas by the Central Queensland University in September and October of 1996 (Housten *et al.* 1996).

Plant communities were assessed using structural characteristics according to Specht (1974) and the regional conservation significance assessed in accordance with Sattler and Williams (1999) and the Regional Ecosystem Description Database (REDD) (EPA 2008). The conservation significance of plant species was assessed in the national context with reference to the EPBC Act and Briggs and Leigh (1996) and in the State context with reference to the NCWR.

### 8.4.2 Results

#### 8.4.2.1 Vegetation Communities

The Project Site is degraded due to several factors, primarily prolonged stress through drought, high levels of grazing by cattle over a long period and extensive invasion by Buffel Grass.

Seven (7) distinct vegetation associations containing remnants or derivatives of naturally occurring vegetation types were recorded from the Study Area. Additionally, large areas containing highly modified vegetation were also present.

Of the 7 vegetation types identified from the Study area (excluding the highly modified lands), four are considered representative of '*endangered'* ecological communities under the provisions of EPBC Act and three are considered representative of endangered RE's under the VM Act and a further one is classified as *'of concern'* under the VM Act. The locations of the remnant regional ecosystems regrowth vegetation are shown in **Figure 8-1.**

### 8.4.2.2 Mapped Remnant Vegetation

The EPA's certified RE mapping shows that there is mapped remnant vegetation on site. **Table 8-2** illustrates the mapped regional ecosystems on the Project Site as per the EPA Regional Ecosystem (RE) mapping (Version 5.0, 2005).

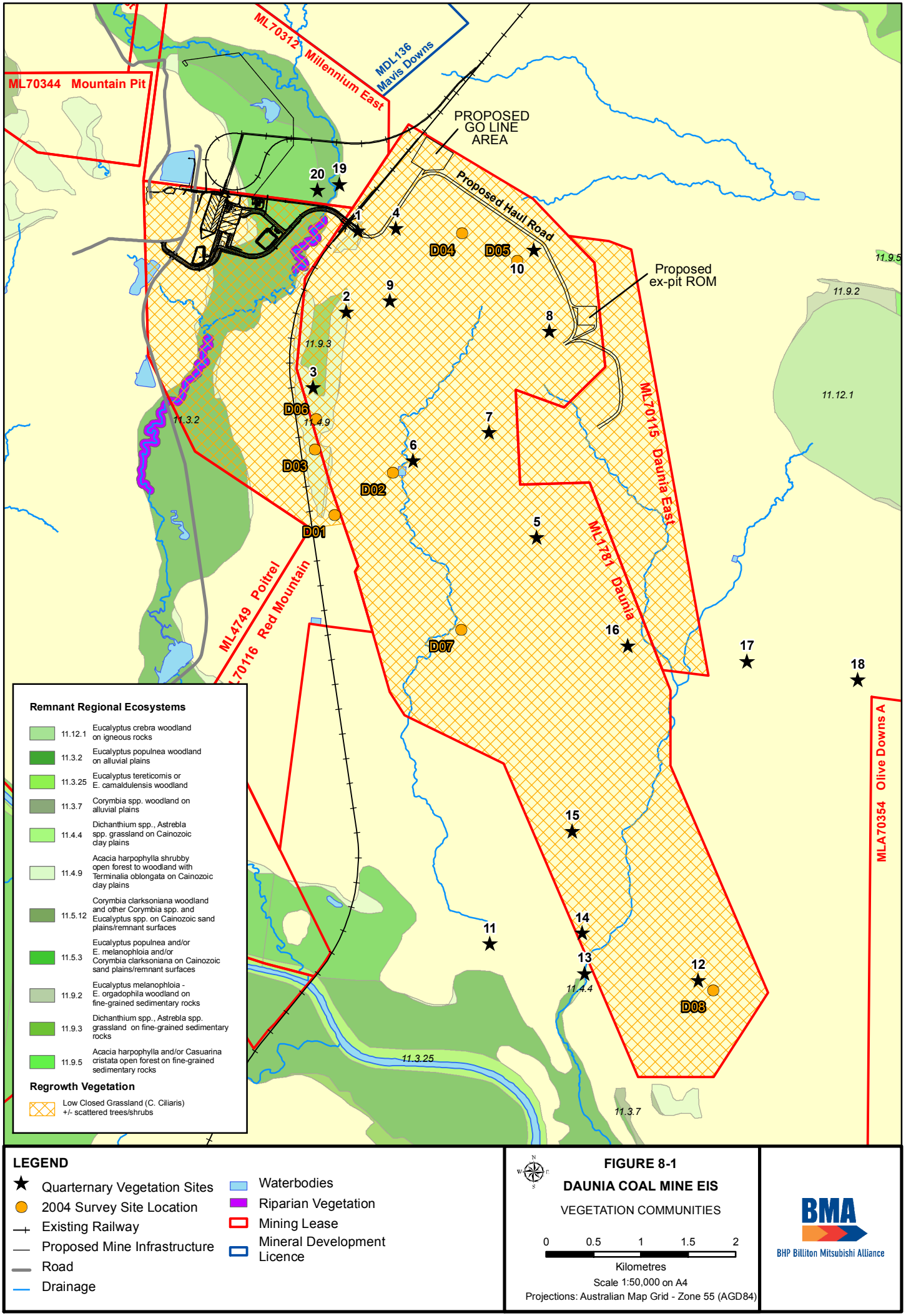
**Table 8-2 Mapped Regional Ecosystem on the Project Site**

| RE Code | Description | VMR status[1] | EPBC Act Status[2] |
|---|---|---|---|
| 11.3.1 | *Acacia harpophylla* and/or *Casuarina cristata* on alluvial plains | Endangered | Endangered |
| 11.3.2 | *Eucalyptus populnea* woodland to open-woodland. | Of Concern | N/A |
| 11.3.25 | *Eucalyptus camaldulensis* or *E. tereticornis* open-forest to woodland. | Not Of Concern | N/A |
| 11.5.3 | *Eucalyptus crebra, Callitris glaucophylla, C. endlicheri, E. chloroclada, Angophora leiocarpa* on Cainozoic sand plains/remnant surfaces. | Not Of Concern | N/A |
| 11.9.2 | *Eucalyptus melanophloia* and/or *E. orgadophila* grassy woodland to open-woodland | Not of Concern | N/A |
| 11.9.3 | Grassland dominated by *Dichanthium sericeum* and/or *Astrebla* spp. | Not of Concern | Endangered |
| 11.9.5 | Open-forest dominated by *Acacia harpophylla* and/or *Casuarina cristata* | Endangered | Endangered |
| 11.4.9 | Open-forest, occasionally woodland, dominated by Acacia harpophylla usually with a low tree mid-storey of *Terminalia oblongata* and *Eremophila mitchellii* | Endangered | Endangered |

[1] Status under the *Vegetation Management Act 1999*

[2] Status under the *Environment Protection and Biodiversity Conservation Act 1999*.

Note: Most of the RE's listed occur in mixed polygons and do not occur as dominant RE's on the Project Site.




**LEGEND**

- Quarternary Vegetation Sites
- 2004 Survey Site Location
- Existing Railway
- Proposed Mine Infrastructure
- Road
- Drainage
- Waterbodies
- Riparian Vegetation
- Mining Lease
- Mineral Development Licence

**FIGURE 8-1**

**DAUNIA COAL MINE EIS**

VEGETATION COMMUNITIES

0 0.5 1 1.5 2

Kilometres

Scale 1:50,000 on A4

Projections: Australian Map Grid - Zone 55 (AGD84)

BMA

BHP Billiton Mitsubishi Alliance

I:\QENV\Projects\QE06520\1800 SpatialArc_MXD\Figures\Fig_8-1_Vegetation_Communities_v4.mxd Produced: 6/10/2008 This figure should be read in conjunction with the data disclaimer at the front of this report.

### 8.4.2.3 Observed Remnant Vegetation

Whilst the site investigations revealed that the majority of vegetation present on the Project Site corresponds directly with the EPA's Regional Ecosystem mapping, some of the RE's mapped to exist within the mixed polygons were not observed during field surveys. **Table 8-3** lists the observed RE's on the Project Site and highlights those RE's which were found to be absent.

**Table 8-3 Observed Regional Ecosystems on the Project Site**

| RE Code | Description | VMR status[1] | EPBC Act Status[2] | Occurrence in Study Area |
|---|---|---|---|---|
| 11.3.1 | *Acacia harpophylla* and/or *Casuarina cristata* on alluvial plains | Endangered | Endangered | Present within mixed polygons at a scale too small to be mapped under the RE framework |
| 11.3.2 | *Eucalyptus populnea* woodland to open-woodland. | Of Concern | N/A | Present as the dominant RE within mixed polygons on the Red Mountain Lease. |
| 11.5.3 | *Eucalyptus crebra*, *Callitris glaucophylla*, *C. endlicheri*, *E. chloroclada*, *Angophora leiocarpa* on Cainozoic sand plains/remnant surfaces. | Not Of Concern | N/A | Present as the dominant RE within elevated portions of the Red Mountain Lease. |
| 11.9.2 | *Eucalyptus melanophloia* and/or *E. orgadophila* grassy woodland to open-woodland | Not of Concern | N/A | Not observed. |
| 11.3.25 | Eucalyptus camaldulensis or E. tereticornis open-forest to woodland. | Not Of Concern | N/A | Not observed. |
| 11.9.3 | Grassland dominated by *Dichanthium sericeum* and/or *Astrebla* spp. | Not of Concern | Endangered | Not observed. |
| 11.9.5 | Open-forest dominated by *Acacia harpophylla* and/or *Casuarina cristata* | Endangered | Endangered | Not observed. |
| 11.4.9 | Open-forest, occasionally woodland, dominated by *Acacia harpophylla* usually with a low tree mid-storey of *Terminalia oblongata* and *Eremophila mitchellii* | Endangered | Endangered | Present as a single, consolidated remnant unit on the western boundary of the Daunia lease. |

### 8.4.2.4 Regrowth/Non-Remnant Vegetation

Regrowth/non-remnant vegetation communities dominate the Project Site. This vegetation is highly modified and is in very poor condition, with low species diversity and high levels of weed incursion, particularly by the perennial grass species Buffel grass. The following description gives an indication of the location, structure and species diversity of this disturbed community.

### Grass Dominated (RE no equivalent)

Location and Extent: This vegetation type was heavily represented in the heavily grazed and exposed areas on the Project Site. This vegetation type is dominant across the Project Site and consists mostly of Buffel grass (*Cenchrus ciliaris*) pastures with scattered trees and shrubs.

Structure: The community comprises primarily various grass species, both native and introduced, with scattered small trees and shrubs. Cover is around 80 to 90 per cent.

**Dominant / Common Species:**
Groundcovers (grasses, herbs, graminoides):

*Cenchrus ciliaris, Astrebla sp., Dactyloctenium radulans, Bothriochloa sp., Dichanthium sericeum, Chloris divaricata, Cymbopogon refractus* and *Aristida personata, Dichanthium sericeum*, *Heteropogon contortus Panicum decompositum*.

Weeds:

Parthenium

**General Condition:** This vegetation community is currently thriving under the good conditions and overall groundcover across this community is very high. This community is lacking in substantial amounts of native grasses and is heavily invaded by Buffel Grass and Parthenium. Some sections containing only native grasses are present, although only as isolated pockets.

#### 8.4.2.5 Floristic Diversity

Floristic diversity / richness for the Project Site is relatively low due to the amount of past clearing and heavy grazing that has occurred. These practices have reduced the number of native species present in the Study Area. Based on the results of previous studies and the supplementary survey undertaken in 2008, a total of 132 flora species from 47 families were identified and recorded within the Study Area.

Of the total species recorded, 19 species of introduced flora were identified, representing approximately 15% of the total species.

A list of the flora species identified from the Project Site is in **Appendix I.1**.

### 8.4.3 Assessment of Results

#### 8.4.3.1 Flora of Conservation Significance

#### Ecological Communities of National Significance

Of the regional ecosystems mapped within the Project Site, four are listed as Nationally Endangered Ecological Communities (EECs) under the EPBC Act. The communities are:

- 11.4.9 Brigalow (*Acacia harpophylla*) and Yellowwood (*Terminalia oblongata*) woodland;
- 11.9.3 Grassland dominated by *Dichanthium sericeum* and/or *Astrebla* spp.
- 11.9.5 Open-forest dominated by *Acacia harpophylla* and/or *Casuarina cristata*
- 11.3.1 *Acacia harpophylla* and/or *Casuarina cristata* on alluvial plains

As discussed above, RE's 11.9.3 and 11.9.5 were not observed to occur on the Project Site. The Brigalow EECs occur within the Project Site in several locations. A monospecific stand of Brigalow (of Regional Ecosystem 11.4.9) occurs along the northwestern boundary between the Daunia and Red Mountain Mining Leases (see **Figure 8-1**). This stand is in poor condition, with evidence of dieback and a high level of invasion by Buffel Grass. Native species have virtually been eliminated from the mid and low strata of the

stand. Additional linear stands of RE 11.4.9 exist on the western boundary of the large patch of mapped vegetation in the north portion of the Project Site, within the Red Mountain and Poitrel Mining Leases (see **Figure 8-1**).

The Brigalow EEC also occurs within a stand mixed regional ecosystem vegetation which contains Poplar Box, Red Gum and Dawson Gum woodlands within the Red Mountain Mining Lease (see **Figure 8-1**). Within this stand, the Brigalow EEC is sparsely distributed as discrete clumps of vegetation associated with depressions.

### Regional Ecosystems of State Significance

Of the 4 regional ecosystems identified on the Project Site, all have conservation significance at the state level, as they are listed as either endangered or of concern under the VM Act. The communities are:

- 11.3.2 *Eucalyptus populnea* woodland on alluvial plains – O*f Concern*;
- 11.4.9 Brigalow (*Acacia harpophylla*) and Yellowwood (*Terminalia oblongata*) woodland – *Endangered;*
- 11.3.1 *Acacia harpophylla* and/or *Casuarina cristata* on alluvial plains – *Endangered*; and
- 11.9.5 Open-forest dominated by *Acacia harpophylla* and/or *Casuarina cristata* – *Endangered*.

### Species of National and State Significance

Significant flora species are defined as those listed under the EPBC Act (Critically Endangered, Endangered or Vulnerable) or NC Act (Endangered, Vulnerable, Rare, Near Threatened or Least Concern). Literature review, database searches and field surveys failed to locate any significant flora species on or near to the Project site.

### 8.4.3.2 Weeds of Management Concern

A number of weeds of management concern were identified as part of the flora surveys. These include those declared as pests by the Department of Natural Resources and Water (DNRW) under the *Land Protection (Pest and Stock Route Management) Act 2002*. **Table 8-4** lists the declared weeds located on the Project Site and comments on distribution within the site.

**Table 8-4 Declared weed species identified on the Project Site**

| Scientific Name | Common Name | Location | Declared Status* |
|---|---|---|---|
| *Parthenium hysterophorus* | Parthenium | In most woodland areas and in most grazed areas of the Project Site. Only minor occurrences in the Riparian vegetation of the Isaac River. | Class 2 |
| *Eriocereus martinii* | Harrisia Cactus | Common in all Poplar Box and Brigalow woodland areas. Also present in areas containing low regrowth. | Class 2 |
| *Opuntia tomentosa* | Velvety Tree Pear | Scattered individuals located mainly in stands of Brigalow and occasional individuals within the other woodland areas. | Class 2 |

Class 2: Requires control. Must avoid spreading onto other properties.

One of these species, Parthenium, is also listed as a Weed of National Significance (WONS), which is a list of weeds developed under the ANZECC National Weeds Strategy (ANZECC, 1997). The Strategy aims to

reduce the detrimental impact of weeds on the sustainability of Australia's productive capacity and natural ecosystems.

## 8.5 Terrestrial Fauna

### 8.5.1 Methodology

Several fauna surveys have been completed within the Study Area and more specifically on the Project Site. Results from studies undertaken in 1996 and 2004 have been considered alongside those attained from the supplementary fauna survey conducted in 2008 in describing the existing fauna values of the Project Site. The results of these surveys are discussed herein and incorporated in the assessment of impacts on terrestrial fauna.

Prior to and during the 2004 fauna survey, the Central Queensland region experienced severe drought. This factor is likely to have affected the diversity of fauna present in the Study Area, particularly as the Isaac River, New Chum Creek associated tributaries were completely dry and had not flowed for several months. On site water was limited to small quantities stored in dams used for stock watering.

The supplementary survey undertaken for the current assessment aimed to target gaps in the previous survey work, paying particular attention to the Mining Leases to be impacted during the Daunia project. The survey was conducted in April 2008 after considerable rainfall had fallen across the region during the last season. The survey consisted of targeted efforts on naturally vegetated areas. Efforts included spotlighting, targeted herpetological searches (nocturnal and diurnal), nocturnal and diurnal avifauna surveys, Anabat II survey across the project area and specific search for threatened species known to inhabit the wider Study Area.

The majority of the Project Site comprises cleared and modified agricultural lands with very little natural vegetation cover. These areas are generally considered of low value to native fauna, being utilised by common species and those tolerant of disturbed habitats. Surveys in cleared modified lands were limited to opportunistic observations and spotlighting.

A combination of standard fauna survey methods were employed across the surveys including diurnal and nocturnal census and additional opportunistic observations. Details of survey techniques, effort and localities are provided in **Appendix I.2**.

### 8.5.2 Results

#### 8.5.2.1 Fauna Habitats

Five major fauna habitat types occur within the Project Site and adjoining lands, and are described as:

- cleared and modified grassland habitat, including farm dams and regrowth;
- eucalypt woodland habitat;
- Brigalow woodland habitat;
- riparian open forest habitat; and
- aquatic habitats.

### Cleared and modified grassland

This is the dominant fauna habitat present in the Study Area. Much of the vegetation of the Project Site has been cleared and is currently used for grazing. The resulting cleared and modified grassland habitats provide limited diversity and complexity of habitat for fauna and generally support a lower fauna diversity than intact native vegetation. In general, these areas do not support a representative suite of fauna and are dominated by common and adaptable open country species and introduced fauna. Although the value of isolated mature remnant trees has been documented previously in terms of their ability to provide food and sheltering resources for mobile fauna species (Law *et al* 2000), these are very widely scattered across the site and provide limited opportunity for fauna.

Stands of trees which are present within the grassland are in very poor condition. The Project Area is heavily infested with an exotic perennial grass species, Buffel Grass (*Cenchrus ciliaris*).

Buffel grass is an introduced perennial tussock grass which has improved rangeland pastoral production and helped land rehabilitation. More recently, its invasive capacity has been of concern and modelling suggests that it has the capacity to expand across a large area of northern Australia by altering vegetation structure and species composition, and reducing invertebrate diversity, invasion by Buffel grass impacts on the suitability of habitat for a wide range of native flora and fauna.

### Eucalypt woodland

Much of the remnant Eucalypt woodland habitat has been cleared from the Study Area and is now restricted to linear strips and small patches along New Chum Creek and its tributaries, the Isaac River and the mesa and foothills at the north-western end of the Study Area (within and adjacent to the Millennium East Mining Lease). There are no intact stands of Eucalypt woodland on the Daunia Mining Lease.

Fauna activity across the Study Area (in 3 surveys) has been found to be concentrated around the remaining woodland habitats, which provide continuous areas of vegetation with a comparative abundance of important microhabitat features capable of supporting fauna. These features include an abundance of sheltering, foraging and breeding resources, and ephemeral freshwater habitats. Mature eucalypt trees provide particularly important habitat for faunal diversity because of their contribution of tree hollows and logs for hollow-dependent species (Recher 1991).

Many of the remaining woodland habitats have become degraded through prolonged cattle grazing and trampling and selective clearing. However, a few areas of higher quality woodland habitats are present in the Study Area particularly where grazing has been restricted in recent years and the vegetation allowed regenerating. Good quality woodland fauna habitats were identified from:

- the northern half of the Red Mountain Mining Lease in proximity to New Chum Creek;
- in the southern end of New Chum Creek near its confluence with the Isaac River;
- riparian forest / woodland associated with the Isaac River; and
- vegetation on the mesa at the north-western end of the Study Area (outside the Project Site).

The only area of Eucalypt woodland to be affected by the Project is located on the Red Mountain Mining Lease.

A moderate diversity of species from all fauna groups would be expected to occupy these habitat types including some species of conservation significance. Commonly recorded species include the Torresian and Little Crow (*Corvus* sp), Apostlebird (*Struthidea cinerea*), Noisy and Little Friarbird (*Philemon* sp), Blue-faced Honeyeater (*Entomyzon cyanotis*), Pale-headed Rosella (*Platycercus adscitus*), Grey-crowned Babbler (*Pomatostomus temporalis*), several Honeyeaters (family Meliphagidae) and Thornbills (family Pardalotidae) as well as the Open-litter Rainbow Skink (*Carlia pectoralis*), and Bynoe's Gecko (*Heteronotia binoei*).

Species of conservation significance recorded in the woodland habitats include the Rare (NC Act) Black-chinned Honeyeater (*Melithreptus gularis*) and Collett's Snake (*Pseudechis colletii*).

### Brigalow woodland habitat

As discussed previously, much of the former Brigalow woodland in the Study Area has been cleared and the land is currently used for grazing or comprises young Brigalow regrowth of limited value to fauna. A moderately large patch of remnant Brigalow occurs on the Project Site on the eastern side of the Peak Downs rail line outside of the proposed mining area. This area is suffering from dieback, is heavily invaded by Buffel grass and is in relatively poor condition.

Brigalow habitats generally support a lower overall diversity of fauna species than Eucalypt woodlands in the same landscape, although they are important for a small number of specialised species, many of which are threatened. The overall lower level of diversity is the result of a low flora diversity and structure providing only limited food resources and mainly for insectivorous species as well as a lack of sheltering opportunities for arboreal mammals and hollow nesting birds, as Brigalow does not readily form tree hollows and lacks an abundance of large hollow logs. The only mammal species recorded from the Brigalow habitats during the surveys included the Eastern Grey Kangaroo (*Macropus giganteus*) and introduced Rabbit (*Oryctolagus cuniculus*). Other commonly occurring species include Bynoe's Gecko (*Heteronotia bineoi*), Tree-base Litter Skink (*Cryptoblepharis virgatus*) utilising the abundance of small logs and dense shrubs. Some common insect eating bird species were also found to frequent the Brigalow including the Magpie-lark (*Grallina cyanoleuca*), Grey Shrike-thrush (*Colluricincla harmonica*), Thornbills (family Pardalotidae), Pied Butcherbird (*Cracticus nigrogularis*) and Tawny Frogmouth (*Podargus strigoides*).

### Riparian habitat

Creek and riparian areas have the potential to provide high value fauna habitat and can represent significant features, particularly in the modified agricultural and floodplain landscapes. Such areas provide habitat for fauna dependent on aquatic and semi aquatic habitats, especially frogs, some reptiles and several common wader and water bird species and can exhibit a comparatively species rich habitat. Riparian habitats may also provide important fauna movement corridors and provide refuge during fire and drought events.

Riparian habitats within the Project Site are restricted to New Chum Creek on the Red Mountain Mining Lease. There are no riparian habitats on the Daunia Mining Lease. On New Chum Creek the riparian zone is highly variable in nature, with some areas exhibiting well developed riparian woodland of River Red Gum and others displaying limited variation in structure or species composition from the surrounding landscape. Some sections of creek support a high density of vegetation when compared to surrounding communities, but no flora species were strictly associated with the riparian zone.

Whilst the riparian habitats of the Isaac River comprise comparatively intact areas of vegetation, those of New Chum Creek have been subject to a higher level of historical disturbance and are subsequently of lower overall value to fauna. In some areas there is no obvious riparian zone habitat.

A number of fauna species recorded from the locality have only been identified from the riparian habitats near the Isaac River, including the Masked Owl (*Tyto novaehollandiae*), Yellow-bellied Glider (*Petaurus australis*), Great Bowerbird (*Chlamydera nuchalis*) Inland Forest Bat (*Vespadelus baverstocki*) and Dubious Gecko (*Gehyra dubia*). None of these species were recorded from New Chum Creek during the current study and with the exception of the Dubious Gecko; none are expected to occur within the Project Site.

In terms of uniqueness, the riparian habitat of New Chum Creek provides a range of resources for a variety of common species of amphibian and (seasonally) waterbirds which are not freely available in the broader landscape. However, none of the species recorded from the Project Site are likely to be restricted to the riparian habitat of New Chum Creek.

### 8.5.2.2 Fauna Diversity

A total of 212 native fauna species have been recorded from the Study Area during field surveys in 1996 (Housten *et al* 1996), 2004 and 2008. The spring surveys in 2004 revealed 11 mammal species, 1 reptile, and 13 bird species not recorded during surveys in 1996 (Housten *et al* 1996). The 2008 surveys recorded a further 3 mammals, 3 reptiles and 17 bird species not recorded in either the 1996 or 2004 surveys. The total species diversity recorded from the Study Area is listed in **Appendix I.1** and data on specific native fauna groups summarised in **Table 8-5**.

**Table 8-5 Summary of faunal diversity recorded in the Study Area**

| Fauna Group | 2008 Survey (no. of species) | 2004 Survey (no. of species) | 1996 Survey (no. of species) | 2004 Survey (species not recorded in 1996) | 2008 Survey (species not recorded in 1996 or 2004) | Total Native Fauna Species |
|---|---|---|---|---|---|---|
| Mammals | 16 | 16 | 23 | 11 | 3 | 37 |
| Reptiles | 5 | 8 | 28 | 1 | 3 | 32 |
| Frogs | 9 | 0 | 11 | 0 | 0 | 11 |
| Birds | 69 | 74 | 102 | 13 | 17 | 129 |
| **Total** | 99 | 98 | **164** | **25** | **23** | **212** |

### Mammals

A total of 37 mammal species from 17 families were recorded from the Study Area during the field surveys. These species have been separated into broad groups based on morphology and behaviour for ease of discussion.

#### *Insectivorous bats (Microchiroptera)*

A total of 13 microchiropteran bat species from 8 genera have been recorded from the Study Area using a combination of trapping and ultrasonic call detection techniques. 3 species were recorded during harp trap surveys undertaken in 2004 (see **Table 8-6**).

**Table 8-6 Results of the bat trapping survey**

| Site | Date | Species | Sex | Age |
|---|---|---|---|---|
| P02 | 23/08/04 | No captures | | |
| P02 | 24/08/04 | No captures | | |
| P04 | 23/08/04 | No captures | | |
| P04 | 24/08/04 | No captures | | |
| P05 | 25/08/04 | Hoary Wattled Bat (*Chalinolobus nigrogriseus*) | M | Adult |
| P05 | 25/08/04 | Inland Forest Bat (*Vespadelus baverstocki*) | M | Adult |
| P05 | 25/08/04 | Eastern Cave Bat (*Vespadelus troughtoni*) | M | Adult |
| P05 | 25/08/04 | Eastern Cave Bat (*Vespadelus troughtoni*) | M | Adult |
| P05 | 25/08/04 | Eastern Cave Bat (*Vespadelus troughtoni*) | M | Juvenile |
| P05 | 25/08/04 | Eastern Cave Bat (*Vespadelus troughtoni*) | F | Adult |
| P05 | 26/08/04 | Eastern Cave Bat (*Vespadelus troughtoni*) | M | Adult |
| P05 | 26/08/04 | Eastern Cave Bat (*Vespadelus troughtoni*) | M | Adult |
| P05 | 26/08/04 | Eastern Cave Bat (*Vespadelus troughtoni*) | M | Adult |
| P05 | 26/08/04 | Eastern Cave Bat (*Vespadelus troughtoni*) | F | Adult |

An additional 13 species have been recorded via the ultrasonic call detection surveys (see **Table 8-7**).

**Table 8-7 Results of the bat call detection surveys**

| Species | | Definite | Likely |
|---|---|---|---|
| 1. | Gould's Wattled Bat (*Chalinolobus gouldii*) | √ | |
| 2. | Hoary Wattled Bat (*Chalinolobus nigrogriseus*) | √ | |
| 3. | Little Pied Bat (*Chalinolobus picatus*) | | √ |
| 4. | Inland Forest Bat (*Vespadelus baverstocki*) | √ | |
| 5. | Eastern Cave Bat (*Vespadelus trougtoni*) | √ | |
| 6. | Yellow-bellied Sheathtail Bat (*Saccolaimus flaviventris*) | √ | |
| 7. | Northern Freetail-bat (*Chaerephon jobensis*) | √ | |
| 8. | Beccari's Freetail-bat (*Mormopterus beccarii*) | | √ |
| 9. | Eastern Freetail-bat (*Mormopterus* sp.2) | | √ |
| 10. | *Mormopterus sp.6* | √ | |
| 11. | White striped Mastiff Bat *(Tadarida australis)* | √ | |
| 12. | Little Bent-wing Bat (*Miniopterus australis*) | √ | |
| 13. | Little Broad-nosed Bat (*Scotorepens greyii*) | | √ |

### *Arboreal mammals*

The Project Site provides virtually no suitable habitat for Arboreal mammals. Several Yellow-bellied Gliders (*Petaurus australis*) were recorded from the broader Study Area in riparian tall open forest habitat associated with the Isaac River during 2004. Whilst moderately common, the species distribution was restricted to this area and no observations were made on the Project Site. This is consistent with previous sightings (Housten *et al.* 1996). No other arboreal mammals were recorded during the 2004 or 2008 field surveys, however, two species were recorded by Housten *et al* (1996), namely the Greater Glider (*Petauroides volans*), which is

restricted to riparian habitat, and the Common Brushtail Possum (*Trichosurus vulpecula*), which was more widely distributed.

### *Terrestrial mammals*

Small mammal diversity and abundance is very low, which is typical of areas heavily infested with Buffel grass and containing limited remnant vegetation cover. The Project Site contains very limited suitable habitat for small terrestrial mammals due to a lack of fallen logs and debris, dominance of exotic grass and lack of canopy cover.

Diversity and abundance of small mammals was markedly low during the 2004 surveys with only two captures of the introduced House Mouse (*Mus musculus*). This is likely to be a result of the extreme drought conditions and grazing impacts over the majority of the site. In contrast trapping surveys during favourable conditions in 1996 recorded two marsupials (Dasyuridae) and three native mice (Muridae) (see **Appendix I.1**). Other observations during 1996 included bandicoots (Peramelidae), the Rufous Bettong (*Aepyprymnus rufescens)* and several macropod species (Macropodiae). These species are likely to be associated with the forest and woodland habitats in the Study Area.

Hair and bone samples (raptor pellets) collected from the Study Area in 2004 were analysed and the remains identified as the Rufous Bettong (*Aepyprymnus rufescens*) and Striped-faced Dunnart (*Sminthopsis macroura*). Neither species were captured or observed during the 2004 field surveys; however they were recorded from the Study Area by Housten *et al.* (1996) as common.

### *Birds*

Surveys in 2004 recorded 74 bird species from 37 genera. The 2008 surveys recorded an additional 17 species which were not recorded during the 1996 or 2004 surveys. During the 2004 surveys, the majority of species and individuals were recorded from the more heavily timbered woodland and riparian habitats along the Isaac River and New Chum Creek. The remaining open grazing areas were frequented by common and abundant species, albeit the Emu was recorded in low abundance in cleared grazing lands.

Locally significant species recorded in the Study Area included the Australian Bustard, Striped Honeyeater, Great Bowerbird and Masked Owl. The most common species recorded on the Project Site were the Little Crow, Noisy and Little Friarbird, Apostlebird, Nankeen Kestel, Brown Falcon, Blue-faced Honeyeater and Magpie.

### *Reptiles*

The 2004 surveys recorded 8 species from 4 genera, predominantly geckos (Gekkonidae) and skinks (Scincidae). In general reptile abundance was high and individuals were recorded across all timbered portions of the Project Site associated with the abundance of logs and fallen timber present, in particular in woodland habitats previously thinned and ringbarked for grazing land. The 2008 survey added three additional species, the Zigzag Velvet Gecko (*Oedura rhombifer*), Carpentaria Snake (*Cryptophis boschmai*) and Curl Snake (*Suta suta*). Common species include Bynoe's Gecko, a skink (*Carlia pectoralis* – no common name) and the Fence Skink.

Several additional reptile species were recorded during surveys in 1996. This is attributed to a broader range of habitats surveyed incorporating the elevated mesa area in the northern end of the Poitrel Mine Site, well outside the Daunia Project Site. A number of species listed in Housten *et al* (1996) frequent rocky

habitats, such as the Ocellated Gecko, Marbled Velvet Gecko, Prickly Knob-tailed Gecko and Freckled Monitor and may be absent or restricted throughout the Project Site.

### *Frogs*

As stated previously, no frog activity was recorded in the Study Area during 2004 despite extensive diurnal and nocturnal searches. The supplementary surveys conducted in 2008 revealed 9 species of frogs. Eleven species were recorded during the 1996 survey which covered a wider study area. No frogs of conservation significance are known from the Study Area or the Project Site.

Common species on the Project Site include the New Holland Frog (*Cyclorana novaehollandiae*) and Green-striped Frog (*Cyclorana alboguttata*).

### *Introduced Species*

A total of 7 introduced fauna species have been recorded from the three surveys in the Study Area, including 1 amphibian and 6 mammals. These are the Cane Toad; European Rabbit; cattle; House Mouse; Feral Cat; European Red Fox; and Feral Pig.

All species were in low abundance except for rabbits, which were common in both forested and open habitats. Cane toads were absent during the 2004 survey as a result of the drought although this species would also be expected to be common during optimal conditions and was found to be abundant during the 2008 survey. No foxes were recorded during the 2004 survey, however two were detected in 2008. Whilst dingoes were considered common during the 2004 survey, none were detected during the 2008 survey, although several wild dogs were recorded. The Dingo was introduced to Australia some 4000 years ago (Strahan 1995) and its status as an introduced or native species is debated. For the purposes of this assessment, the species has been considered as native.

## 8.5.3 Assessment of Results

### 8.5.3.1 Fauna of Conservation Significance

Fauna species of conservation significance recorded from the Study Area during the 1996, 2004 and 2008 field surveys are presented in **Table 8-8**. This includes 2 bird species, 1 reptile and 1 mammal.

**Table 8-8 Fauna of conservation significance recorded from the Study Area**

| Species | Conservation Status | | Survey Period | | |
|---|---|---|---|---|---|
| | National[1] | State[2] | 1996 | 2004 | 2008 |
| Squatter Pigeon (*Geophaps scripta*) | Vulnerable | Vulnerable | √ | √ | √ |
| Collet's Snake (*Pseudechis colletti*) | Not listed | Rare | √ | | |
| Little Pied Bat (*Chalinolobus picatus*) | Not listed | Rare | | √ | |
| Black-chinned Honeyeater (*Melithreptis gularis*) | Not listed | Rare | | √ | |

1. *Commonwealth Environment Protection and Biodiversity Conservation Act, 1999*
2. *Queensland Nature Conservation Wildlife Regulation, 1994*

Information regarding these species predicted distribution and habitat preferences in the Study Area are detailed below. Further information on the general ecology, habitats and threats to these species are detailed in **Appendix I.1**.

### Squatter Pigeon (Geophaps scripta scripta)

Several individuals were recorded from the access road to the Daunia Mining Lease in 2008 and one individual was recorded during the 2004 field surveys in the bed of the Isaac River near the existing rail bridge. However, the species was recorded as 'common' during previous surveys of the Study Area in 1996 (Housten *et al* 1996). Given the Squatter Pigeon's preference for habitats near permanent water (Blakers *et al* 1984) the decline in abundance in the Study Area in 2004 after an extensive period of drought would be expected. Housten *et al* (1996) noted that "*the Squatter Pigeon was observed mainly in association with pastures and grassy woodlands/forests near the Isaac River*".

It is apparent that the woodland and riparian habitats along the Isaac River to the south of the Project Site provide potentially important habitat for this species particularly when water is abundant. Some use could also be expected to occur along parts of New Chum Creek when water is available. Due to the degree of disturbance at the Project Site, there is little suitable habitat for the species.

### Collets Snake (Pseudechis colletti)

Collets Snake was recorded by Housten *et al* in (1996) in "*Eucalyptus cambageana woodlands with Acacia harpophylla understorey*". Populations are likely to be in naturally low abundance and associated with all forested woodland and riparian habitats along the drainage paths and foothills of the mesa. It was not observed during the 2004 or 2008 surveys on the Project Site.

### Little Pied Bat (Chalinolobus picatus)

The Little Pied Bat was recorded via call recordings, flying over the Isaac River at the southern end of the Study Area, and also spotlighted over the Isaac River during the 2004 surveys. Tree roosting opportunities are well represented within the vegetated woodland and riparian areas along the Isaac River and New Chum Creek. Schulz *et al* (1994) indicates tree hollows are used by this species in Queensland. Little Pied Bats may also roost in rock mesas and disused mine tunnels or shafts in the wider area. The species was not recorded at the Project Site during the 2008 surveys.

### Black-chinned Honeyeater (*Melithreptis gularis)*

Only one individual was recorded in eucalypt woodland on the Red Mountain Mining Lease associated with New Chum Creek in 2004. It may occur in riparian forest and woodland along the length of New Chum Creek and the Isaac River.

Further discussion on the extent of habitat removal and potential impacts on threatened fauna species are discussed in **Section 8.6**.

### 8.5.3.2 Migratory Species

The EPBC Act Protected Matters Search Tool listed several migratory bird species that may be found in the vicinity of the Project Site (refer **Table 8-9**). These species migrate between the northern and southern hemispheres, to breed, over winter or complete other phases of their lifecycles. Six of these species were observed during field investigations.

**Table 8-9 Listed migratory species**

| Species | Recorded on Project Site | | | Predicted to occur | Not expected (habitat unsuitable) |
|---|---|---|---|---|---|
| | 1996 | 2004 | 2008 | | |
| Black-faced Monarch (*Monarcha melanopsis*) | ✓ | | | | |
| Satin Flycatcher (*Myiagra cyanoleuca*) | ✓ | | | | |
| Rufous Fantail (*Rhipidura rufifrons*) | ✓ | | | | |
| Rainbow Bee-eater (*Merops ornatus*) | ✓ | ✓ | | | |
| Great Egret (*Egretta alba*) | ✓ | | ✓ | | |
| Cattle Egret (*Ardea ibis*) | | | ✓ | | |
| White-throated Needletail (*Hirundapus caudacutus*) | | | | ✓ | |
| White-bellied Sea Eagle (*Haliaeetus leucogaster*) | | | | | ✓ |
| Latham's Snipe (*Gallingo hardwickii*) | | | | | ✓ |
| Little Curlew (*Numenius minutus*) | | | | | ✓ |
| Painted Snipe (*Rostratula benghalensis*) | | | | | ✓ |

### Black-faced Monarch (Monarcha melanopsis)

The Black-faced Monarch is found along the east coast of Australia between the Great Dividing Range and the coast. It frequents a diverse range of habitat types from rainforests and vine forests, eucalypt forests and woodlands. The Project is unlikely to have an adverse impact on this species, as it is found over an extended range from which its habitat will not be substantially impacted.

### Satin Flycatcher (*Myiagra cyanoleuca*)

The Satin Flycatcher occupies heavily vegetated gullies in forests and taller woodlands. It is found across wide areas of coastal and inland eastern Australia. Habitat for the species does not lie within the Project Site and thus the Project is unlikely to have an adverse impact on this species.

### Rufous Fantail (Rhipidura rufifrons)

This species is typically found in the undergrowth of rainforests and wet eucalypt forests, inland and coastal scrub communities, as well as parks and gardens in town areas. It occurs across eastern Australia from inland to coastal areas. The habitats of the Project Site are unlikely to be significant for this species, particularly during drier times. Any use of the Study Area by this species is likely to be restricted to the moister riparian forest along the Isaac River outside of the Project Site, thus the Project is unlikely to have an adverse impact on this species.

### Rainbow Bee-eater (*Merops ornatus*)

The Rainbow Bee-eater occupies a diversity of drier woodland habitats, generally with sparse tree cover. The species migrates from northern to southern Australia. This species may occur throughout much of the treed portions of the Study Area. The species was not recorded at the Project Site during the 2008 surveys and preferred habitats are widespread, thus the Project is unlikely to significantly impact on the species.

### Great Egret (*Egretta alba*)

The Great Egret frequents aquatic habitats in search of its prey, which comprise small fish, crustaceans, insects and amphibians. It is likely to be associated with the deeper watered sites across the Project Site. The potential habitat for the species is common and widespread.

### White-throated Needletail (*Hirundapus caudacutus*)

During the summer migration period, this species is found across eastern Australia over forests woodlands, farms, towns, coastal areas and lakes. It has a broad habitat preference and can be locally common particularly prior to storm events. The White-throated Needletail may be found across the entire Project Site. Due to its broad habitat preference and large area of distribution, the Project is unlikely to significantly impact on the species.

### Cattle Egret (*Ardea ibis*)

The cattle egret frequents open paddocks, pastures, wetlands and drains. Suitable habitat can be found across much of the Project Site, however potential habitat for this species is common and widespread and thus the Project is unlikely to significantly impact on the species.

### 8.5.3.3 Habitat Corridors

Habitat corridors are a frequently discussed landscape feature and recommended management tool to enhance landscape connectivity, however, the presence of vegetation cover does not necessarily imply connectivity.

The fundamental question that must be asked in the discussion of such corridors is whether the particular corridor is capable of facilitating sufficient delivery of the target species to the recipient habitat patch(es). It is implicit that corridor capability can only be measured or evaluated on a site by site and species by species basis. A given strip of habitat may be effective for one species and completely ineffective for another.

A review of aerial photography and remnant regional ecosystem maps was completed (in conjunction with field surveys) to assess the location, extent and functionality of habitat corridors on the Project Site and within the Study Area. This assessment found the following:

- there are no contiguous habitat corridors on the Daunia Mining Lease, only a small fragment of Brigalow woodland is present and this area enjoys no connectivity with other patches of vegetation;
- a patchy corridor extends north from the Isaac River along New Chum Creek. This corridor runs through the Red Mountain and Millennium West Mining Leases and ultimately connects to a larger habitat system at Carborough Downs. This corridor varies in width from 1 km to less than 20 m, with occasional breaks in vegetation cover due to roads, clearing for agriculture, the Red Mountain rail loop and the New Chum Creek diversion for the Poitrel Mine. Future open cut operations at Poitrel Mine will create additional breaks in vegetation cover. Where vegetation cover remains intact, this corridor is likely to facilitate the dispersal of a variety of species from all fauna groups. The utility of this corridor for species which are gap-limited such as small skinks, forest interior birds and marsupial gliders will be limited north of the vegetation clearing works required for the Poitrel Mine.
- a relatively contiguous habitat corridor extends north from the Isaac River along North Creek to the east of the Project Site. This corridor varies in width from 100 m to 2 km, and remains unbroken in terms of vegetation canopy cover. Dispersal of all fauna groups is possible at present along this pathway.

- the Isaac River continues to support a broad and relatively intact habitat system up to 4 km in width. This is a major habitat corridor at the regional level. All fauna groups are likely to disperse successfully along this pathway.

## 8.6 Impacts

The Project Site has a long history of vegetation clearing and grazing, resulting in significant losses of remnant forest and woodland, suppression of natural regeneration, loss of topsoil and productive seed banks, a reduction in native shrub and groundcover diversity and weed invasion. These impacts can be seen across much of the Project Site, which is predominately covered in Buffel grasslands and scattered poor patches of low regrowth vegetation.

### 8.6.1 Construction Impacts

Direct impacts will result from the clearing of woodland and forest vegetation and the associated fauna habitats to accommodate the mine footprint and infrastructure. Regional ecosystem areas to be cleared are shown on **Figure 8-2**. This includes the clearing of mature trees, removal of small and regenerating trees, shrubs and ground cover as well as dead trees, logs and fallen timber. The clearing impacts are considered to be minimal as the mine footprint and associated infrastructure have been designed to avoid and minimise clearing in areas with high habitat value.

Edge effects refer to disturbance associated with an edge or boundary between retained vegetated habitats and cleared areas such as mining areas or infrastructure. While the existing vegetated habitats are already affected by edge effects resulting from past clearing and grazing as well as roads and rail, new edges would be created during construction of the mine. Effects could include loss of soil moisture, increased wind, dust and noise impacts, changes to species composition and abundance, increased predation and competition and particularly increased weed invasion.

Disturbance effects, in particular relating to noise, vibration, dust, lighting and vehicle movements would also be associated with both the construction and operation stages of the Project.

### 8.6.2 Operational Impacts

There may be indirect impacts on faunal presence and abundance within these habitats as a result of continual and long-term noise, general activity and lighting. This would negatively affect several nocturnal and diurnal fauna species although, in contrast would also benefit other disturbance tolerant fauna species, in effect potentially altering the faunal assemblages tending towards the more adaptable species.

### 8.6.3 Impacts on Threatened Communities and Ecosystems

#### 8.6.3.1 Regional Ecosystems/EEC's

**Brigalow EEC (RE11.4.9, RE11.3.1, RE11.9.5)**

The Brigalow EEC occurs within the Project Site in several locations. A monospecific stand of Brigalow (RE 11.4.9) and some additional linear stands occur along the north-western boundary of the Daunia Mining Lease (see **Figure 8-2**). These stands are in poor condition, with evidence of dieback and a high level of invasion by Buffel Grass. Native species have virtually been eliminated from the mid and low strata of the stands. The Project has been designed to avoid the clearing of the larger stand of the Brigalow EEC, however due to engineering and lease constraints a small portion (2.3 ha) of the smaller linear stand will be cleared for a haul road (see **Figure 8-2**). The portion of the smaller linear stand to be cleared is of poor quality and will not impact on the quality or connectivity of the remaining Brigalow EEC in the area.

The Brigalow EEC also occurs within a mixed RE woodland which contains Poplar Box, Red Gum and Dawson Gum within the Red Mountain Mining Lease (see **Figure 8-1**). Within this woodland, the Brigalow EEC is sparsely distributed as discrete clumps of vegetation associated with depressions. Haul roads are proposed to traverse the area and a total of 12 ha of mixed RE woodland (including the Brigalow EEC) will be cleared for the haul road.

The potential for impacts on the Brigalow EEC associated with groundwater drawdown has been assessed given the proximity of the proposed Daunia mine area to the edge of the EEC. The assessment of the potential groundwater impacts of the Project is presented in **Section 7** of the EIS. The assessment found that it is unlikely that the Brigalow EEC will be significantly impacted by groundwater drawdown, due to the factors listed below.

- Groundwater systems in the Brigalow Belt are generally too far below the surface for tree roots to access (Isbell 1962), thus the ecosystem type is unlikely to be groundwater dependent.
- Brigalow vegetation has a recognised tendency to develop an extensive horizontal root system (West *et al* 1999), which is typical of trees in environments where there is no access to a groundwater table. Johnson (1964) observed lateral roots to occur in the upper 90 cm of the soil profile, being particularly well developed in the top 30 cm. Tunstall and Connor (1981) studied hydrological interactions in a mature Brigalow community and found that most of the soil water interactions occurred in the top 1 m of the soil.
- The depth to the groundwater table across the Project Site is typically between 20 to 25 m below the natural surface (SKM 2005), which is well outside the effective root depth of Brigalow, at less than 1 m. As such, limited interaction between the Brigalow EEC and groundwater is anticipated.

### Of Concern RE – *Eucalyptus populnea* woodland on alluvium (RE11.3.2)

An RE is listed as *of concern* if the remnant vegetation is 10 to 30 % of its pre-clearing extent across the bioregion, or more than 30 % of its pre-clearing extent remains and the remnant extent is less than 10,000 hectares.

A portion of this community will be removed in the northern area of the Project Site, within the Red Mountain Mining Lease (see **Figure 8-2**).

## 8.6.4 Impacts on Threatened Flora and Fauna

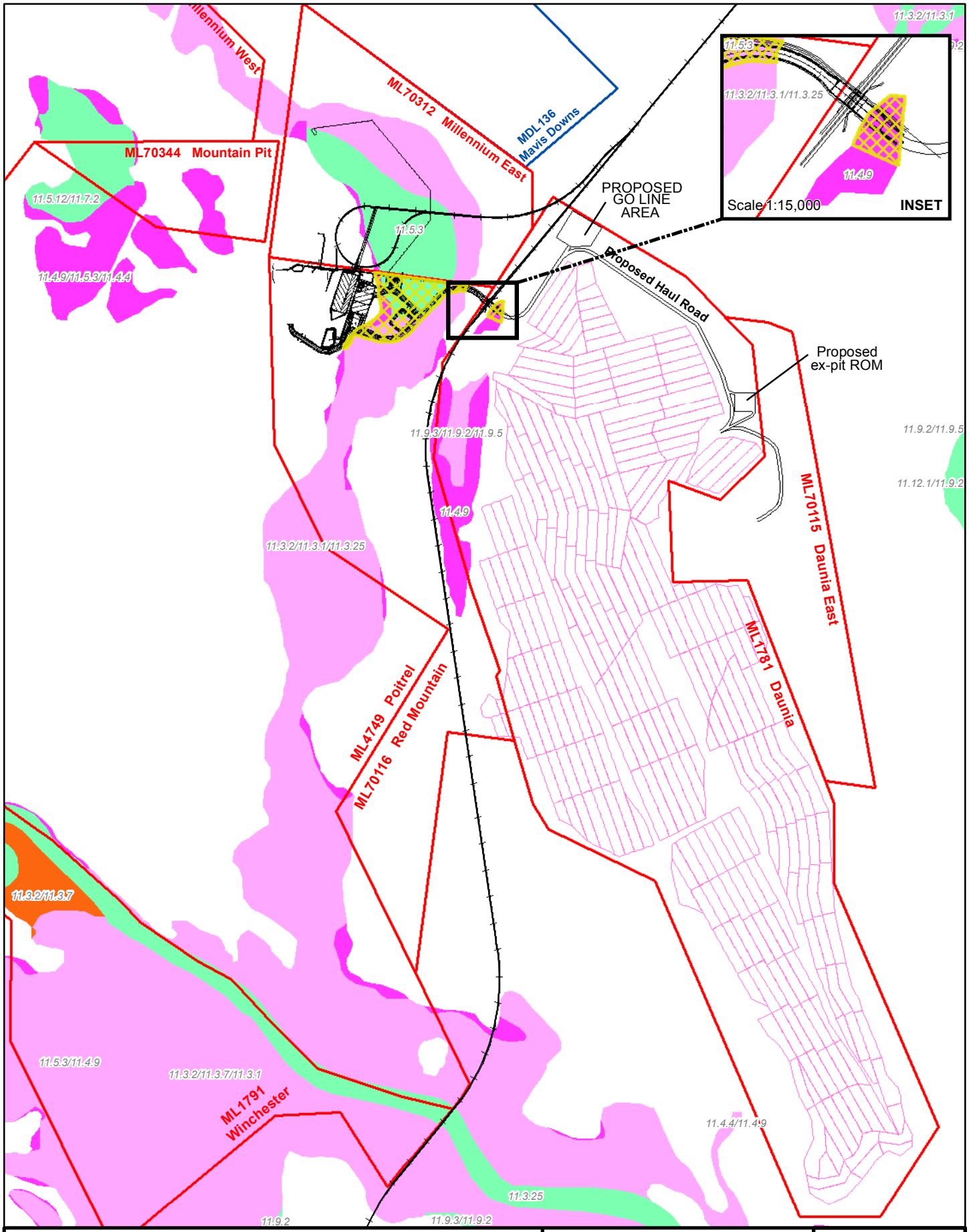
### 8.6.4.1 Listed Threatened Species

The EPBC Act Protected Matters Search Tool indicates that 9 threatened fauna species potentially occur in the Study Area. The likelihood of occurrence of these species is addressed in **Table 8-10** below.

The extent and distribution of fauna habitat in the Study Area has been directly influenced by past clearing and grazing. The remaining habitat areas are mostly limited to along the Isaac River and New Chum Creek, with other areas of limited habitat value.

The conservation value of the remaining fauna habitats in the Study Area is influenced by the presence of shelter, in the form of tree and shrub cover, presence of tree hollows and food and water resources and as movement corridors in an otherwise cleared landscape.

During extreme drought events as experienced in 2003-04, these areas provided significant refuges for stressed fauna populations as evidenced by the fauna survey results. Therefore, it is evident that the woodland/forest areas of the Isaac River (which lies outside of the Project Site) and, to a lesser degree, New Chum Creek (which will have limited disturbance from the Project) represent habitat of local importance to threatened fauna species recorded in the Study Area. Also, the Isaac River riparian habitats are considered locally important due to their mature condition and less evidence of impacts from grazing and fire. The disturbance to the habitats along New Chum Creek will be limited to the development of a haul road and light vehicle access road across the creek.




**LEGEND**

- Existing Railway
- Proposed Mine Infrastructure
- Mining Blocks
- Regional Ecosystem to be Cleared
- Mining Lease
- Mineral Development Licence

**Regional Ecosystems**

- Remnant Endangered - Dominant
- Remnant Endangered - Sub Dominant
- Remnant of concern - Dominant
- Remnant of concern - Sub dominant
- Remnant - Not of Concern

**FIGURE 8-2**

**DAUNIA COAL MINE EIS**

IMPACT ON REGIONAL ECOSYSTEM

0 0.5 1 1.5 2

Kilometres

Scale 1:50,000 on A4

Projections: Australian Map Grid - Zone 55 (AGD84)

BMA

BHP Billiton Mitsubishi Alliance

I:\QENV\Projects\QE06520\1800 Spatial\Arc_MXD\Figures\Fig_8-2_Impact_on_Regional_Ecosystem_v3.mxd Produced: 3/11/2008 This figure should be read in conjunction with the data disclaimer at the front of this report.

**Table 8-10 Likelihood of occurrence of threatened species**

| Species | Common Name | Status | Source | Habitat | Likelihood of Occurrence |
|---|---|---|---|---|---|
| **Birds** | | | | | |
| *Erythrotriorchis radiatus* | Red Goshawk | E (Q)<br>V(A) | EPBC | Red Goshawks occupy a range of habitats, often at ecotones, including coastal and sub-coastal tall open forest, tropical savannahs crossed by wooded or forested watercourses, woodlands, the edges of rainforest and gallery forests along watercourses, and wetlands that include Melaleuca and Casuarina species (EPA 2006a) | **Unlikely.** Depends on extensive tracts of productive forest and woodland. |
| *Geophaps scripta scripta* | Squatter Pigeon (southern) | V(A)<br>V(Q) | EPBC | The Squatter Pigeon (southern) occurs mainly in grassy woodlands and open forests that are dominated by eucalypts. It has also been recorded in sown grasslands with scattered remnant trees, disturbed habitats (Longmore 1976), in scrub (Baldwin 1975) and acacia growth. | **Likely**. Individuals observed within the vicinity of the Project Site. |
| *Neochmia ruficauda ruficauda* | Star Finch (eastern), Star Finch (southern) | E(A)<br>E(Q) | EPBC | The star finch inhabits tall grass and reed beds associated with swamps and watercourses. It may also be found in grassy woodlands, open forests and mangroves (EPA 2006b). | **Unlikely.** Grasslands and woodlands of the Project Site are completely compromised by Buffel grass. |
| *Rostratula australis* | Australian Painted Snipe | V(A)<br>R(Q) | EPBC | Inhabits shallow vegetated wetlands, either freshwater or brackish, that are either permanently or temporarily filled in coastal or inland areas. | **Unlikely.** Suitable habitat absent from the Project Site. |
| **Mammals** | | | | | |
| *Dasyurus hallucatus* | Northern Quoll | E(A)<br>C(Q) | EPBC | The Northern Quoll lives in a range of open woodland and open forest types preferring rocky areas. Their distribution ranges over northern Australia including the northern and eastern half of Queensland (EPA 2006c). | **Unlikely.** Suitable habitat absent from the Project Site. |
| *Nyctophilus timoriensis (South-eastern form)* | Eastern Long-eared Bat | V(A) | EPBC | The species is found in the mallee, open savanna and Black box woodland. They prefer semi-arid areas (Churchill 1998). | Possible, but **unlikely** to occur due to lack of foraging and roosting resource. |

| Species | Common Name | Status | Source | Habitat | Likelihood of Occurrence |
|---|---|---|---|---|---|
| **Reptiles** | | | | | |
| *Egernia rugosa* | Yakka Skink | V(A) | EPBC | Usually found in open dry sclerophyll forest or woodland (Cogger 2000). Occurs near the coast and in the sub-humid to semi-arid eastern interior of Qld, from the St. George area in the south to Cape York Peninsula (Cogger 2000). | **Unlikely.** Suitable habitat absent from the Project Site. Microhabitat elements completely lacking in all site habitats. |
| *Paradelma orientalis* | Brigalow Scaly-foot | V(A) | EPBC | This species occurs in the area known as the Brigalow Belt, east of the Great Dividing Range in south-central Qld (Cogger et al. 1993). | **Unlikely.** Suitable habitat absent from the Project Site. Microhabitat elements completely lacking in all site habitats. |
| *Rheodytes leukops* | Fitzroy Tortoise | V(A) | EPBC | This species is found only in the drainage of the Fitzroy River, Qld; (Cogger et al. 1993). This tortoise is found in rivers with large deep pools with rocky, gravelly or sandy substrates, connected by shallow riffles. | **Unlikely.** Suitable habitat absent from the Project Site. |

One nationally threatened species was recorded within the vicinity of the Project Site (notably not found on the Project Site) during the 2008 survey, which is the southern subspecies of the Squatter Pigeon, (*Geophaps scripta scripta*). This species is listed as 'vulnerable' under the EPBC Act. An assessment of the significance of impacts on this species under the assessment guidelines of the EPBC Act (Environment Australia 2000) is provided in **Table 8-11** and **Appendix C** .Supporting information on the ecology, habitat requirements and threats to this species were reviewed. These are detailed in **Appendix I.1**.

**Table 8-11 EPBC Act assessment of significance on listed threatened species**

| Criteria | Assessment of Significance |
|---|---|
| ***The action is likely to have a significant impact on a vulnerable species if it is likely to:*** | Squatter Pigeon, *Geophaps scripta scripta* |
| *Lead to a long-term decrease in the size of an important population of a species* | Within its range, the Squatter Pigeon exhibits a preference for woodland habitats featuring permanent water sites, required for daily drinking. This information is consistent with the observations of this species on the Project Site.<br><br>During surveys in 1996, abundant water was available in New Chum Creek, the Isaac River and local dams. Subsequently the species was recorded as *'common near watered areas'* (Housten *et al* 1996), in particularly within riparian habitat near the Isaac River (outside of the Project Site). In contrast, only one individual bird was observed during the 2004 survey despite a similar survey effort. This may be attributed to the extreme drought conditions however only three individuals were recorded during the wetter 2008 survey (all were recorded outside the Project Site).<br><br>This information suggests that local populations of the Squatter Pigeon have suffered natural and severe decline in the Study Area as a result of overgrazing and drought during the past several years. Indeed, the disappearance of the Squatter Pigeon at the southern end of its range in NSW has been previously attributed to |

| Criteria | Assessment of Significance |
|---|---|
| | these factors (Garnet & Crowley 2000). Further, cattle grazing followed by drought in 1902 apparently caused a decline in numbers in the Suttor and Dawson River valleys (Campbell and Barnard, 1917, Barnard and Barnard, 1925 cited in Garnet & Crowley 2000), but the species is again common at these locations suggesting natural population fluctuations may occur.<br><br>Nomadic movements and population fluctuations may occur in response to water availability. In this regard, the Project is designed to minimise impacts on the water supply on site, which may reduce the long-term impacts on recovery of the species in the locality.<br><br>A number of factors suggest that the Project is unlikely to lead to a long-term decrease in local populations of the Squatter Pigeon, as:<br><br>▪ the Project will involve minimal impacts on the water supply to the Isaac River and New Chum Creek;<br><br>▪ the retention of woodland habitats in the North-western portion of the Daunia Mining Lease will also ensure that suitable habitat remains available. Gradual removal of Buffel grass from this remnant and replacement with native herbs and grasses would benefit the Squatter pigeon;<br><br>▪ the majority of the mining activities are to be located in areas which already exhibit extensive degradation;<br><br>▪ ameliorative measures are designed to protect and enhance potential habitat areas; and<br><br>▪ natural population fluctuations and recoveries are known to occur in former impacted areas and it is likely that rehabilitation of the Project Site post-mining can provide suitable habitat for population recovery.<br><br>Consequently, no significant and long-term decrease in a population of this species is envisaged based on the items listed above. Based on the evidence available it is reasonable to expect the natural recovery of this species in the regional area will continue to occur as impacts from the drought ceases independent of the mining activity. |
| *Reduce the area of occupancy of an important population* | It is difficult to estimate the area of occupancy of the Squatter Pigeon on the Project Site due to the fact that no individuals were observed on the Project Site. However, Housten *et al* (1996) noted that '*the Squatter Pigeon was observed mainly in association with pastures and grassy woodlands/forests near the Isaac River*' during wet conditions in 1996. This is consistent with the species preference for habitats near water and with the observation of a single individual during 2004 in the Isaac River.<br><br>It is likely that the proposed retention and preservation of a suitably large riparian buffer along the Isaac River and the no mining zones at the northern and southern ends of New Chum Creek would adequately conserve the areas of habitat for this species in the area. |
| *Fragment an existing important population into two or more populations* | As stated previously, no habitats of potential importance will be fragmented as a result of the Project. Habitat retention along the Isaac River and New Chum Creek will ensure that connectivity of habitat will remain along the Isaac River. Therefore, an existing population of the species is unlikely to be fragmented as a result of the Project. |

| Criteria | Assessment of Significance |
|---|---|
| *Adversely affect habitat critical to the survival of a species* | Based on information of the species habitat preferences and ecology and on specific locations of individuals identified on the Project Site it is likely that the forest/woodland habitats along the Isaac River could be considered critical to the survival of the Squatter Pigeon in the locality.<br><br>The Project will have minimal direct impact on critical habitat of the species. The Project may indirectly impact on a 3 km section of habitat along the Isaac River, through potential noise impacts. However large areas of similar habitat occur along the Isaac River which would not be impacted by the Project. The habitat buffer along the Isaac River will reduce indirect impacts on fauna. |
| *Disrupt the breeding cycle of an important population* | Impacts on potentially important habitat for the species would be minimised and avoided by the Project. The species nests on the ground and therefore is vulnerable to predation by foxes. Ongoing fox control as required will minimise impacts on the breeding cycle of the Squatter Pigeon. |
| *Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline* | It is likely that the proposed retention and preservation of a considerable riparian buffer along the Isaac River and New Chum Creek would adequately conserve the areas of expected occupancy for the Squatter Pigeon in the area.<br><br>Furthermore, the Project mine footprint is located in land that has already been extensively cleared and exhibits extensive degradation from overgrazing during the drought and is considered sub-optimal for this species.<br><br>As such, the Project will not result in a significant degree of modification, destruction or isolation of habitat likely to lead to a decline in the species. Further field monitoring following favourable rainfall seasons is proposed to examine the species recovery rate in relation to rainfall and determine distribution on the Project Site. |
| *Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species habitat* | As stated previously, the species nests on the ground and therefore is vulnerable to predation by foxes. Ongoing fox control will be implemented as required to minimise impacts on the Squatter Pigeon. |
| *Interferes substantially with the recovery of the species* | No recovery plan has been prepared for the Squatter Pigeon under the provisions of the EPBC Act.<br><br>It is likely that when a plan is drafted, the recovery of the species would be addressed using a landscape approach for the Central Queensland area and the entire distribution of the species. The evidence gathered in the Study Area suggests that local population decline has already occurred and may be the result of overgrazing during the drought. The issue of overgrazing should be addressed on a regional scale and may be interfering with the recovery of the species.<br><br>The Project will avoid and minimise disturbance to important areas of habitat identified on the Project Site and adjacent areas, and therefore is unlikely to substantially interfere with the regional recovery of the Squatter Pigeon. |

The assessment indicates that due to the restriction of the mine footprint to existing cleared, modified and degraded lands, and the limited disturbance to suitable habitat from development of infrastructure, the impacts of the Project on the Squatter Pigeon will be negligible.

#### 8.6.4.2 Endangered Ecological Communities

An assessment of the potential significance of impacts on the nationally endangered Brigalow (*Acacia harpophylla*) EEC under the assessment guidelines of the EPBC Act (Environment Australia 2000) is provided in **Table 8-12** and **Appendix C**.

**Table 8-12 EPBC Act assessment of significance on endangered ecological communities**

| Criteria | Assessment of Significance |
|---|---|
| ***The action is likely to have a significant impact on an endangered community if it is likely to:*** | Brigalow (*Acacia harpophylla*) community |
| *Lead to a long-term adverse impact on an ecological community* | Brigalow dominated communities originally covered 7,324,560 ha with stands in both Queensland and NSW. This total amount has been reduced to around 10% of the original cover through various practices (DEH 2004). Currently, it is estimated that some 661,000 ha of Brigalow dominated vegetation types are still present within the Queensland Brigalow Belt Region. Approximately 2.3 ha of monospecific Brigalow (RE 11.4.9) is to be removed as part of the Project. In addition to this, approximately 12 ha of mixed RE, which includes RE 11.4.9, will be cleared as part of the Project. Due to the highly fragmented nature of the existing RE 11.4.9 on site, and the limited area and poor ecological quality of the portion to be cleared, no long-term adverse impacts are expected. |
| *Reduce the extent of a community* | As indicated above there will be a minimal reduction of the community's extent on the Project Site. |
| *Fragment an occurrence of the community* | The vegetation type is currently fragmented through past clearing and exacerbated by current grazing practices across the Project Site and the wider locality. Additionally, infrastructure such as train transport corridors and vehicular tracks are also present. Whilst the Project will result in removal of a small amount of RE 11.4.9, it is not considered that this will result in further significant fragmentation of this already highly fragmented community. |
| *Adversely affect habitat critical to the survival of an ecological community* | Approximately 2.3 ha of monospecific Brigalow (RE 11.4.9) is to be removed as part of the Project. In addition to this, approximately 12 ha of mixed RE, which includes RE 11.4.9, will be cleared as part of the Project. Due to the highly fragmented nature of the existing RE 11.4.9 on site, and the limited area and poor ecological quality of the portion to be cleared, no long-term adverse impacts are expected. |
| *Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for the community's survival* | Approximately 2.3 ha of monospecific Brigalow (RE 11.4.9) is to be removed as part of the Project. In addition to this, approximately 12 ha of mixed RE, which includes RE 11.4.9, will be cleared as part of the Project. Modification or destruction of abiotic factors to the extent that the community's survival is compromised outside of these areas is highly unlikely. |
| *Result in invasive species that are harmful to the endangered community becoming established in an occurrence of the community* | The Brigalow communities of the Project Site currently have several invasive species present (e.g. Buffel grass, Parthenium, Harrisia Cactus, Velvety Tree Pear, etc.) in addition to the presence of a constant grazing regime. There is potential for the spread of weed species as a result of construction and operation activities, however as part of the mine operation there will be a weed management plan in place. As a result weeds should be kept under control as part of the Project. |
| *Interfere with the recovery of an ecological community* | No formal recovery plan has been adopted for the Brigalow communities under the provisions of the EPBC Act as yet. |

### 8.6.5 Impacts on Migratory Species

Six listed migratory species have been recorded on the Project Site. These species include:

- Rainbow Bee-eater;
- Black-faced Monarch;
- Satin Flycatcher;
- Rufous Fantail;

- Great Egret; and
- Cattle Egret.

An additional species is considered to have at least a moderate likelihood of occurring at the Project Site (White-throated Needletail), based on the suitability of the habitat.

An assessment of the level of impact of the Project on these seven migratory species is provided in **Table 8-13**. The administrative guidelines on significance of impacts with reference to a migratory species (Environment Australia 2000) consider the impacts of the Project on *important habitat* of the migratory species. An area of *important habitat* is defined as:

- habitat utilised by a migratory species occasionally or periodically within a region that supports an *ecologically significant proportion* of the population of a species; or
- habitat utilised by a migratory species which is at the limit of the species range; or
- habitat within an area where the species is declining.

**Table 8-13 EPBC Act assessment of significance on migratory species**

| Criteria | Assessment of Significance |
|---|---|
| ***The action is likely to have a significant impact on a migratory species if it is likely to:*** | Rainbow Bee-eater;<br>White-throated Needletail;<br>Black-faced Monarch;<br>Satin Flycatcher;<br>Rufous Fantail;<br>Great Egret; and<br>Cattle Egret |
| *1. Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat of the migratory species; or* | There is no evidence to suggest that the Project Site supports an '*ecologically significant*' proportion of a population of these migratory species. Given their migratory habits, the ephemeral nature of important food and habitat resources and the extent of similar and comparable habitat throughout the range of these species, it is likely that the habitats on the Project Site would be utilised infrequently and on a transitory basis only.<br>**Rainbow Bee-eater**<br>The rainbow bee-eater may occur throughout much of the wooded portions of the Study Area. Some areas of suitable habitat would be removed by the Project, however preferred habitats are widely distributed throughout the range of the species and the Project is unlikely to significantly impact on the species<br>**White-throated Needletail**<br>A wide-ranging aerial species, which spends the large majority of their time feeding, drinking and resting on the wing. Some use of forested areas occurs when roosting at night. The Project would have minimal impact on the potential habitat of this species throughout its range.<br>**Black-faced Monarch**<br>Generally reliant on moist and closed forest systems, which would be preserved along the Isaac River outside of the Project Site. |

| Criteria | Assessment of Significance |
|---|---|
| | **Satin Flycatcher**<br>Generally reliant on moist and closed forest systems, which would be preserved in their natural state. The clearing activities would mostly be restricted to modified and degraded open forests, which are unlikely to be of importance to this species.<br>**Rufous Fantail**<br>Generally reliant on moist and closed forest systems, which would be preserved in their natural state. The clearing activities would be restricted to modified and degraded open forests, which are unlikely to be of importance to this species.<br>**Great Egret**<br>Habitat for this species includes shallow streams, dams, waterholes, and vegetated swamps. This habitat type intermittently occurs on the Project Site and is influenced by wet and dry periods. Individuals are likely to move considerable distances in search of optimal feeding habitat and the site would only be important during wet periods and high rainfall. Potentially important habitat would be preserved outside the mine footprint within Isaac River and upper reaches of New Chum Creek.<br>**Cattle Egret**<br>The cattle egret frequents open paddocks, pastures, wetlands and drains. Suitable habitat can be found across much of the Project Site however potential habitat for this species is common and widespread throughout the wide range of this species. The Project will not impact any important habitat for the species. |
| *2. Result in invasive species that are harmful to the migratory species becoming established in an area of important habitat of the migratory species; or* | Based on the survey results there is little evidence to suggest that the Study Area supports important habitat for these migratory species, based on the small numbers of individuals observed. Much of the Brigalow Belt North Bioregion, including the Study Area, has a history of forest clearing and habitat modification, which has benefited a number of feral and invasive flora and fauna species. The Project is unlikely to further increase the rates of species invasion that would result in harmful affects to the habitat of these migratory species. |
| *3. Seriously disrupt the lifecycle (breeding, feeding migration or resting behaviour) of an ecological significant proportion of the population of a species.* | There is no evidence to suggest that the Study Area supports an ecological significant proportion of the population of these migratory species.<br>**Rainbow Bee-eater**<br>More likely to breed in sandy habitats along the Isaac River and New Chum Creek, breeding opportunities will remain outside the mine footprint.<br>**White-throated Needletail**<br>The species breeds in the northern hemisphere (Siberia, the Himalayas and Japan). It would not be impacted, as the Project would not alter foraging activities or the prey base of this species.<br>**Black-faced Monarch**<br>Disturbance will be restricted to modified and degraded ecosystems, which are unlikely to be of importance to this species. No effects on breeding or foraging are anticipated.<br>**Satin Flycatcher**<br>Disturbance will be restricted to modified and degraded ecosystems, which are unlikely to be of importance to this species. No effects on breeding or foraging are anticipated.<br>**Rufous Fantail**<br>Disturbance will be restricted to modified and degraded ecosystems, which are unlikely to be of importance to this species. No effects on breeding or foraging are anticipated.<br>**Great Egret**<br>The ephemeral nature of the aquatic habitats suggest that the Project Site would only provide optimum breeding and feeding habitat during favourable wet conditions and that during other times populations are likely to move in search of water bodies and therefore would not be reliant on the Project Site area for life-cycle events.<br>**Cattle Egret**<br>The cattle egret often favours disturbed environment and suitable habitat is plentiful both within the immediate project area and the wider environment. No effects on lifecycle of this species are anticipated. |

This assessment indicates that the Project's mine and infrastructure footprints are restricted to modified and degraded lands. Hence, the Project would present a negligible impact on migratory species listed in the EPBC Act. It is anticipated that the Project would not alter the current visitation rates and population sizes of migratory species in the locality and wider region.

There is no evidence to suggest that the Study Area supports an '*ecologically significant*' proportion of a population of these migratory species. Given their migratory habits, the ephemeral nature of important food and habitat resources and the extent of similar and comparable habitat throughout the range of these species, it is likely that the habitats on the Project Site would be utilised infrequently and only on a transitory basis.

### 8.6.6 Impacts on Listed Marine Species

Whilst several marine listed bird species (EPBC Act) have been recorded and could possibly occur within the Project Site and surrounding areas, the Project Site is not identified as a Commonwealth Marine area and the provisions of the EPBC Act assessment of significance do not apply in relation to impacts on marine listed species as a result of the Project.

### 8.6.7 Impacts on Habitat Corridors

The degree of habitat fragmentation that has occurred in the region has restricted fauna movement opportunities to the larger vegetated riparian corridors along local watercourses such as the Isaac River and New Chum Creek. This permits the movement of mobile species of wildlife across the landscape, particularly birds, frogs and arboreal mammals.

There are no contiguous areas of vegetation present on the Daunia Mining Lease which have the capacity to function as dispersal pathway between large vegetation patches. There is relatively contiguous vegetation present along some sections of New Chum Creek within the Red Mountain Mining Lease, The functionality of the New Chum Creek corridor has already been reduced by creek diversion works associated with Poitrel Mine, and will be further compromised by future open cut operations. Disturbance to vegetation as a result of the Daunia Project will be limited to the development of a haul road and light vehicle access road within an area which will essentially function as an isolated patch of vegetation.

Given that there are already major canopy gaps within the New Chum Creek corridor, it is considered that the suite of species currently utilising this area as a dispersal pathway will be restricted to those which are not gap-limited or edge adverse, such as open country birds and bats. Forest interior birds, small mammals, reptiles and amphibians are unlikely to be moving through the corridor at present. The Haul Road and access road are unlikely to present a barrier for those species which currently use the corridor.

There will be no impact on the functionality of the Isaac River or North Creek habitat corridors. The Isaac River will continue provide east-west connectivity at a sub-regional level and North Creek provides a north-south dispersal pathway at the local level.

## 8.7 Mitigation Measures

The following practical measures have been devised for protecting and enhancing the terrestrial ecological values on the Project Site and minimising the impacts of the Project on identified areas of ecological value.

### 8.7.1 Construction Impacts

#### 8.7.1.1 Protection of Brigalow Vegetation

An area of mature Brigalow woodland (approximately 100 ha) occurs on the north western portion of the Daunia Mining Lease. This woodland is of poor quality with a distinct lack of a shrub layer, an understory dominated by Buffel grass and uneven and patchy canopy cover. Only a very small portion of this Brigalow will be cleared (see **Figure 8-2**), however, some impacts may occur due to the locality of the pit which currently is proposed to finish near the edge of the vegetation. Impacts on this ecosystem have been considered in **Section 8.6.3** of this report.

#### 8.7.1.2 Minimising Vegetation Loss

Vegetation loss has been minimised by locating the mine footprint outside of remnant vegetation. The only remnant vegetation to be cleared will be within the Red Mountain Mining Lease due to the development of a haul road and light vehicle access road, however removal of vegetation will be restricted to the minimum amount necessary. Where possible, those areas that are already disturbed would be used in preference to clearing remnant vegetation. Where an area of remnant vegetation is required to be cleared and then revegetated post-mining, the following measures would be applied:

- the boundary would be fenced and the area cleared in such a way that it would not be extended during clearing works; and
- soil erosion and sedimentation control measures would be constructed in stages to minimise the area of unstable or unprotected soil surface.

### 8.7.2 Operational Impacts

#### 8.7.2.1 Weeds

Field surveys indicate that a number of weed species are present on the Project Site. It is desirable that there is no net increase in weed abundance as a result of the Project. The Project will develop a weed management plan that is consistent with any local authority plans. Ongoing monitoring as part of the management plan will determine if weed species are spreading into riparian buffer areas and rehabilitated areas, and effective response to weed infestation will be implemented as required.

#### 8.7.2.2 Pest Species

Ongoing fox control as required will ensure population numbers are kept low and thereby minimise potential impacts on the breeding and recovery of the Squatter Pigeon in the area.

#### 8.7.2.3 Fauna Mortality on Roads

Measures to avoid fauna mortality on internal and external roads connecting the Project Site will be implemented. This is particularly important for the haul road and light vehicle access road crossing along New Chum Creek. Appropriate measures include the provision of fauna crossing signs to warn drivers and speed reduction measures.

### 8.7.3 Habitat Rehabilitation

There are a number of opportunities to improve habitat connectivity and quality on the Project Site as a compensation for the loss of habitat resulting from the Project. Revegetation and rehabilitation will be carried out progressively during the construction and operational phases of the Project.

- Areas of vegetation that are considered significant (i.e. ‘endangered’ or ‘of concern’) and are to be retained on the Project Site will be identified and have protective fencing and/or signage erected, to restrict access to these areas. These areas should also be maintained and regenerated by way of a weed removal program and a Project specific revegetation plan, which would include methods to ensure long-term viability of these areas.
- Several areas of former Brigalow woodland are currently in a state of young regrowth. Those areas not to be cleared for the Project will be allowed to naturally rehabilitate with the aid of the Project’s weed management plan.
- Any freshwater sediment dams constructed on the Project Site will be developed with the aim of providing aquatic habitat for frogs and waterbirds. Where practicable, the dams will be designed with shallow perimeters, and rocks or logs placed near the edges to provide basking areas. Where practicable, these dams should be fringed by native grasses and herbs, improving habitat quality for the Squatter pigeon.

### 8.7.4 Ongoing Monitoring of Flora and Fauna

Given the presence of flora and fauna of conservation significance within and surrounding the Project Site, a flora and fauna monitoring program will be established. Issues to be addressed in the monitoring program include:

- monitoring the protection of 'endangered' and 'of concern' vegetation through pre-clearing checks and the fencing-off of vegetation to be retained outside the mine footprint to avoid construction impacts;
- monitoring the revegetation of 'endangered' and 'of concern' regional ecosystems;
- seasonal monitoring of birds, in particular identifying the extent and distribution of the Squatter Pigeon population and monitoring use of the lease and surrounding areas by aquatic and migratory species; and
- weed monitoring.

BMA has developed and provided to the DEWHA a database for recording observations of the Squatter Pigeon. Monitoring data collected by or on behalf of BMA is provided to DEWHA annually to allow the database to be updated.

## 8.8 Conclusions and Recommendations

The Project Site has a long history of vegetation clearing and grazing, resulting in

- significant losses of remnant forest and woodland;
- suppression of natural regeneration;
- loss of topsoil through erosion including the loss of productive seed banks;
- a reduction in native shrub and groundcover diversity and abundance; and
- weed invasion, particularly the proliferation of Buffel grass and Parthenium weed.

Remnant vegetation on the Project Site is concentrated along the north-western boundary of the Daunia Mining Lease. In contrast, areas of regrowth vegetation are scattered thinly across the Project Site as several relatively small fragments of vegetation, occurring along fence lines and in grazing paddocks. These fragments are little more than scattered trees.

The vegetation of the Project Site comprises 7 mapped remnant vegetation types (largely within mixed woodland on the Red Mountain Mining Lease) and 1 highly modified vegetation type (grassland with scattered trees). The grassland vegetation community dominates the Project Site.

No rare or threatened flora species have been recorded from the Project Site.

Two matters of NES are known on the Project Site, the Endangered Brigalow Ecological Community and the vulnerable Squatter Pigeon.

Small areas (approximately 2.3 ha of monospecific RE 11.4.9 and approximately 12 ha of mixed woodland in which RE 11.4.9 is known) are to be cleared as part of the Project. The potential for groundwater drawdown associated with mining in close proximity to the remnant vegetation has been considered and adverse impacts are considered unlikely.

The Squatter Pigeon is provided with limited suitable habitat on the Project Site, although it may occur in conjunction with remaining native vegetation associated with New Chum Creek. Impacts on this species as a result of the Project are considered unlikely to be significant, and it may benefit by the Project's vegetation restoration works.

Three species considered to be rare in Queensland have been recorded from the broader locality (Collet's snake, Little Pied Bat and Black-chinned Honeyeater). None of these species is provided with essential habitat factors on the Daunia Mining Lease. Limited areas of suitable habitat may be disturbed due to infrastructure development on the Red Mountain Mining Lease.

All practical measures available will be implemented to reduce the amount of unnecessary clearing and preservation of remaining native vegetation, with particular emphasis on the vegetation types of significance.