

# Isaac Plains East – Matters of National Environmental Significance Fauna Species Management Plan

Stanmore IP Coal Pty Ltd



Source: Hansen Bailey



Client Stanmore Coal  
Reference J0053

## Document Control

<b>Title</b>	Isaac Plains East MNES Species Management Plan
<b>Job Number</b>	J0053
<b>Client</b>	Stanmore IP Coal Pty Ltd

## Document Issue

<b>Issue</b>	<b>Date</b>	<b>Prepared By</b>	<b>Reviewed/Approved By</b>
DRAFT 1	28/1/2018	Craig Streatfeild	Miranda Weston
DRAFT 2	21/2/2018	Craig Streatfeild	Richard Oldham
DRAFT 2	21/3/2018	Craig Streatfeild	Richard Oldham
DRAFT 3	26/4/2018	Craig Streatfeild	Belinda Parfitt
FINAL	2/5/2018	Craig Streatfeild	Richard Oldham
DRAFT 4 for Stanmore review	12/7/2018	Craig Streatfeild	Richard Oldham and Belinda Parfitt
Rev 2 – DoEE comments	12/8/2018	Craig Streatfeild	Craig Streatfeild
Rev 3 – Response to DoEE comments	4/9/2018	Craig Streatfeild	Richard Oldham
Rev 4 – Response to DoEE comments	27/9/2018	Craig Streatfeild	Richard Oldham
Rev 5 – Final for Submission to DoEE	28/9/2018	Craig Streatfeild	Richard Oldham

## Table of Contents

Glossary	iv
Approval Holder Declaration	vi
1.0 Introduction	1
1.1 Background	1
1.2 Purpose	1
1.3 Commonwealth approval	4
1.3.1 Condition 2	4
1.3.2 Conditions 3 and 4	4
1.4 Relationships to other plans	5
1.5 Responsibilities	5
2.0 Matters of national environmental significance (MNES)	6
2.1 Impact assessment ecological survey effort	6
2.1.1 Threatened species habitat mapping	7
2.2 Threatened ecological communities and flora	9
2.3 Threatened fauna	9
2.3.1 Greater Glider ( <i>Petauroides volans</i> )	9
2.3.2 Squatter Pigeon - southern sub-species ( <i>Geophaps scripta scripta</i> )	12
2.3.3 Ornamental Snake ( <i>Denisonia maculata</i> )	15
2.3.4 Koala ( <i>Phascolarctos cinereus</i> )	18
2.4 Habitat quality assessment	21
2.4.1 Habitat quality plots	21
2.4.1 Habitat quality scoring results	22
3.0 Impact assessment	24
3.1 Direct impacts	24
3.1.1 Impacts to threatened fauna species	24
3.2 Indirect impacts	25
3.2.1 Habitat fragmentation	25
3.2.2 Pest plants and animals	25
3.2.3 Predation	25
3.2.4 Noise and vibration	25
3.2.5 Dust	26
3.2.6 Light	26
3.2.7 Vehicle strike	26
3.2.8 Erosion and sediment control	26
3.2.1 Fire	27
3.3 Impact duration	27
3.4 Summary of impacts	27
4.0 Mitigation and management measures	29
4.1 Management objectives	29
4.2 Relevant plans and guidelines	30
4.3 General management actions	33
4.4 Design phase strategy	33
4.5 Pre-construction and construction phase strategy	33
4.6 Rehabilitation, operation and maintenance phase strategy	33
4.7 Management measures	34
5.0 Monitoring	50
5.1.1 General site inspections	50
5.1.2 Habitat quality monitoring	50
5.1.3 Weed monitoring	51
5.1.4 Pest animals	52
5.1.5 Dust	52
5.1.6 Noise and vibration	52
5.1.1 Water and erosion and sediment control	52
5.1.2 Fire	52
6.0 Data management, reporting, implementation and auditing	54
6.1 Data management	54
6.2 Reporting	54
6.3 Implementation	54

6.4	Auditing and review	54
7.0	Risk assessment	56
8.0	References	70
Appendix A	IPE Terrestrial Ecology Report	A
Appendix B	Habitat Quality Plot Ecology Report	B
Appendix C	IPE Environmental Authority	C
Appendix D	Riparian Monitoring Program Ecological Report	D

## Glossary

Term	Definition
Action Area	This area is the Project area of the proposed action that was referred to the Department of the Environment and Energy (DoEE) under the <i>Environment Protection and Biodiversity Conservation Act 1999</i> . The Action Area is the same as the Project area.
Threatened Species	Prescribed to a threatened species under the Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act).
EPBC Act conservation status	The EPBC Act lists threatened species in a range of categories including: Extinct in the wild: <ul style="list-style-type: none"> <li>▪ Only known to survive in cultivation, in captivity or as a naturalised population well outside its past range; or</li> <li>▪ Not recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a timeframe appropriate to its life cycle and form.</li> </ul> Critically Endangered: <ul style="list-style-type: none"> <li>▪ It is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.</li> </ul> Endangered: <ul style="list-style-type: none"> <li>▪ It is not critically endangered; and it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.</li> </ul> Vulnerable: <ul style="list-style-type: none"> <li>▪ It is not critically endangered or endangered; and</li> <li>▪ It is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.</li> </ul>
Project Area	The area defined on Figure 1 and Figure 2.
Disturbance Area	The areas shown on Figure 2, Figure 3, Figure 4 and Figure 6.
Regional ecosystem	A vegetation community within a bioregion that is consistently associated with a particular combination of geology, landform and soils. Prescribed to regional ecosystems listed under the Queensland <i>Vegetation Management Act 1999</i> .
Regulated vegetation	Vegetation regulated through Queensland's <i>Planning Act 2016</i> and <i>Vegetation Management Act 1999</i> .
Remnant vegetation	Defined under the Queensland <i>Vegetation Management Act 1999</i> as, woody vegetation that has not been cleared or vegetation that has been cleared but where the dominant canopy has >70 % of the height and >50 % of the cover relative to the undisturbed height and cover of that stratum and is dominated by species characteristic of the vegetation's undisturbed canopy.
Significant species and vegetation	Refers to: Species listed as Critically Endangered, Endangered or Vulnerable under the Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> . Threatened ecological community listed as Critically Endangered, Endangered or Vulnerable under the Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> . Regional ecosystems with an Endangered or Of Concern biodiversity status or <i>Vegetation Management Act 1999</i> status.

Threatened ecological community	A community listed under the Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> .
Vegetation Management Act status	<p>This is a statutory classification under the Queensland <i>Vegetation Management Act 1999</i>.</p> <p>A regional ecosystem is listed as 'endangered' if:  Remnant vegetation for the regional ecosystem is less than 10 % of its pre-clearing extent across the bioregion; or 10-30 % of its pre- clearing extent remains and the remnant vegetation for the regional ecosystem is less than 10,000 ha.</p> <p>A regional ecosystem is listed as 'of concern' if:  Remnant vegetation for the regional ecosystem is 10-30 % of its pre- clearing extent across the bioregion; or more than 30 % of its pre- clearing extent remains and the remnant vegetation extent for the regional ecosystem is less than 10,000 ha.</p> <p>A regional ecosystem is listed 'least concern' if:  Remnant vegetation for the regional ecosystem is over 30 % of its pre-clearing extent across the bioregion, and the remnant vegetation area for the regional ecosystem is greater than 10,000 ha.</p>

# Approval Holder Declaration

I declare that:

- 1. To the best of my knowledge, all the information contained in, or accompanying this Species Management Plan is complete, current and correct.
- 2. I am duly authorised to sign this declaration on behalf of the approval holder.
- 3. I am aware that:
  - a. Section 490 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) makes it an offence for an approval holder to provide information in response to an approval condition where the person is reckless as to whether the information is false or misleading.
  - b. Section 491 of the EPBC Act makes it an offence for a person to provide information or documents to specified persons who are known by the person to be performing a duty or carrying out a function under the EPBC Act or the *Environment Protection and Biodiversity Conservation Regulations 2000* where the person knows the information or document is false or misleading.
  - c. The above offences are punishable on conviction by imprisonment, a fine or both.

Signed: B. O'Neill

Full name: BERNARD O'NEILL

Organisation: GENERAL MANAGER OPERATIONS  
STANMORE COAL

Date: 27, 09, 2018

## 1.0 Introduction

Base Consulting Group (Base) was commissioned by Stanmore IP Coal Pty Ltd (Stanmore) to prepare this Species Management Plan (SMP) for impacts to listed Commonwealth fauna species from operations at the Issacs Plains East (IPE) Project (the Project). The SMP has been developed in accordance with the Project's Commonwealth approval (EPBC 2016/7827) issued on **28 February 2018** and to address **Conditions 3 and 4** of the approval.

### 1.1 Background

The Isaac Plains Coal Mine is an operating open cut coal mine located approximately 5 km northeast of Moranbah in Central Queensland (see Figure 1). The Isaac Plains Mine commenced operation in 2006 and produced approximately 2.8 million tonnes per annum (Mtpa) of coking coal for export to international markets. The Isaac Plains Mine was put into care and maintenance by the previous owners and was acquired by Stanmore in late 2015, whom recommenced operations from the existing open cut pit.

The current mining operation includes truck and shovel stripping and dragline overburden removal. Run of Mine (ROM) coal is hauled from the open cut pits to the existing Coal Handling and Preparation Plant (CHPP) for washing and processing. The resulting product coal is loaded on trains at the on-site train loadout facility. Viable resources within the current operation are expected to be exhausted by approximately 2018.

The Project involves an extension into a new mining lease to the east of the existing Isaac Plains Mine operation with the development of new open cut pits that adjoin the existing operation (see Figure 2). As such, the IPE will be operated as an extension to the existing operation and will utilise the existing infrastructure, where possible, mining equipment and workforce. The IPE extension will extend the life of the existing mine by approximately seven (7) years.

The proposed expansion will utilise open cut mining operations that will be similar to the current operations. However, new infrastructure will be required including:

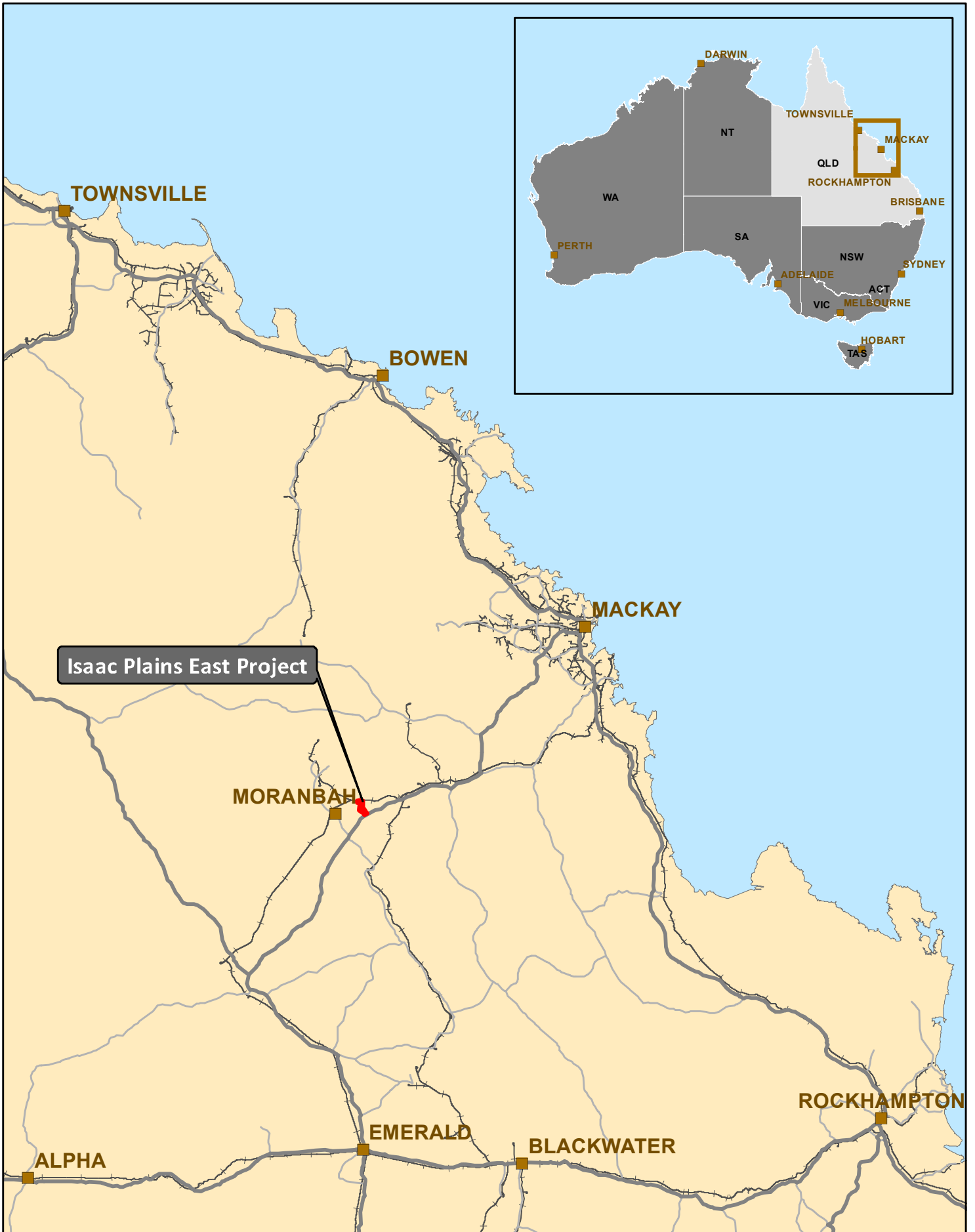
- Haul roads and access tracks that connect to the existing operations road network;
- Vehicle parking areas and mobile crib huts;
- Additional laydown areas and an electricity sub-station; and
- Stormwater management including clean water drains, pipelines to transfer pit water and sediment control works.

### 1.2 Purpose

During the Project planning stage, site ecological investigations indicated that the Project has potential to impact on Matters of National Environmental Significance (MNES) listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). As such, the Project was referred to the Commonwealth Department of Environment and Energy (DoEE) in November 2016 (EPBC: 2016/7827). On 4 January 2017, DoEE determined that the Project is a controlled action to be assessed by preliminary documentation with listed threatened species and communities (sections 18 and 18A of the EPBC Act) and a water resource, in relation to coal seam gas development and large coal mining development (section 24D & 24E of the EPBC Act) as the controlling provisions. On 25 January 2017, the DoEE requested additional information for preliminary documentation. The Project was approved by a delegate of the Minister with **Conditions on 28 February 2018** and the relevant **Conditions** to this management plan are outlined in Section 1.3 below.

In accordance with the Commonwealth approval obtained for the Project, Stanmore is required to provide appropriate management of the EPBC Act listed species within the Project area. This document presents the management objectives and measures that are proposed to be implemented within the Project's mining leases for species management and to minimise impacts to current biodiversity values of the site.





0 62 124 km

Scale @A3: 1:2040000  
 Date: 18/7/2016  
 Drawn: Joshua T



Legend

- Property Boundary
- Highway
- Road
- Town

Figure 1: Project Location



DATA SOURCE  
 BASE CONSULTING GROUP 2016; OSPATIAL 2016  
 The State of Queensland (Department of Natural Resource and  
 Mines) 2017

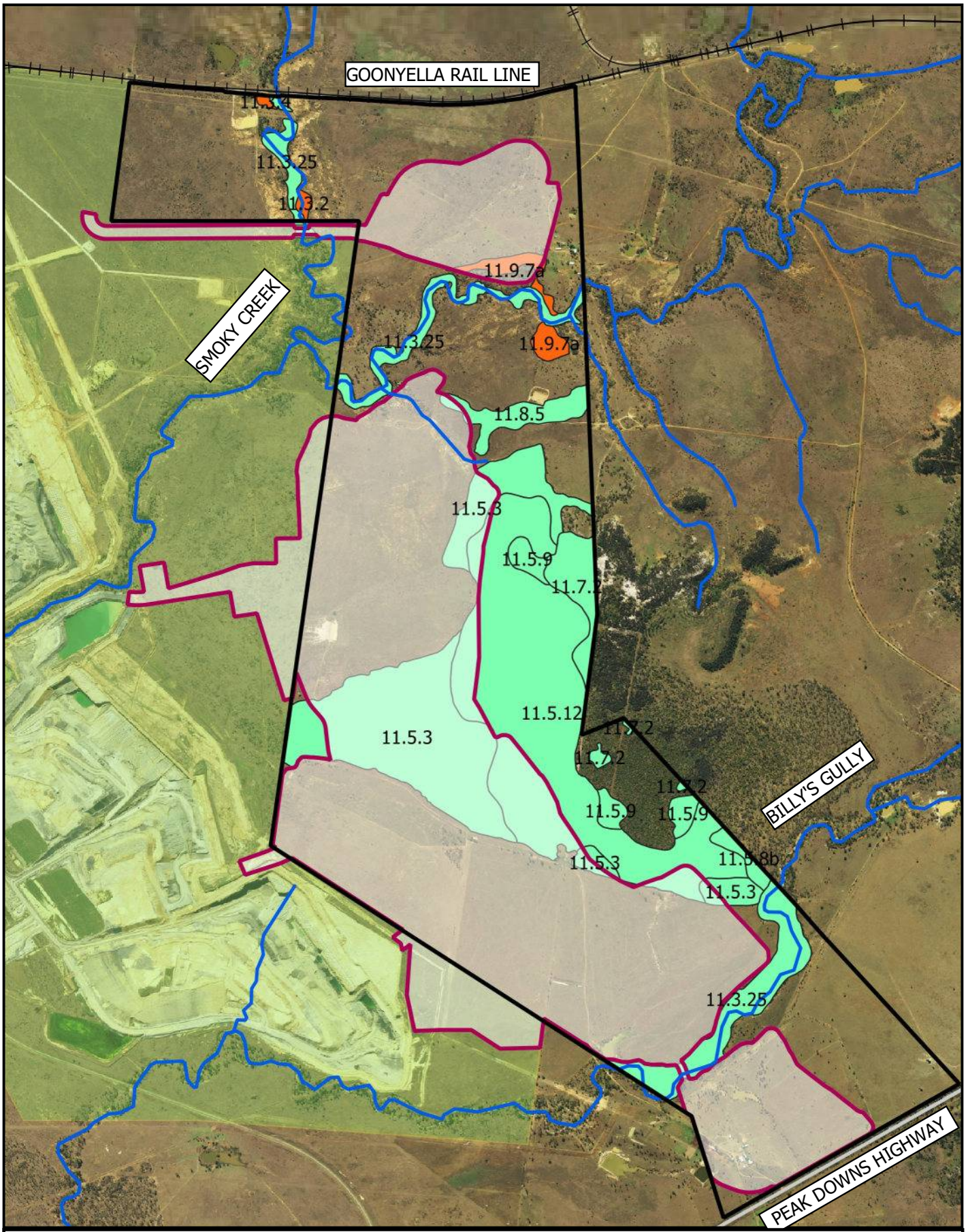


Figure 2: Project Layout and Disturbance Footprint

0 0.75 1.5 km





Scale @ A3: 1 : 24000  
 Date: 21/8/2018  
 Drawn: Joshua T



DATA SOURCE  
 BASE CONSULTING GROUP 2018; QSPATIAL 2018  
 The State of Queensland (Department of Natural Resource and  
 Mines) 2017

Legend

-  Existing Issac Plains Mine
-  Issac Plains East Boundary
-  Disturbance Area
-  Watercourse

-  Road
-  Railway
-  Remnant Vegetation: Area of Least Concern
-  Remnant Vegetation: Area of Concern

**BASE/**

### 1.3 Commonwealth approval

The EPBC approval decision (EPBC 2016/7827) for the Project was received on **28 February 2018**. Conditions relevant to listed species include disturbance limits, management of impacts, monitoring of impacts and offsets. Listed species occurring or potentially occurring in the Action area, as described in the Approval, are:

- Koala (*Phascolarctos cinereus*);
- Greater Glider (*Petauroides volans*);
- Squatter Pigeon (Southern) (*Geophaps scripta scripta*); and
- Ornamental Snake (*Denisonia maculata*)

Conditions 2 to 4 of the EPBC Act approval are relevant to the development of this SMP and are discussed in Sections 1.3.1 and 1.3.2.

#### 1.3.1 Condition 2

Condition 2 of the EPBC Act approval relates to the maximum area of habitat for listed threatened species and ecological communities that Stanmore is permitted to impact on over the life of the IPE. These maximum approved disturbance limits for listed threatened species permitted in Condition 1 of the EPBC Act approval are presented in Table 1.

**Table 1: Approved disturbance limits for MNES**

MNES	EPBC Act status	Approved disturbance limits offsets (ha)
Koala ( <i>Phascolarctos cinereus</i> )	Vulnerable	125
Greater Glider ( <i>Petauroides volans</i> )	Vulnerable	125
Squatter Pigeon (Southern) ( <i>Geophaps scripta scripta</i> )	Vulnerable	74
Ornamental Snake ( <i>Denisonia maculata</i> )	Vulnerable	1.4

#### 1.3.2 Conditions 3 and 4

Conditions 3 and 4 of the EPBC Act approval relate to the requirements to develop and have approved, an SMP for the MNES listed in Condition 2. These conditions and where they have been addressed in this SMP are outlined in Table 2.

**Table 2: EPBC Act approval conditions addressed as part of this SMP**

Condition	Summary of condition	Relevant section
Condition 3	The approval holder must submit a Species Management Plan for the written approval of the Minister. The approved Species Management Plan must be prepared by a suitably qualified person in accordance with the Department's Environmental Management Plan Guidelines and include:	This document.
Condition 3 (a)	Measures that will be implemented to avoid, mitigate and manage impacts to EPBC Act listed threatened species and their habitat during vegetation clearance, construction, operation and decommissioning of the action.	Section 4.0 and Section 4.7.
Condition 3 (b)	A monitoring program to determine the success of management measures that informs adaptive implementation of the Species Management Plan for the duration of this approval.	Section 5.0.
Condition 3 (c)	Details of how proposed management measures take into account relevant approved conservation advices	Section 4.2 and Section 4.7.

Condition	Summary of condition	Relevant section
	and are consistent with the measures contained in relevant recovery plans and threat abatement plans.	
Condition 4	The approval holder must not clear habitat suitable for the Koala ( <i>Phascolarctos cinereus</i> ) (combined populations of Qld, NSW and the ACT), Greater Glider ( <i>Petauroides volans</i> ), Squatter Pigeon (Southern) ( <i>Geophaps scripta scripta</i> ) habitat or Ornamental Snake ( <i>Denisonia maculata</i> ) habitat until the Minister has approved the Species Management Plan. The approved Species Management Plan must be implemented.	Noted.

## 1.4 Relationships to other plans

Various other management plans will be developed and implemented to address the requirements of approval conditions under Commonwealth and Queensland legislation and there will be some interaction among the plans during the construction and operation phases.

The following management plans and site procedures, amongst others, are relevant to this SMP:

- Offsets Management Plan (OMP);
- Approved Species Management Program (for State listed fauna species);
- Erosion and Sediment Control Plan;
- Dust Management Plan;
- Weed and Feral Animal Management Plan;
- Permit to Disturb; and
- Rehabilitation Management and Monitoring Plan.

Prior to the commencement of Project construction works, the Permit to Disturb process will be used to authorise clearing and the management commitments within this SMP will be implemented through the Permit to Disturb process.

## 1.5 Responsibilities

This SMP will be implemented as part of construction, operational and decommissioning contracts for the mining activities including where vegetation clearing, or other activities will result in the disturbance of fauna habitat, vegetation and soil.

All employees, contractors or other agents will be required to operate in accordance with this SMP as part of the activity. The Project's Environmental Officer (EO) is required to apply this SMP to the activity areas and implement where necessary, the corrective actions outlined in Section **Error! Reference source not found.** for the period of EPBC Act approval.

## 2.0 Matters of national environmental significance (MNES)

As part of the Project's State and Commonwealth approvals process, detailed ecological assessments were undertaken (refer to Appendix A for the ecological report undertaken by Ecological Survey and Management, 2016 and Appendix B for the ecological assessment undertaken in April 2018 to determine baseline habitat quality for input into the OMP), in order to:

- Determine the presence/absence of listed flora and fauna species within the Project area;
- Assess the vegetation characteristics and the presence of ecological communities within the Project area;
- Describe the likely adverse impacts on MNES within the Project area;
- Describe measures that would be implemented to avoid and mitigate impacts on those MNES; and
- Assess the baseline habitat quality of the impact area

This section provides a summary of the ecological assessments undertaken to determine the likelihood of occurrence of MNES to occur or potentially occur, within the Project area and to assess the potential impacts to those MNES. Detailed information including habitat quality within the Project area for each of the MNES is outlined in the ecological report in Appendix A and the habitat quality plot report in Appendix B.

### 2.1 Impact assessment ecological survey effort

The ecological assessment to support the EPBC referral incorporated a dry season and a wet season fauna survey. The dry season fauna survey was conducted over eight days in mid-October 2015 with the wet season survey undertaken over seven days in early March 2016 (Appendix A). An additional and supplementary survey of vegetation along Smoky Creek was also undertaken in early May 2017 for the purpose of obtaining data specific to a required State approval under Queensland's *Nature Conservation Act 1992*. Habitat quality assessments were undertaken in April 2018 to provide preliminary data to support the OMP and EPBC offset calculator inputs and also to obtain initial baseline data on the habitat quality within the Project area (Appendix B). A summary of the impact assessment results are provided below, a summary of the habitat quality assessment in Section 2.4 and the corresponding habitat quality assessment results in Appendix B.

A variety of flora and fauna survey methods were used to detect MNES during the impact assessment surveys. Flora surveys were undertaken in accordance with the Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland, Version 3.2 (Nelder et al., 2012). Assessment sites were undertaken across the entire Project area and included both vegetation assessment sites and photo monitoring points within each vegetation community type as follows:

- 95 vegetation assessment sites in total comprising
  - 24 detailed secondary sites
  - 35 tertiary sites
  - 36 modified quaternary sites
  - 36 photo monitoring sites

Fauna assessments included systematic trap sites, spotlighting, call playback, infrared cameras, active searching, supplementary survey sites, harp traps, Anabat survey sites, Koala transects and observation (e.g. bird surveys and opportunistic observations). The survey techniques were applied across eight systematic trap sites and a range of supplementary sites and involved a total of:

- 800 Elliott A trap nights
- 112 pitfall trap nights
- 224 funnel trap nights
- 207 infrared camera trap nights
- 16 Anabat survey nights

- 24.5 hrs spotlighting
- 55 hrs diurnal bird survey hours
- 22 hrs active searching hours
- 10 hrs nocturnal owl and Koala call playback sessions
- 11 Koala transects.

Survey methods undertaken were in accordance with applicable Commonwealth and Queensland threatened species and communities survey guidelines including:

- Commonwealth guidelines
  - Survey guidelines for Australia’s threatened birds (DEWHA, 2010a)
  - Survey guidelines for Australia’s threatened reptiles (SEWPaC, 2011a)
  - Survey guidelines for Australia’s threatened mammals (SEWPaC, 2011b)
  - EPBC Act referral guidelines for the vulnerable Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) (DotE, 2014)
  - Draft referral guidelines for nationally listed Brigalow Belt reptiles (SEWPaC, 2011c)
  - SPRAT databases for relevant EPBC Act listed species and communities (as of July 2016)
- Queensland guidelines
  - Flora Survey Guidelines – Protected Plants *Nature Conservation Act 1992* (EHP, 2014)
  - Terrestrial Vertebrate Fauna Survey Guidelines for Queensland (Eyre et al., 2014).

The Commonwealth guidelines provide survey methodologies specifically for threatened flora and fauna species and ecological communities listed under the EPBC Act. The Queensland survey guidelines provide general guidance on survey methods and survey effort for assessing the presence of all species. The survey effort undertaken used a range of survey methods aimed at maximising the probability of detecting species, if they were present.

### 2.1.1 Threatened species habitat mapping

Habitat mapping was undertaken as part of the ecological assessment and was based on detailed vegetation mapping to assign areas of potential habitat based on known habitat preferences and field observations. Habitat preferences for the Squatter Pigeon are based on the Red Hill Project EPBC Act approval and were deemed applicable for this Project by DoEE during the EPBC referral and assessment and approval process. Habitat preferences for the Greater Glider, Koala and Ornamental Snake were based on the species conservation advice and SPRAT profiles. During the finalisation of the EPBC approval, DoEE advised that Greater Glider habitat is comparable with Koala habitat and that the level of impact for both species is one and the same.

A summary of the ecological results from the EPBC impact assessment are shown below.

#### ***Greater Glider***

This species was identified at five locations in the study area, along Smoky Creek and Billy’s Gully in mixed eucalypt riparian woodland (RE 11.3.25). The approved conservation advice for this species (TSSC 2016) indicates that taller, moist eucalypt forest with relatively old trees and abundant hollows and a diversity of eucalypt species is favoured by this species. Using this description and in

consideration of the communities in which the Greater Glider was observed in the study area and in other surveys conducted throughout Central Queensland, the riparian and alluvial communities were considered to provide the most suitable habitat for this species. These vegetation communities are considered to provide the greatest availability of large old hollow-bearing trees and provide the greatest connectivity with larger patches of remnant vegetation in the landscape. As detailed in Ecology Report in Appendix A, habitat mapping for the Greater Glider within the study area has been undertaken in accordance with information contained in the conservation advice for this species which determined that 125 ha of potential Greater Glider habitat will be directly impacted.

### ***Squatter Pigeon (Southern)***

Squatter Pigeons were recorded frequently throughout the study area during both survey periods. Recorded locations comprised both remnant vegetation and cleared areas, often along dirt vehicle tracks and usually within approximately 1 km of a dam. Water sources that still contained water at the time of the October 2015 (dry season) survey were considered permanent water points (typically farm dams) for the purpose of mapping Squatter Pigeon habitat.

As detailed in the Ecology Report in Appendix A suitable habitat was determined as grassy woodland habitat in REs on land zones 3, 5 or 7, which are either: within 1 km of a permanent water body; or within 1 km of a Queensland Government mapped wetland or  $\geq 3$ rd order stream.

Based on this definition, there is 181.5 ha of suitable habitat for the Squatter Pigeon in the study area of which 74 will be directly impacted.

### ***Ornamental Snake***

One individual of the Ornamental Snake was detected in the study area during the wet season survey. This individual was recorded on a vehicle track in a cleared area characterised by introduced species (Buffel Grass) and weeds (Parthenium). No gilgai or wetland habitats were recorded at this location, or indeed anywhere else within the project site. The location where the individual was recorded is approximately 400 m south of Smoky Creek (which has habitat for the Ornamental Snake). The observed record is likely a dispersing individual.

As noted in Ecology Report in Appendix A, there were no gilgai or wetlands within the project site or areas of Land Zone 4. However, the Riparian Monitoring Program (Appendix D), undertaken to address condition 10 of the EPBC approval, determined using the precautionary principle that habitat was assumed to be present within 200 m of Smoky Creek (a 4th order stream). Therefore, REs 11.3.2, 11.3.4 and 11.3.25 within 200 m of this watercourse are mapped as potential habitat for the Ornamental Snake resulting in 75.9 ha of this Ornamental Snake habitat within the Riparian Monitoring area (Appendix D).

### ***Koala***

Any forest or woodland containing species that are known Koala food trees, or shrubland with emergent food trees provides potential Koala habitat. Although Koalas were not identified in the study area during surveys, the EPBC Act referral guidelines for the vulnerable Koala explain that "Koalas do not necessarily have to be present" for Koala habitat to be present. Based on the habitat definitions contained in these guidelines and the records of the species from the region, the Koala has a high probability of occurrence in the Project Area.

As detailed in the Ecology Report (Appendix A), all the areas of remnant vegetation within the study area, and particularly the riparian corridors of Billy's Gully and Smoky Creek, are considered to provide habitat for the Koala due to the presence of the Koala feed trees. These Eucalypt and Corymbia Woodlands include RE 11.3.2, RE 11.3.4, RE 11.3.25, RE 11.5.3, RE 11.5.8b, RE 11.5.9, RE 11.5.12, RE 11.7.2, RE 11.8.5, and RE 11.9.7a.

In addition, some areas of non-remnant habitat with emergent gums (such as Narrow-leaved Red Ironbark) are considered potential habitat for this species. There are 380.1 ha of suitable habitat for the Koala in the study area of which 125 ha will be directly impacted (refer to Appendix A).

## 2.2 Threatened ecological communities and flora

The flora survey assessments undertaken failed to identify any of the potentially occurring threatened ecological communities (TEC) (Ecological Survey and Management, 2016). Flora assessments also failed to find any EPBC Act listed species or potential habitat for listed species.

## 2.3 Threatened fauna

Fauna assessments undertaken in support of State and Commonwealth approvals identified three fauna species listed as vulnerable under the EPBC Act as being present on site (Greater Glider, Squatter Pigeon and Ornamental Snake) and one species listed as vulnerable as having the potential to occur based on habitat availability (Koala).

Refer to the ecological report in Appendix A for detailed information on the habitat areas within the Project area for each of the MNES as well as the areas that will be impacted through direct habitat clearing.

### 2.3.1 Greater Glider (*Petauroides volans*)

The Greater Glider was the only threatened mammal species to be confirmed as present within the Project area and was recorded at five locations within mixed eucalypt riparian woodlands along Smoky Creek and Billy's Gully (refer to Figure 3). In addition, potential habitat that supports hollow bearing trees, both alive and dead, occur along Smoky Creek.

#### **Description**

EPBC Act = Vulnerable

The Greater Glider is the largest gliding possum in Australia, with a head and body length of approximately 35–46 cm and a long furry tail measuring approximately 45–60 cm. The Greater Glider has thick fur that is white or cream below and varies from dark grey, dusky brown through to light mottled grey and cream above (TSSC, 2016). The Greater Glider is nocturnal and uses tree hollows during the day to rest and/or nest (van Dyck & Strahan, 2008).



#### **Distribution**

Greater Gliders are restricted to eastern Australia between Windsor Tableland in north Queensland and Wombat State Forest in central Victoria and occur from sea level up to 1,200 m above sea level. Two isolated subpopulations exist in Queensland, one in the Gregory Range west of Townsville and another in the Einasleigh Uplands (TSSC, 2016).

#### **General habitat preferences**

The Greater Glider occurs in a range of eucalypt-dominated habitats, including low open forests along the coast to tall forests in the ranges and low woodland to the west of the Dividing Range. It does not use rainforest habitats (van Dyck & Strahan 2008; van Dyck et al., 2013). This species favours taller, montane, moist eucalypt forests with relatively old trees and abundant hollows and a diversity of eucalypt species (TSSC, 2016).

#### **Foraging habitat**

The Greater Glider has an almost exclusive diet of eucalypt leaves but also feeds on flowers or buds (van Dyck & Strahan, 2008; TSSC, 2016). Although the species is known to feed on a range of eucalypt species, in any area it is likely to only forage on a select number of species (van Dyck & Strahan, 2008).



**Breeding habitat**

Breeding occurs between March and June with only a single young born (van Dyck & Strahan, 2008; TSSC, 2016). The young stays with the mother or is left in the nest and becomes independent at about 9 months of age (Menkhorst & Knight, 2011).

**Additional information**

Greater Gliders can glide over distances of up to 100 m and appear to have low dispersal ability with small home ranges of approximately 1-4 ha which appear to be related to food and nest availability. In lower productivity forests, home ranges may be as large as 16 ha for males. In general, home ranges of males do not typically overlap (TSSC, 2016) which suggests a degree of territorial behaviour.

**Nearest record**

Greater Gliders were recorded within the Project area at five locations along Smoky Creek and Billy's Gully (Appendix A). Potential habitat that supports hollow bearing trees occur along Smoky Creek.

**Suitable habitat within the project area**

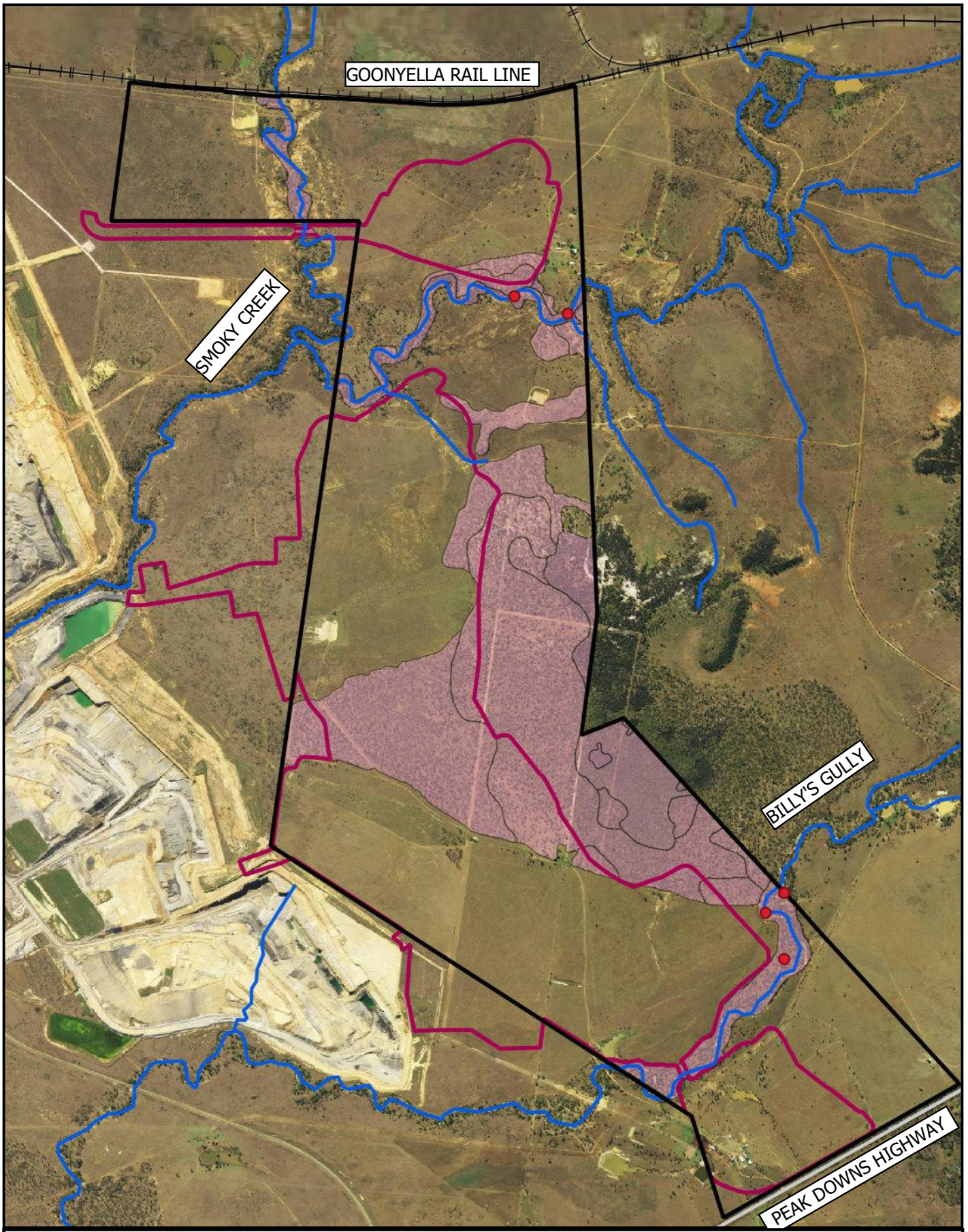
The approved conservation advice for the Greater Glider (TSSC, 2016) along with habitat definitions included in the current EPBC Act approval, suggests that forests, woodlands or emerging shrublands, including riparian and non-riparian environments that contain one or more of *Angophora*, *Corymbia*, *Eucalyptus*, *Lophostemon* and *Melaleuca* tree species are all potential Greater Glider habitat.

**Impacted habitat within the project area**

Based on the above habitat definition, it is estimated that residual impacts to approximately 125 ha of potential Greater Glider habitat are likely to occur from the proposed Project works.

**Key threats**

Key threats to Greater Gliders are habitat loss leading to increased habitat fragmentation and loss of nesting habitat in tree hollows, predation by owls and frequent and intense bushfires. Loss of hollow bearing trees and distance between habitat patches in particular is thought to have contributed to the decline of Greater Gliders in central Queensland over the last 20 years (TSSC, 2016).



0 0.75 1.5 km

Scale @ A3: 1 : 24000  
 Date: 21/8/2018  
 Drawn: Joshua T



DATA SOURCE  
 BASE CONSULTING GROUP 2018; QSPATIAL 2018  
 The State of Queensland (Department of Natural Resource and  
 Mines) 2017

Legend

- Issac Plains East Boundary
- Disturbance Area
- Greater Glider Habitat Mapping
- Greater Glider
- Watercourse
- Road
- Railway

Figure 3: Greater Glider Habitat impacted by project



### 2.3.2 Squatter Pigeon - southern sub-species (*Geophaps scripta scripta*)

The Squatter Pigeon was the only threatened avian species to be recorded within the Project area and was recorded at several locations within remnant woodland vegetation and cleared areas in relatively close proximity to water (refer to Figure 4). It is probable that this species utilises the vegetation fringing Smoky Creek along with adjacent cleared areas and vehicle tracks that are in close proximity to permanent water.

#### **Description**

EPBC Act = Vulnerable

The Squatter Pigeon (southern) is a medium-sized ground dwelling pigeon approximately 30 cm long. Adults of both sexes are generally grey-brown with black and white stripes on the face and throat, have iridescent green or violet patches on the wings, a blue-grey lower breast and white flanks and lower belly. The southern Squatter Pigeon sub-species has a patch of blue-grey skin around the eye, whereas the northern Squatter Pigeon has an orange-red orbital skin patch (TSSC, 2015).



#### **Distribution**

Squatter Pigeons are largely restricted to Queensland with the southern sub-species of the Squatter Pigeon known to occur north of the Burdekin River, east to Townsville and Proserpine and south to the Queensland-New South Wales Border and west as far as Longreach. Where Squatter Pigeon occurs, it can be locally abundant (Reis, 2012). The known distribution of the southern sub-species overlaps with the known distribution of the northern subspecies (DotEE, 2018a).

The estimated extent of occurrence is approximately 440,000 km<sup>2</sup> (DotEE, 2018a). The estimated total population of the species is an estimate as no systematic surveys have been undertaken. However, in 2000 the population was estimated at 40,000 breeding birds (Garnett & Crowley, 2000). Given the Squatter Pigeon's ubiquitous nature and relative abundance, the population is thought to be stable at present. It is also thought this species occurs as a single, contiguous (i.e. inter-breeding) population (DotEE, 2018a).

#### **General habitat preferences**

Squatter Pigeons can occur in tropical dry, open sclerophyll woodlands and occasionally in savannah habitats with overstorey species of *Eucalyptus*, *Corymbia*, *Acacia* or *Callitris*. Patchy groundcover layer is typical and generally consists of native, perennial tussock grasses or a mix of grasses and low shrubs or forbs. The groundcover layer rarely exceeds 33% of the ground area. It appears to favour sandy soil dissected with low gravelly ridges and is less common on heavier soils with dense grass cover. Squatter Pigeons are regularly found in close proximity (within 3 km) to permanent water (DotEE, 2018a).

#### **Foraging habitat**

Squatter Pigeon foraging habitat occurs in any remnant or regrowth open-forest to sparse, open woodland or scrub dominated by *Eucalyptus*, *Corymbia*, *Acacia* or *Callitris* species, on sandy or gravelly soils within 3 km of a suitable, permanent or seasonal waterbody. It feeds primarily on seeds of grasses, herbs and shrubs but is also known to consume legumes, herbs and forbs, acacia seeds, insects and ticks (DotEE, 2018a).

#### **Breeding habitat**

Squatter Pigeons nest on the ground, usually laying two eggs in sheltered positions amongst vegetation which are incubated for about 17 days. (Crome, 1976; Frith, 1982). They prefer to nest on stony rises on sandy or gravelly soils (i.e. land zones 5 and 7), within 1 km of a suitable (and permanent) water body (Squatter Pigeon Workshop, 2011).

Squatter Pigeons typically breed from April to October, although this is variable and highly dependent on food availability (Frith, 1982, Squatter Pigeon Workshop, 2011). Nests are depressions scraped into the ground beneath a tussock of grass, bush, fallen tree or log, and sparsely lined with grass (Frith, 1982). Chicks remain in the nest for two to three weeks and are dependent on their parents for around four weeks (DotEE, 2018a).

### ***Dispersal habitat***

Dispersal habitat can be any forest or woodland occurring between patches of foraging or breeding habitat, and suitable waterbodies and may include denser patches of vegetation not suitable for foraging or breeding (DotEE, 2018a).

### ***Nearest record***

Squatter Pigeons were recorded at several locations during the Project's ecological assessment. Individuals were recorded in both remnant woodland vegetation and in cleared areas but within approximately 1 km of water (Appendix A; Appendix B).

### ***Suitable habitat within the project area***

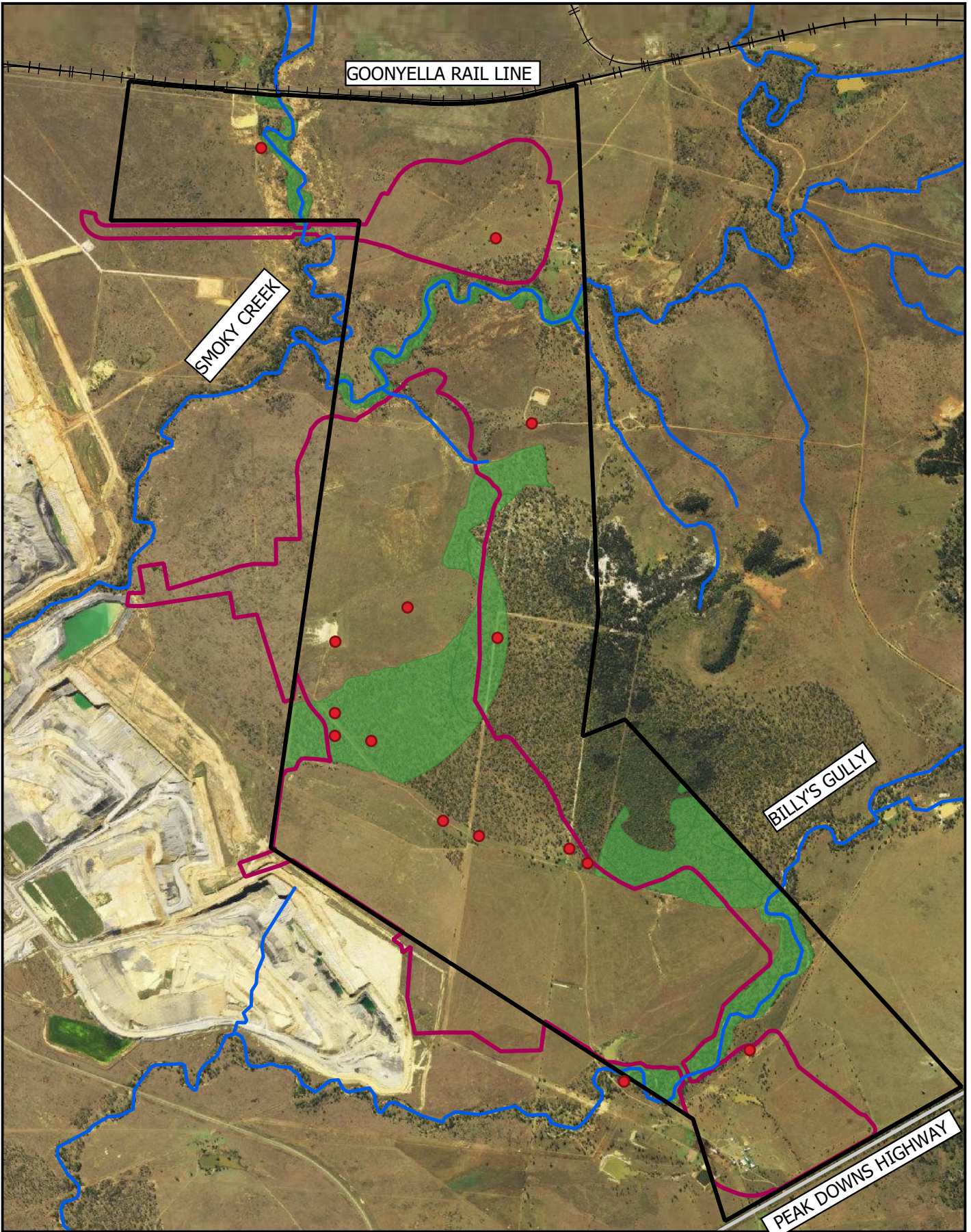
Squatter Pigeons potentially utilise vegetation fringing Smoky Creek along with adjacent cleared areas and vehicle tracks that are in close proximity to permanent water. Within the Project area, they are most likely found in regional ecosystems with land zones 3, 5 and 7 and within 1 km of a permanent water sources, mapped wetland or >3<sup>rd</sup> order stream (Appendix A; Appendix B).

### ***Impacted habitat within the project area***

Based on the above habitat definition, there is approximately 74 ha of potential Squatter Pigeon habitat that has the potential to be impacted by the proposed works.

### ***Key threats***

The primary threats to the Squatter Pigeon (southern) are ongoing habitat clearing, overgrazing of habitat by livestock and feral herbivores such as rabbits, thickening of understorey vegetation, and predation by invasive mammals such as cats and foxes (TSSC, 2015). Their habit of remaining stationary when disturbed makes them particularly vulnerable to predation and vehicle strikes. Other known threats include fragmentation of habitat, trampling of nests by domestic stock and feral herbivores, invasion of habitat by weeds such as Buffel Grass (*Cenchrus ciliaris*) drought, and bushfires (TSSC, 2015). Changes in hydrological regimes can also affect Squatter Pigeons by changing the distance between water sources and feeding habitat; affecting their movement through the landscape (Reis, 2012).







0 0.75 1.5 km

Scale @ A3: 1 : 24000  
 Date: 21/8/2018  
 Drawn: Joshua T



DATA SOURCE  
 BASE CONSULTING GROUP 2018; QSPATIAL 2018  
 The State of Queensland (Department of Natural Resource and  
 Mines) 2017

Legend

-  Issac Plains East Boundary
-  Disturbance Area
-  Squatter Pigeon Habitat Mapping
-  Squatter Pigeon




-  Watercourse
-  Road
-  Railway

Figure 4: Squatter Pigeon Habitat impacted by project

**BASE/**

### 2.3.3 Ornamental Snake (*Denisonia maculata*)

The only threatened reptile to be recorded within the Project area was the Ornamental Snake, with a single individual recorded on a vehicle track in a cleared area, dominated by introduced flora species including Buffel Grass and Parthenium (refer to Figure 5). No gilgai or wetland habitats or microhabitat features normally associated with Ornamental Snakes (cracking clay soils, coarse woody debris and hollow logs or tree stumps), were recorded in the vicinity of where the individual snake was found; however, potential prey species (frogs) were identified.

#### **Description**

EPBC Act = Vulnerable

The Ornamental Snake is a stout brown, grey-brown or grey-black snake with a darkly flecked or overall darker head with the lips distinctly barred in white/cream. The belly is white or cream with dark spots/flecks on the outer edges (TSSC, 2014). The iris is usually golden and the tail often grades to a lighter orange-brown at the tip. The Ornamental Snake is nocturnal, moving only at night. It is probably active year-round but can remain inactive in shelters for periods of months during dry conditions (SEWPaC, 2011c). Peak activity is likely to be late spring to early summer (SEWPaC, 2011c).



#### **Distribution**

The Ornamental Snake is only known from the Brigalow Belt North, and parts of the Brigalow Belt South Bioregions (DotEE, 2018b). The stronghold of this species is within the Fitzroy and Dawson River catchments (McDonald et al., 1991).

#### **General habitat preferences**

Ornamental Snakes are found in close association with frogs which form the majority of its prey and is known to favor woodlands and open forests associated with moist areas, particularly gilgais with clay soils but is also known from lake margins, wetlands and waterways. This species is most likely to be found in Brigalow (*Acacia harpophylla*), Gidgee (*Acacia cambagei*), Blackwood (*Acacia argyrodendron*) or Coolabah (*Eucalyptus coolabah*) - dominated vegetation communities or pure grassland associated with gilgais. Regional ecosystems where it has been recorded include; 11.4.3, 11.4.6, 11.4.8 and 11.4.9 and 11.3.3 and 11.5.16 (DotEE, 2018b).

Ornamental Snakes tend to shelter in logs, under coarse woody debris and in ground litter and seem to prefer a diversity of gilgai size and depth, with some fringing groundcover vegetation and timber debris, where soils are of a high clay content with deep-cracking characteristics. Habitat patches greater than 10 ha and connected to larger areas of remnant vegetation are preferred (DotEE 2018b). The Draft Referral guidelines for the nationally listed Brigalow Belt reptiles describes gilgai depressions and mounds as being important habitat with habitat connectivity between gilgai and other suitable habitats also being important (SEWPaC, 2011c).

#### **Foraging and refuge habitat**

Soil cracks on the high ground of gilgai development provide shelter for Ornamental Snakes during dry periods, and an abundance of frogs in gilgai areas provide food resources during wet periods (Brigalow Belt Reptiles Workshop, 2010). Ornamental Snakes prefer areas with ground cover such as logs and coarse woody debris, and ground litter, which it uses for shelter (DotEE, 2018b).

#### **Nearest record**

A single Ornamental Snake individual was recorded in the Project area during wet season field surveys. The individual was located adjacent to a vehicle track approximately 400 m south of Smoky Creek. Desktop assessment revealed the next nearest record was approximately 5 km west of the Project area (Appendix A).

#### **Suitable habitat within the project area**

Ornamental Snakes prefer habitat that is in closely associated with its preferred prey such as moist areas within open woodlands but particularly gilgai and wetland habitat. Although the prey of Ornamental Snakes were identified as occurring within the Project area including several of its preferred frog species

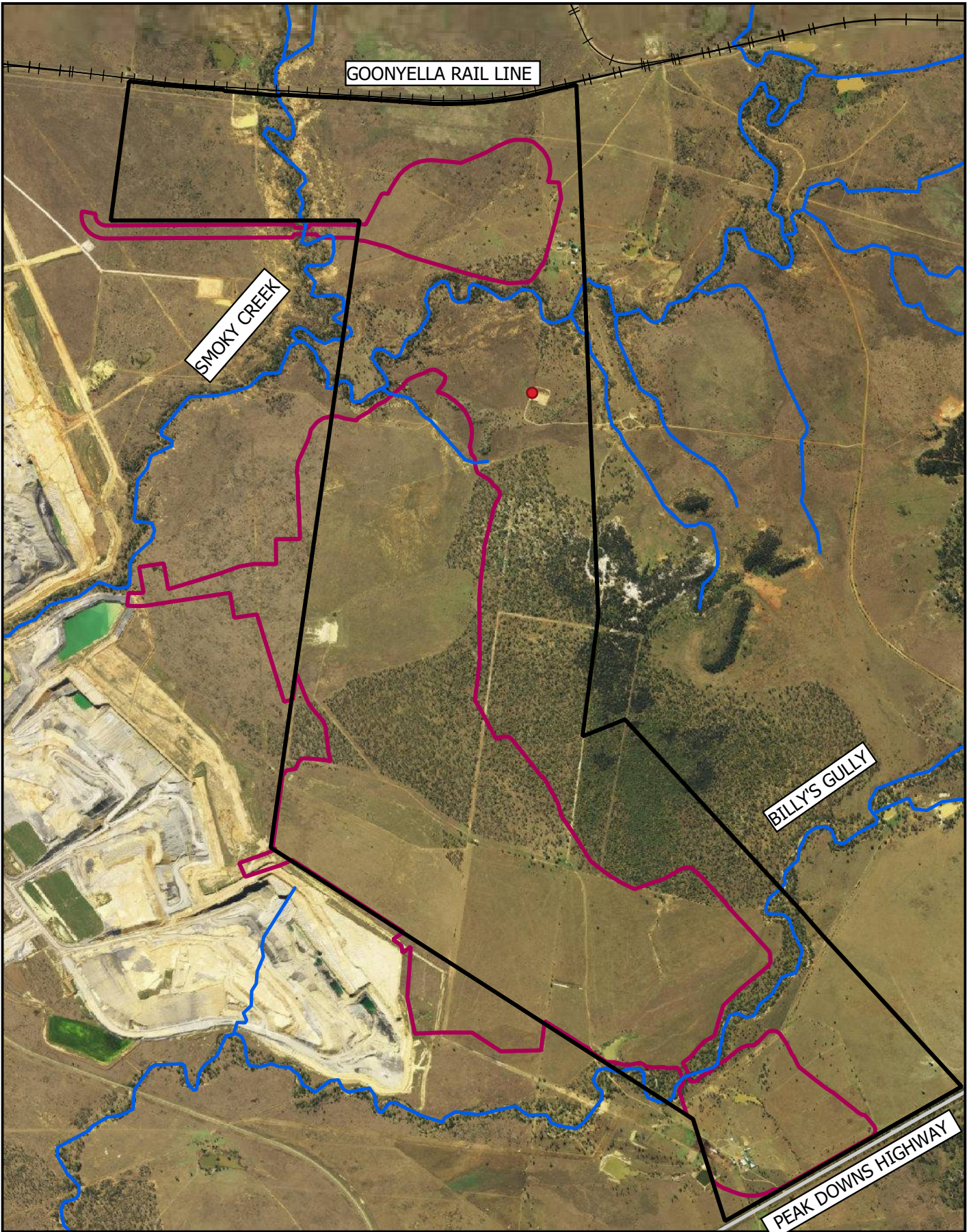
including the Sotted Marsh Frog, Ornate Burrowing Frog and the Broad-palmed Rocket Frog, suitable habitat within the Project area that is of a quality that could sustain and support a viable population, such as most woodland areas, gilgai habitat and wetlands, is limited. The observed record is likely a dispersing individual that was moving between habitat nearby to the Project area rather than residing in the Project area. However, riparian vegetation fringing Smoky Creek where ground timber is abundant may provide limited potential habitat for this species.

***Impacted habitat within the project area***

Based on the above habitat definition and habitat availability within the Project area, there is limited habitat suitable to sustain a population of Ornamental Snakes. However, there is a potential the areas in close proximity to frog habitat may offer some habitat values to the species (refer to the detailed ecological report in Appendix A for locations where frog species were identified).

***Key threats***

The primary threats to the Ornamental Snake are historical broad-scale habitat clearing for grazing and habitat degradation by cattle (TSSC, 2014; Cogger et. al., 1993) combined with ongoing habitat loss for agriculture and development (Cogger et. al., 1993). Feral pigs are also of great concern, given their degradation of wet areas, competition for frog prey (TSSC, 2014) and potential predation on snakes they encounter. Additional threats include alteration of landscape hydrology and water quality in gilgai environments (which affect the primary prey species of the Ornamental Snake), invasive weeds, and predation by feral predators (foxes and cats) (Eco Logical Australia, 2015).



0 0.75 1.5 km

Scale @ A3: 1 : 24000  
 Date: 21/8/2018  
 Drawn: Joshua T



Legend

- Issac Plains East Boundary
- Disturbance Area
- Snake
- Watercourse
- Road
- Railway

Figure 5: Ornamental Snake Record for ecology study area



DATA SOURCE  
 BASE CONSULTING GROUP 2018; QSPATIAL 2018  
 The State of Queensland (Department of Natural Resource and  
 Mines) 2017



### 2.3.4 Koala (*Phascolarctos cinereus*)

The Koala was not recorded in the Project area. However, potential habitat occurs along Smoky Creek in the form of Eucalypt woodlands, which are connected to habitat in the broader region where Koala's have been recorded. Potential Koala habitat is outlined in Figure 6.

#### Description

EPBC Act = Vulnerable

The Koala is one of Australia's most distinctive wildlife species (TSSC, 2012). It is a large grey, arboreal mammal with woolly fur, long black claws, a large black nose, fluffy ears, and no tail (van Dyck & Strahan, 2008). They have a head and body length of approximately 65–74 cm depending on sex with males larger than females and they can weigh up to 9 kg (van Dyck & Strahan, 2008).



#### Distribution

The Koala is found in eastern Australia in fragmented populations, from the temperate south to the tropical north. In Queensland, the Koala is widespread in sclerophyll forest and woodlands on foothills and plains on both sides of the Great Dividing Range from about Chillagoe, Queensland to Mt Lofty Ranges in South Australia (Menkhorst & Knight, 2011).

#### General habitat preferences

Koala's use a range of habitats, including temperate, sub-tropical and tropical forest, woodland and semi-arid communities dominated by Eucalyptus species. However, they are strongly associated with eucalypt forests which it feeds on (van Dyck & Strahan, 2008). Habitat quality for Koalas is based on the identification of local preferences for food tree species and quantification of the availability of those species (Phillips et al., 2000). Any forest or woodland containing species that are known Koala food trees, or shrubland with emergent food trees provides potential Koala habitat. The Koala is also known to occur in modified or regenerating native vegetation communities (DoEE, 2017c).

#### Foraging and refuge habitat

Koalas rely on eucalyptus trees for food and shelter. This species feeds on approximately 50 different eucalypt species across its range, with food preferences varying locally and across regions (Krockenberger et al., 2012). The South East Queensland Koala Conservation State Planning Regulatory Provisions define Koala food trees as species of the *Corymbia*, *Melaleuca*, *Lophostemon* or *Eucalyptus* genera (DES, 2017; DotEE, 2017c).

It has been suggested that shelter (non-food) trees are important to Koalas, with Crowther et al. (2013) indicating that shelter trees are equally important as food tree. Shelter trees play an essential role in thermoregulation and are likely to be selected based on height, canopy cover and elevation, with large trees occurring in gullies being preferable (Crowther et al., 2013).

In the drier regions of the Burdekin, Isaac, Whitsunday and Charters Towers Shires, Koalas prefer to feed and shelter in Forest Red Gum (*Eucalyptus tereticornis*) and River Red Gum (*E. camaldulensis*) but are also known to feed on Brown's box (*E. brownii*), Dawson River blackbutt (*E. cambageana*), Coolabah (*E. coolabah*), Queensland peppermint (*E. exserta*), Gum-topped box (*E. moluccana*), Yapunyah (*E. ochrophloia*), Mountain coolabah (*E. orgadophila*) and Poplar Box (*E. populnea*).

#### Breeding habitat

In Queensland, Koalas breed between September and April (Krockenberger et al., 2012). Female Koalas can breed annually, from 2 years of age (van Dyck & Strahan, 2008). Koala joeys remain in the pouch for approximately 6 months and become independent at 12 months of age (van Dyck & Strahan, 2008).

#### Additional information

The Koala is solitary, mostly nocturnal and spends much of its time in distinct home ranges which vary in size depending on availability of food and shelter resources (van Dyck & Strahan, 2008). In areas of high quality habitat, home ranges overlap extensively and can be quite small (1–2 ha) but are discrete and larger (100 ha) at lower abundances and in less favourable habitat (van Dyck & Strahan, 2008). Young female Koala's often stay in similar areas as their mother, whereas males disperse to new areas

once they reach 2–3 years old. At Blair Athol in central Queensland, home ranges are estimated at 135 ha for males and 101 ha for females (Ellis et al., 2009).

The Koala is inactive for a large portion of the day (van Dyck & Strahan, 2008) with movements between feeding trees species generally occurring at dawn, dusk and night (Crowther et al. 2013). These moves can be several hundred metres making Koalas particularly vulnerable to attacks by wild and domestic dogs. Koala activity generally peaks between August and January, and breeding females with back-young are most easily observed at this time (DotEE, 2017c). Individuals tend to use the same set of trees, but generally not at the same time, and they change trees only a few times per day (TSSC, 2012).

#### ***Nearest record***

Koala was not recorded within the Project area. However, potential habitat does occur along Smoky Creek (Appendix A) and the desktop assessment identified that surveys external to this Project have recorded the Koala within 7 km of the Project.

#### ***Suitable habitat within the project area***

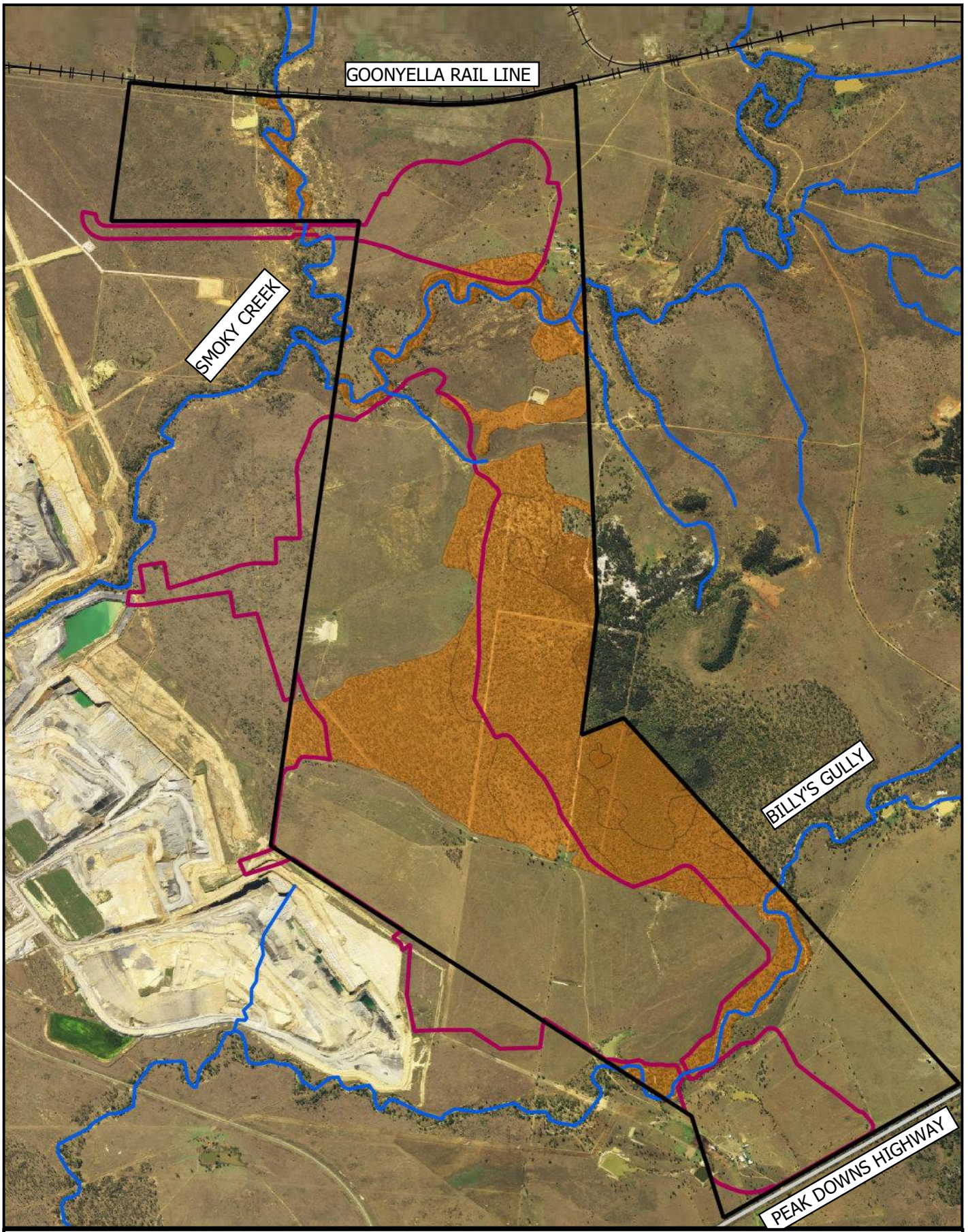
Based on the SPRAT habitat description and the habitat definition included in the EPBC Act approval conditions, forests, woodlands or emerging shrublands, including riparian and non-riparian environments that contain one or more of *Angophora*, *Corymbia*, *Eucalyptus*, *Lophostemon* and *Melaleuca* tree species are all potential Koala habitat. This equates to regional ecosystems dominated by Eucalypt and *Corymbia* species and include 11.3.2, 11.3.4, 11.3.25, 11.5.3, 11.5.8b, 11.5.9, 11.5.12, 11.7.2, 11.8.5 and 11.9.7a. Some areas of non-remnant vegetation with emergent food trees such as Narrow-leaved Red Ironbark also provide potential habitat (refer to the ecological report in Appendix A and the habitat quality plot report in Appendix B for more information on suitable habitat).

#### ***Impacted habitat within the project area***

Based on the above habitat definition, residual impacts to approximately 125 ha of Koala habitat are likely to occur from the proposed Project works.

#### ***Key threats***

Primary threats to the Koala are the loss and fragmentation of habitat resulting in loss of food and shelter trees, increased risk of vehicle strike, dog attacks and isolation of populations (TSSC, 2012). Habitat fragmentation results in isolated high-density population areas where the risk of disease transmission is increased and the potential to recolonise dryland areas post-drought is impeded (TSSC, 2012). Wildfire and drought are semi-natural processes that are also considered to threaten Koala populations, particularly in dryland areas where water sources and the availability of shelter trees have been anthropogenically altered (TSSC, 2012).






0 0.75 1.5 km

Scale @ A3: 1 : 24000  
 Date: 21/8/2018  
 Drawn: Joshua T



Legend

-  Issac Plains East Boundary
-  Disturbance Area
-  Koala Habitat Mapping




-  Watercourse
-  Road
-  Railway

Figure 6: Koala Habitat impacted by project



DATA SOURCE  
 BASE CONSULTING GROUP 2018; QSPATIAL 2018  
 The State of Queensland (Department of Natural Resource and Mines) 2017

## 2.4 Habitat quality assessment

As part of the EPBC approval conditions, offset are required for significant impacts to the Koala, Greater Glider and Squatter Pigeon. As such, a habitat quality assessments were undertaken to determine the baseline habitat quality condition of the impact site. Assessments undertaken in accordance with Queensland's Department of the Environment and Science (DES) Guide to Determining Terrestrial Habitat Quality (the Guide) determined the impact area was restricted to five Regional Ecosystems (RE) or five assessment units.

Habitat quality for the impact area was assessed using the Guide which, being based on the Queensland BioCondition survey methodology, uses a range of habitat indicators to measure the ecological viability and habitat values of a site and its capacity to support fauna. The process used for assessing habitat quality is designed so that it is repeatable and relatively simple and uses a combination of field attributes associated with vegetative structure and habitat related information.

The methodology undertaken as part of the habitat quality assessment was developed to obtain data about 'site ecological condition' and 'species habitat index', which are two of the three indicators required to develop a habitat quality score. The third component, the 'site context' information is developed geospatially and did not form part of the habitat quality assessment for the purposes of this SMP.

The key indicators for determining habitat quality of a land-based impact site or an offset site are:

- Site Condition (10 attributes):
  - Recruitment of woody perennial species in EDL
  - Native plant species richness - trees
  - Native plant species richness - shrubs
  - Native plant species richness - grasses
  - Native plant species richness - forbs
  - Tree canopy height
  - Tree canopy cover
  - Shrub canopy cover
  - Native perennial grass cover
  - Organic litter
  - Large trees
  - Coarse woody debris
  - Non-native plant cover

Species habitat indices were recorded for each relevant species that was determined as having habitat within the Project area (i.e. Koala, Squatter Pigeon and Greater Glider) at each habitat quality plot. The following attributes were assessed:

- Quality and availability of food and foraging
- Quality and availability of shelter
- Threat to Species
- Species mobility capacity
- Role of site location to overall population

### 2.4.1 Habitat quality plots

The survey sites undertaken as part of the Project's impact assessment in late 2015 and early 2016 were used as a basis for the habitat quality plots. These survey sites were then upgraded with additional data collected in April 2018 into habitat quality plots. Habitat quality plots were located throughout the Project area to survey each RE (refer to Appendix B for the habitat quality plot report). Some REs comprised more than one polygon within the Project area and therefore, assessment units were established that represented each RE.

Habitat quality scores for the impact area were determined from surveys undertaken in April 2018 from a total of 21 habitat quality plots within the 10 assessment units. These surveys were undertaken to determine habitat quality of the impact site for input into the EPBC offsets calculator (as required for the associated OMP) as well as for the purposes of this SMP. Habitat quality scoring was undertaken for each of the three MNES that were identified as having suitable habitat within Project area (Koala, Greater Glider and Squatter Pigeon) with the site condition data used to assess the overall vegetative habitat quality. The 21 habitat quality plots are outlined in Table 3. The habitat quality data for each of the three species and for vegetative quality is shown in Appendix A within the habitat quality plot report in Appendix B.

**Table 3: Habitat quality plots**

Assessment unit	Regional ecosystem	Area (ha)
AU1	11.3.2	1.2
AU2	11.3.25/11.3.4	48.6
AU3	11.5.3	105.2
AU4	11.5.8b	3.4
AU5	11.5.9	9.7
AU6	11.5.12	142.2
AU7	11.7.2	14.6
AU8	11.8.5	11.8
AU9	11.9.7a	8.5
AU10	Regrowth (11.9.5)	9.0

#### 2.4.1 Habitat quality scoring results

Detailed habitat quality results are provided in Appendix D and a summary of the key results outlined below of the vegetation communities as well as for each of the MNES assessed during the habitat quality survey.

Baseline habitat quality data was derived from 10 REs within the Project area and five (5) within the impact area. Overall habitat quality within the Project area varies compared to benchmark RE values. In general, however; recruitment of ecologically dominant (EDL) layer tree species is similar to benchmark values irrespective of RE and native plant species richness for grasses, forbs, shrubs and trees is generally similar to or slightly higher for the majority of REs compared to benchmark. Tree canopy height was variable throughout the project area and generally lower than the relevant benchmarks whereas tree canopy cover was consistently higher. Native grass cover within the project area was consistently high compared to benchmark values whereas non-native plant cover was consistently much higher than benchmark.

##### ***Squatter Pigeon***

For this project, habitat for the Squatter Pigeon is defined as grassy woodlands REs on land zones 3, 5 or 7, which are either within 1 km of a permanent water body or within 1 km of a Queensland Government mapped wetland or  $\geq 3$ rd order stream'. This includes the majority of REs in the Project area, including; REs 11.3.2, 11.3.4, 11.3.25, 11.5.3, 11.5.8b, 11.5.9, 11.5.12 and 11.7.2.

The local landscape has been largely cleared of native vegetation for cattle grazing, mining and exploration activities. Native habitat is generally confined to watercourses and has been previously cleared or thinned. The suitability of Squatter Pigeon habitat varies throughout the Project area and is dependent on abundance of weeds, particularly exotic pasture grasses, and presence of native grasses in the ground layer and proximity of these foraging resources in relation to water resources.

Squatter Pigeons shelter in nearby trees as described in the SPRAT Profile and requires a combination of open forest or woodland habitats within close proximity to water sources. The Project area provides a moderate level of this habitat. Water resources are scarce through the middle of the Project area away from riparian areas.

### **Greater Glider**

The Ecology Report in Appendix A outlines that the riparian and alluvial communities are considered to provide preferred habitat for the Greater Glider due to the availability of large old hollow-bearing trees and connectivity between remnant vegetation in the landscape. A moderate abundance and diversity of flowering Eucalypt species was observed throughout the majority of habitat in the Project area.

Due to the restricted nature of riparian habitat and remnant vegetation generally within the landscape, availability of shelter habitat is limited. However, a moderate abundance of hollows was observed throughout the majority of the riparian areas.

Greater Glider mobility in the landscape is generally restricted to riparian zones and adjacent areas where trees are a suitable distance apart. The riparian areas of Smoky Creek are generally narrower and more fragmented in the landscape compared to Billy's Gully. As such, mobility is considered to be slightly more restricted in this habitat areas compared with habitat along Billy's Gully.

### **Koala**

Forest or woodland containing emergent Koala food trees (i.e. trees of any of the following genera: *Angophora*, *Corymbia*, *Eucalyptus*, *Lophostemon*, *Melaleuca*) is considered potential habitat for the Koala. All remnant and regrowth vegetation within the Project area was assessed as Koala habitat.

Immediate threats to Koala's in the Project area include the Goonyella Railway and local Broadlea Road. Regional threats occur from mining and petroleum exploration activities which involves clearing and constructing access tracks which leads to a reduction in the availability of food trees and increasing irregular vehicle movements in the local area. Predators are present in the landscape, but there is limited evidence to suggest they are high in numbers or putting considerable pressure on the Koala.

The local landscape has been largely cleared of native vegetation for cattle grazing, mining and exploration activities. Better quality habitat is associated with an abundance of food trees and this is often prominent on watercourses and in some open woodland communities.

The mobility of Koala's within the Project area is variable and influenced by the extent of clearing and thinning and factors that may restrict movement on ground between shelter and food trees, e.g. steep sided banks along watercourse, dense grass cover a very low shrubby understorey.

## 3.0 Impact assessment

This section of the report summarises the likely impacts of the Project on the EPBC Act listed fauna species outlined in section 2 (refer to the ecological report in Appendix A for a detailed impact assessment). Potential impacts for each species constitute direct impacts such as vehicle strikes and vegetation and habitat clearing and indirect impacts such as, increased noise and vibration, increased dust, lighting, erosion and sediment control, altered hydrology regimes and the spread or introduction of invasive species.

### 3.1 Direct impacts

The Project involves clearing of remnant and non-remnant vegetation for open cut mining activities and associated infrastructure including:

- Five open cut pits;
- Overburden and waste rock piles;
- Haul roads connecting the new pits to the existing haul road network.

Haul road construction will be nominally 80 m wide to allow for construction and associated activities and a haul road crossing will be constructed across Billy's Gully and the northern tributary of Smoky Creek (see Figure 2).

The proposed disturbance footprint has been designed to avoid impacts to remnant vegetation and fauna habitat as much as practically possible. As an example, where the haul roads cross the riparian habitat of Billy's Gully and Smoky Creek, the clearing extent has been reduced to 40 m in order to minimise the disturbance to fauna habitat. In addition, operations have been staged such that clearing of vegetation will be gradual and undertaken over several years as each open cut pit is progressed. This will minimise the area of disturbed ground at any one time and encourage fauna to move away from the disturbance area of their own accord.

#### 3.1.1 Impacts to threatened fauna species

The main impact to threatened fauna as a result of the Project will come from vegetation clearing which will result in the loss and reduction in species habitat. Approximately 122.3 ha of remnant *Eucalyptus* and *Corymbia* woodland and riparian habitat is proposed to be cleared over the life of the Project. Approximately 2.5 ha of non-remnant emergent woodland that has the potential to provide fauna habitat values is also proposed to be cleared.

A summary of the fauna habitat areas proposed to be cleared for each EPBC Act listed species is outlined below in Table 3 and Appendix A. It is important to note that the impact areas are not additive as for example, Koala and Greater Glider habitats overlap.

**Table 3: Fauna habitat within the disturbance footprint**

Species	EPBC Act conservation status	Total area of potential suitable habitat within the project area (ha)	Total area of potential suitable habitat proposed to be cleared (ha)
Greater Glider	Vulnerable	380.1	125.0
Squatter Pigeon (southern)	Vulnerable	181.5	74.0
Ornamental Snake	Vulnerable	75.9 <sup>1</sup>	1.4
Koala	Vulnerable	380.1	125.0

<sup>1</sup> Note: The EPBC assessment and approval determined that the area did not contain any suitable Ornamental Snake habitat. However, the baseline riparian monitoring report was required to address condition.

## 3.2 Indirect impacts

The Project is expected to have several indirect impacts on the ecological values of the remaining vegetation and habitat following the proposed clearing. A detailed discussion on the impacts is provided in Appendix A with summaries of the impacts provided below. The potential for indirect impacts to occur are primarily related to:

- Habitat fragmentation and associated habitat degradation such as edge effects;
- Potential spread and/or introduction of weeds and pest animals;
- Increased noise, vibration, dust and light;
- Potential fauna injury and/or mortality due to vehicle strikes; and
- Erosion of disturbed areas leading to increased sedimentation of waterways.

### 3.2.1 Habitat fragmentation

Vegetation clearing can result in fragmenting the remaining habitat which can have adverse impacts on fauna species by restricting or inhibiting fauna movement. Clearing for this Project will further fragment habitat.

The riparian vegetation along Smoky Creek and Billy's Gully provides habitat corridors in the Project area. Although some clearing is required within these corridors, it has been minimised by constraining the clearing width of the haul roads to 40 m. Further, the mine design avoids works within the floodplains of the surrounding watercourses which further reduces impacts to these corridors. As part of the Project's Environmental Impact Assessment (EIA) undertaken to support the Environmental Authority (EA) and EPBC referral, impacts to connectivity were assessed using Queensland's Department of Environment and Science (DES) (formally the Department of Environment and Heritage Protection (EHP)) Landscape Fragmentation Connectivity Tool. Results of the analysis indicated the proposed works would not have a significant residual impact on local or regional connectivity (refer to Appendix A for assessment results).

### 3.2.2 Pest plants and animals

During the Project's EIA and ecological assessment (refer to Appendix A), seven Queensland declared pest plants were recorded with Parthenium Weed, Harrisia Cactus and Velvety Tree Pear being relatively common. Buffel Grass, although not a declared weed but a significant environmental weed, was also common throughout the Project area. The Project area is already highly disturbed and as such, the proposed works are unlikely to increase the presence of weeds (refer to Figure 12 in Appendix A for known locations of Weeds of National Significance listed under the QLD Biosecurity Act).

Several pest animals were recorded including the Cane Toad, Feral Dogs, Feral Cats and European Rabbit. Although not seen, it is likely the European Fox and Feral Pigs are also present within the Project area. As these animals can readily move throughout the landscape, activities from the Project are unlikely to introduce new pest animals to the area (refer to Risk Assessment in Section 7.0).

Although the Project is unlikely to introduce new plant and animal pests or lead to an increase of pests (refer to Section 7.0), the Project has existing management measures in place to manage plant and animal pests. These measures are outlined in Section 4.7.

### 3.2.3 Predation

The Project's EIA identified Feral Dogs and Feral Cats as being present in the Project area and the European Fox and Feral Pigs as likely to be present. The Greater Glider, Squatter Pigeon, Ornamental Snake and Koala all suffer from predation to varying degrees and predation is listed as a threat in the respective species EPBC Act conservation advice. Feral fauna pests as well as wild dogs all have the potential to prey on these species. Predation impacts will be mitigated through an extension of the existing Isaac Plains Mine plant and pest animal management and monitoring measures.

### 3.2.4 Noise and vibration

Noise and vibration will be generated from a range of sources including mining equipment and operations, excavators and blasting activities.

Noise from these activities may cause changes to the behavioural ecology of some species by modifying feeding, foraging and breeding activities (Francis & Barber, 2013). However, most fauna species exhibit



a range of adaptive responses to noise impacts. Depending on the extent and duration of construction and operational noise generated, some species may respond by moving away from the areas where noise is being generated and where a decrease in the ecological values of these habitats has occurred such as within the riparian corridors.

The proposed expansion will allow mining to advance to the expansion area once the current mining in the program has been exhausted. Hence, mining operations will continue in a similar manner to that which is currently occurring including similar levels of operational noise. Any potential noise and vibration impacts are likely to be minimal as the Project area is already impacted by noise and vibration from the existing operation and the change in noise and vibration generated from this expansion Project is not considered to be significant. Further, the fauna species listed in Section 2 are already inhabiting the site or in the case of Koala, have the potential to inhabit the site.

In accordance with the existing Isaac Plains mine approved EA (refer to Appendix C), specific noise and vibration management actions are currently being implemented which are focused on impacts to humans and their place of residence (sensitive receptors). In the absence of specific fauna measures, these management actions will be extended to this Project and are outlined in Section 4.7.

### **3.2.5 Dust**

Mining activities, including construction and operation will generate dust which has the potential to impact on vegetation/fauna habitat through reducing the health of vegetation and foraging resources for fauna that are in close proximity to mined and/or disturbed areas.

The existing Isaac Plains Mine currently utilises dust minimisation and suppression management actions including watering of haul roads and detailed air quality monitoring. These management actions will continue with this Project and are outlined in Section 4.7. Further, vegetation clearing will be progressive and gradual, which will minimise disturbance areas and areas of bare ground with the potential to generate dust. These disturbed areas will undergo rehabilitation as soon as practical to further reduce dust generation and associated impacts to vegetation and fauna.

### **3.2.6 Light**

The Project has the potential to generate additional artificial light within and adjacent to the mine activity areas. Potential impacts from artificial light include altered behaviour with some species attracted to the new light source whereas others are repelled or unaffected (Stone et. al., 2012). Hence, the extent of impacts will vary between species and will depend on habitat being utilised and the direction and intensity of the artificial light (Bennie et. al., 2015). The fauna species present on site are likely to have some degree of habituation to artificial lighting as the current Isaac Plains Mine currently generates light as does the adjacent Peak Downs Highway and Goonyella Rail Line.

The proposed Project will have limited additional light sources, and these will be limited to operational areas within the open cut pits, overburden piles, crib huts and vehicles. As the mining operation will be progressive, a relatively small proportion of the Project area will be operational at any one time. Further, as lighting will be directed towards the open cut pits and existing buildings, light spill will be mainly confined to the light source with minimal glare into the surrounding vegetation and undisturbed areas. Lighting impacts from vehicles travelling along the haul road will also be transitory and irregular.

### **3.2.7 Vehicle strike**

The construction and operation of mining haul roads have the potential to impact fauna through vehicle strikes that lead to injury or mortality. Ground dwelling or semi-arboreal mammals are more prone to vehicle strikes although birds and reptiles such as Squatter Pigeons and Ornamental Snakes may also be impacted. Locating the majority of the haul roads in non-vegetated areas is expected to reduce the incidence of vehicle strikes as will enforcing vehicle speed limits that are currently in place at the existing mine. However, some vehicle strikes may occur from vehicles traversing access and haul roads, particularly when these roads cross the riparian corridors where fauna are known to inhabit.

As the Project is an expansion to the existing operation, the current traffic and safety management measures will continue be enforced and include speed limits, safe driving practices and fauna crossing awareness (refer to Table 7 for key management measures).

### **3.2.8 Erosion and sediment control**

The Project has the potential to cause erosion from vegetation clearing for the open cut pits, haul roads and associated mining infrastructure. Where erosion occurs, the associated surface runoff can lead to increased sediment loads within local waterways.

As required by the Project's EA conditions, the current Isaac Plains Mine Water Management Plan and Erosion and Sediment Control Plan will be updated by a suitably qualified person prior to construction activities commencing. These plans involve managing storm water to separate clean and dirty water, diverting clean water around disturbed areas and using appropriate sediment control structures for both the construction and operational phases of the Project. These plans will be an extension of the existing plans developed for the current Isaac Plains Mine (refer to Section 4.7 for key management measures).

### **3.2.1 Fire**

Fire has the potential to result in either temporary or permanent loss of vegetative cover, microhabitat and hollow bearing trees (particularly stags) which in turn, has the potential to impact on terrestrial fauna and ecological values. Altered fire regimes that may be caused by the Project activities may also lead to longer term vegetative changes which have the potential to lead to further habitat loss, habitat degradation and a reduction in habitat connectivity.

The risk of fire associated with the Project is considered unlikely. Under Queensland's *Coal Mining Safety and Health Act 1999*, mining operations in general have detailed safety practices due to the operational health and safety implications of fire. The current fire management measures being implemented at the Isaac Plains Mine will be extended to this Project and updated where necessary as determined by the Senior Site Executive and the General Manager – Operations.

### **3.3 Impact duration**

Vegetation clearing is the primary activity that will directly impact fauna and fauna habitat. Clearing will be undertaken progressively over the seven-year mine life and as the mining operation progresses. Progressive rehabilitation will be undertaken as each mining stage is completed which will minimise the area and duration of disturbed and unvegetated land.

### **3.4 Summary of impacts**

Table 4 outlines the potential impacts of the Project that are applicable to the Greater Glider, Squatter Pigeon, Ornamental Snake and Koala and in relation to the Project phase where the impact is likely to occur.

**Table 4: Summary of potential impacts to EPBC Act listed threatened fauna to be avoided or mitigated**

Impacts	Potential impacts associated with the project	Impacted species	Project phase
Vegetation clearing/habitat loss	Removal of vegetation that is considered habitat for threatened species over and above that approved.	All	Pre-construction, construction and operation
Habitat degradation from feral herbivores	Loss of food resources from introduced herbivores (i.e. Rabbits) and habitat degradation by inappropriate vegetation management. Degradation can also occur via destruction of nests by vehicles and machinery, people, and large herbivores.	Squatter Pigeon and Ornamental Snake	Construction and operation
Introduced plant and animal pests	Dispersal of weeds throughout the Project area by vehicles, machinery, and people leading to habitat degradation. Increased incidence of fauna pests leading to predation on native fauna and habitat degradation.	All	Construction and operation
Predation by invasive fauna	Loss of individuals to predation by European Foxes, Feral Dogs and Feral Cats, which are known to increase in abundance around human habitation in dryland areas. Food waste attracting fauna pests to the Project Area.	All	Construction and operation
Noise and vibration	Loss of useable habitat in, and adjacent to, the Project Area due to noise and vibration disturbance.	All	Construction and operation
Dust	Particulate emissions may reduce ground vegetation cover, food resources quality and vegetation quality.	All	Construction and operation
Light	Loss of useable habitat in and adjacent to the Project Area due to light disturbance at night.	Greater Glider, Squatter Pigeon and Koala	Construction and operation
Vehicle strike	Mortality and injury from vehicle strike, due to an increased number of vehicles and access routes.	Squatter Pigeon, Ornamental Snake and Koala	Construction and operation
Erosion and sedimentation	Increased erosion of disturbed surfaces and increased sedimentation of waterways. Severe erosion can alter surface water flows and local hydrological regimes.	Squatter Pigeon and Ornamental Snake	Construction and operation
Fire	Changes in land cover in the Project area may increase the spread of bushfires, which can cause temporary and permanent losses of food resources, as well as injury/mortality of threatened species. Fire can also occur from machinery and site activities.	All	Construction and operation

## 4.0 Mitigation and Management measures

The objectives, performance criteria, mitigation and management measures and monitoring have been chosen based on practicalities of implementing the measures and programs, the EPBC Act conditions of approval, the current EA approval conditions, relevant coal mining legislative requirements and current approved management measures and monitoring programs for the existing Isaac Plains Mine.

Of particular importance are the *Coal Mining Safety and Health Act 1999* (CMSHA) and *Coal Mining Safety and Health Regulation 2017* (CMSHR) which govern all coal mining operations in Queensland. The CMSHA prescribes statutory obligations to ensure that coal mines operate under an acceptable level of risk. A major requirement is the development and implementation of a Safety and Health Management System (SHMS) for operation of the mine which is based on a risk assessment of all hazards present at the mine. Adherence to the requirements of the CMSHA and CMSHR is of particular relevance to this SMP as it outlines statutory provisions for matters such as fire management, management of haul roads, vehicle speeds and dust suppression which are applicable to the management of impacts to MNES.

### 4.1 Management objectives

The main objectives of this SMP are to:

- Ensure no clearing/disturbance to MNES habitats occurs beyond the disturbance limits approved by the EPBC Act approval conditions;
- Prevent injury or mortality of MNES fauna during construction, operation and decommissioning of the Project; and
- Manage remaining areas of MNES habitats to maintain condition and habitat quality for the threatened fauna species outlined in Section 2 through weed, pest and fire management and limiting disturbance to exclusion areas.

Specific management objectives to be achieved through the implementation of this SMP and the associated performance criteria related to each management objective are shown in Table 5.

**Table 5: Habitat management objectives and performance criteria**

SMP management objectives	Performance criteria
Limit or avoid loss of MNES and/or habitat for MNES.	<ul style="list-style-type: none"> <li>• Clearing of habitat for MNES does not occur outside of the approved disturbance footprints.</li> <li>• No net loss of habitat for the Koala and Greater Glider outside of the approved disturbance limits.</li> <li>• No loss of permanent water sources for the Squatter Pigeon outside of the approved disturbance limits.</li> <li>• No net loss of Ornamental Snake foraging resources outside of the approved disturbance limits.</li> <li>• Rehabilitation of disturbed areas will be rehabilitated in accordance with the Project's Rehabilitation Management Plan.</li> </ul>
Prevent injury or mortality of MNES fauna	<ul style="list-style-type: none"> <li>• Ensure vehicle speed limits are enforced</li> <li>• Provide fauna recognition training to make staff aware of the local fauna species</li> </ul>
Prevent habitat degradation and a decline in habitat values within the retained habitat within the Project area.	<ul style="list-style-type: none"> <li>• Maintain habitat quality scores within the retained MNES habitat in relation to baseline habitat quality scores outlined in Appendix B.</li> <li>• Rehabilitation of disturbed areas will be rehabilitated in accordance with the Project's Rehabilitation Management Plan.</li> </ul>
Minimise risk of weed introduction and/or the spread of existing weed species in habitat area for MNES.	<ul style="list-style-type: none"> <li>• No new weed species are established in areas of MNES habitat areas based on baseline data;</li> </ul>

SMP management objectives	Performance criteria
	<ul style="list-style-type: none"> <li>Spreading of weeds does not occur as in areas of retained MNES habitat compared to baseline habitat quality surveys.</li> </ul>
Reduce habitat degradation and potential predation on MNES by pest animals.	<ul style="list-style-type: none"> <li>No new pest animal species are established in areas of MNES habitat in comparison to baseline data.</li> <li>Reduction in pest animal numbers in areas of habitat for MNES to below baseline levels.</li> </ul>
Minimise impact of dust deposition on habitat for MNES during construction and operation of the Project.	<ul style="list-style-type: none"> <li>Dust deposition does not exceed 120 mg per square metre per day, averaged over one month when measured at any sensitive receptor as outlined in Condition B2 of the Project's EA.</li> <li>Dust is monitored in accordance with the Dust Management Plan in accordance with Condition B5 of the Project's EA.</li> </ul>
Minimise noise and vibration impacts in areas of MNES habitat.	<ul style="list-style-type: none"> <li>When measured, noise and vibration levels at sensitive receptors do not exceed criteria set out in Tables 15 and 16 of the Project's EA.</li> </ul>
Minimise degradation of habitat for MNES from an increased risk of fire due resulting from Project activities.	<ul style="list-style-type: none"> <li>No uncontrolled fires within the Project area resulting from Project related activities.</li> </ul>
Minimise alteration of Squatter Pigeon and Ornamental Snake habitat from changes to water quality and hydraulic activity.	<ul style="list-style-type: none"> <li>Water quality does not exceed trigger levels and at any of the monitoring sites listed in the Tables in Condition C – Water of the Project's EA,</li> <li>Water quality monitoring is undertaken in accordance with the Receiving Environment Monitoring Program which has been prepared in accordance with Condition C22 of the Project EA.</li> </ul>
Minimise potential for mortality or injury to MNES from Project activities (e.g. habitat clearing, vehicle strikes etc).	<ul style="list-style-type: none"> <li>No mortality or injury to MNES as a result of Project activities (e.g. from clearing activities, vehicle strikes etc).</li> </ul>

## 4.2 Relevant plans and guidelines

Table 6 lists the conservation advice and plans relevant to each of the MNES species covered by this SMP. These documents have been reviewed in preparing the SMP to capture those management objectives and measures outlined in Table 7 that are specific to each of the threatened species and to address the key threatening processes to each MNES.

**Table 6: Relevant conservation advice, recovery plans and threat abatement plans, and relationships to management objectives and measures (Table 7)**

MNES	Relevant conservation advice and plans	Main threats and recommended actions	Management objectives for this SMP
Koala ( <i>Phascolarctos cinereus</i> )	<ul style="list-style-type: none"> <li>Approved Conservation Advice for <i>Phascolarctos cinereus</i>, Koala (combined populations in Queensland, New South Wales and the Australian Capital Territory), (SEWPaC, 2012).</li> </ul>	<ul style="list-style-type: none"> <li>Habitat fragmentation, vehicle strike and predation.</li> </ul>	<ul style="list-style-type: none"> <li>Limit or avoid loss of MNES and/or habitat for MNES.</li> <li>Prevent habitat degradation and a decline in habitat values within the retained habitat within the Project area.</li> <li>Reduce habitat degradation and potential predation on</li> </ul>

MNES	Relevant conservation advice and plans	Main threats and recommended actions	Management objectives for this SMP
			<p>MNES by pest animals.</p> <ul style="list-style-type: none"> <li>Minimise potential for mortality or injury to MNES from Project activities (e.g. habitat clearing, vehicle strikes etc).</li> </ul>
<p>Greater Glider (<i>Petauroides volans</i>)</p>	<ul style="list-style-type: none"> <li>Conservation Advice for <i>Petauroides Volans</i>, Greater Glider (TSSC, 2016).</li> </ul>	<ul style="list-style-type: none"> <li>Habitat loss, fires and predation from owls.</li> </ul>	<ul style="list-style-type: none"> <li>Limit or avoid loss of MNES and/or habitat for MNES.</li> <li>Prevent habitat degradation and a decline in habitat values within the retained habitat within the Project area.</li> <li>Reduce habitat degradation and potential predation on MNES by pest animals.</li> <li>Minimise degradation of habitat for MNES from an increased risk of fire due resulting from Project activities.</li> </ul>
<p>Squatter Pigeon (Southern) (<i>Geophaps scripta scripta</i>)</p>	<ul style="list-style-type: none"> <li>Approved Conservation Advice for <i>Geophaps scripta scripta</i> (Squatter Pigeon (southern)) (TSSC, 2015);</li> <li>Threat abatement plan for predation by feral cats (Commonwealth of Australia, 2015);</li> <li>Threat abatement plan for competition and land degradation by rabbits (Commonwealth of Australia, 2016); and</li> <li>Threat abatement plan for predation by the European red fox (DEWHA 2008a)</li> </ul>	<ul style="list-style-type: none"> <li>Habitat clearing.</li> <li>Livestock and feral herbivore grazing.</li> <li>Predation, by Feral Cats and European Foxes.</li> <li>Feral Cat control strategies.</li> <li>European Fox control strategies</li> </ul>	<ul style="list-style-type: none"> <li>Limit or avoid loss of MNES and/or habitat for MNES.</li> <li>Reduce habitat degradation and potential predation on MNES by pest animals.</li> <li>Minimise impacts of dust deposition on habitat for MNES during construction and operation of the Project.</li> <li>Minimise potential for mortality or injury to MNES from Project activities (e.g. habitat clearing, vehicle strikes etc).</li> </ul>

MNES	Relevant conservation advice and plans	Main threats and recommended actions	Management objectives for this SMP
Ornamental Snake ( <i>Denisonia maculata</i> )	<ul style="list-style-type: none"> <li>Approved Conservation Advice for <i>Denisonia maculata</i> (Ornamental Snake) (DotE, 2014).</li> </ul>	<ul style="list-style-type: none"> <li>Habitat clearing and degradation of habitat including wetland and frog habitat by Feral Pigs.</li> </ul>	<ul style="list-style-type: none"> <li>Limit or avoid loss of MNES and/or habitat for MNES.</li> <li>Prevent habitat degradation and a decline in habitat values within the retained habitat within the Project area.</li> <li>Reduce habitat degradation and potential predation on MNES by pest animals.</li> <li>Minimise impacts of dust deposition on habitat for MNES during construction and operation of the Project.</li> <li>Minimise habitat alteration from changes to water quality and hydraulic activity.</li> <li>Minimise potential for mortality or injury to MNES from Project activities (e.g. habitat clearing, vehicle strikes etc).</li> </ul>

Management and mitigation measures have been specified to address the general requirements of these plans (refer to Table 7) in relation to:

- Avoid loss of MNES habitat through unauthorised vegetation and habitat clearing (all species);
- Minimising the risk of direct harm to threatened fauna during vegetation clearing and construction of the Project (all species);
- Staff and contractor awareness of threatened fauna in the Project area (all species);
- Minimising the risk of vehicle strike to threatened fauna during construction, operation and decommissioning of the Project (primarily Koala, Squatter Pigeon and Ornamental Snake);
- Fire management to minimise risk of fire (all species);
- Pest plant and animal management within the Project area to minimise predation and the spread of weeds and reduce the extent of weed species and pest animals within and in habitats adjacent the Project area (all species); and
- Appropriate rehabilitation that returns habitat features and food resources to the Project area (all species).

### 4.3 General management actions

Planning and management of disturbances for the proposed mine expansion were assessed taking into consideration of a set of hierarchical management principles as outlined in State and Commonwealth offset policies, that are designed to avoid impacts, minimise impacts and mitigate impacts to the environmental values including threatened fauna.

This SMP has been developed considering these management principles (in order of preference) with relevance to impacts on threatened fauna species:

- *Avoidance*: Avoiding direct and indirect adverse impacts where possible through Project design;
- *Minimise*: Minimising direct and indirect adverse impacts where impacts cannot be avoided through modifying design, the timing of construction or employing specialist clearing and construction methods;
- *Mitigate*: Implement mitigation and management actions to unavoidable impacts, through design management actions and rehabilitation;
- *Remediation and rehabilitation*: Actively and progressively remediate and rehabilitate impacted areas to promote and maintain long-term recovery; and
- *Provide offsets*: The Approval Holder will provide suitable offsets for activities that result in unavoidable significant residual adverse impacts to MNES. These offsets will be provided in accordance with the EPBC Act approval conditions, specifically Conditions 5, 6 and 7 as outlined in the Project's Offset Management Plan (OMP).

The hierarchy of management actions will be applied to all activities with the aim of minimising impacts to threatened MNES fauna species and to satisfy the objectives of the EPBC Act Project approval conditions.

### 4.4 Design phase strategy

The Project and in particular the haul road crossings that traverse Smoky Creek and Billy's Gully have been designed to minimise the overall footprint as much as practicable. Haul road width has been reduced from approximately 80 m wide to 40 m wide where they cross the riparian areas of Smoky Creek and Billy's Gully to minimise the amount of remnant vegetation required to be cleared and to minimise impacts to habitat connectivity.

### 4.5 Pre-construction and construction phase strategy

As part of the vegetation clearing and soil disturbance phases of the activity, pre-clearance surveys undertaken by suitably qualified ecologists will assess the presence of EPBC Act listed threatened fauna species within 48 hours of the disturbance activities and relocate any detected native fauna to suitable habitat outside of the disturbance areas. Qualified Fauna Spotter/Catchers will oversee all vegetation clearing works, with the most suitable ratio of Fauna Spotter/Catcher per machine undertaking clearing activities to be determined by the Qualified Fauna Spotter prior to commencement of clearing activities. This will allow animals to be relocated away from the disturbance area if necessary and for disturbance activities to cease until any danger to the health and wellbeing of fauna has passed.

### 4.6 Rehabilitation, operation and maintenance phase strategy

To minimise impacts to terrestrial fauna caused by habitat loss, habitat degradation, fire and erosion, rehabilitation of disturbed areas will occur, including the riparian corridor crossings Smoky Creek and Billy's Gully. Rehabilitation and decommissioning will be undertaken in accordance with the rehabilitation requirements of the Project's EA including the Rehabilitation Management Plan, with the aim of providing a stable landform with a self-sustaining vegetation cover.

The Project EA and Rehabilitation Management Plan include rehabilitation goals, objectives, indicators and completion criteria for the Project for each mine domain. The mine domains are split into mine infrastructure, overburden emplacement areas, final voids and in-pit tailings storage. Other than final voids, all domains have a post mining grazing land use. Completion criteria, including foliage and ground cover, soil quality, plant regeneration, presence of key plant species, weed abundance, and achievement of grazing land use classification in accordance with Queensland Guideline for Agricultural Land Evaluation, are conditioned to demonstrate the suitability of rehabilitation areas. The Project EA



and Rehabilitation Management Plan also set milestones for when the rehabilitation schedule must be completed, including progressive rehabilitation of overburden emplacement areas, and reshaping to final landform design, topsoiling and seeding.

Rehabilitation monitoring will be undertaken in accordance with the requirements of the EA to identify if rehabilitation goals, objectives, indicators and completion criteria are being achieved, and to take remedial action where monitoring shows this is required.

#### **4.7 Management measures**

This section of the SMP outlines a series of management measures designed to avoid and/or mitigate potential impacts to threatened fauna species, based on known threats to each species identified in Section 2. Table 7 outlines relevant management measures that will be undertaken to mitigate, manage and monitor the impacts of the Project on MNES, and achieve the objectives for habitat management.

The management objectives, performance criteria, management and monitoring activities outlined in Table 6 have been developed based on baseline field surveys and considering operational practicalities. Development has also been undertaken in accordance with the key threats and recommended priority actions as outlined in the species-specific recovery plans, threat abatement plans and conservation advices.

**Table 7. Measures to avoid/mitigate impacts to EPBC Act listed threatened fauna**

Habitat Management objectives	Performance criteria	Management and mitigation measures	Trigger for further action	Monitoring	Corrective actions
<p>1. Limit or avoid loss of MNES and/or habitat for MNES.</p>	<ul style="list-style-type: none"> <li>Clearing of habitat for MNES does not occur outside of the approved disturbance limits and does not exceed the disturbance limits detailed in Table 1 of this SMP.</li> <li>No net loss of habitat for the Koala and Greater Glider outside of the approved disturbance limits.</li> <li>No loss of permanent water sources for the Squatter Pigeon outside of the approved disturbance limits.</li> <li>Rehabilitation of disturbed areas will be rehabilitated in accordance with the Project's Rehabilitation Management Plan.</li> </ul>	<ul style="list-style-type: none"> <li>Infrastructure will be sited in accordance with the State and Commonwealth approval conditions.</li> <li>Areas requiring vegetation removal will be clearly delineated to ensure disturbance to areas being retained is avoided. Limits of clearing are to be delineated using barricading or temporary fencing and signage prior to works commencing. Exclusion areas are to be clearly shown and labelled on all operational and management drawings and plans. GIS shapefiles will be provided to clearing personnel and/or contractors prior to the commencement of clearing operations.</li> <li>Where exclusion fencing is required, consideration shall be given to fauna movement, current land uses and worker safety requirements.</li> <li>Permanent water sources for retention such as farm dams outside of the disturbance limits will be clearly delineated and shown and labelled on all operational and management drawings and plans</li> <li>Avoid where possible and within the constraints of the mining schedule, impacting on MNES habitat during breeding periods through timing of clearing and creek disturbance activities to avoid the main breeding season of impacted MNES (i.e. mid dry season to wet season for Squatter Pigeon.</li> <li>Prior to entry to the Project area, all site personnel including contractors shall be</li> </ul>	<ul style="list-style-type: none"> <li>Clearing of MNES habitat exceeds the approved disturbance limits in Table 1 of this SMP and/or occurs outside of the Project footprint as outlined in Attachment A of EPBC Act approval.</li> <li>No disturbance to permanent water sources, which may provide habitat for Squatter Pigeons and Ornamental Snakes, outside of the disturbance areas.</li> <li>Rehabilitation and decommissioning fails to meet the objectives of the Rehabilitation Management Plan.</li> </ul>	<ul style="list-style-type: none"> <li>Fauna Spotter will monitor and record clearing activities and all fauna encountered.</li> <li>The Environmental Officer (EO) will monitor and record the total area of MNES habitat cleared every quarter and assess against the disturbance limits outlined in Table 1 of this SMP and the Project footprint as outlined in EPBC Act approval.</li> <li>Auditing of the Permit to Disturb will be undertaken quarterly by the EO to ensure any disturbance has been undertaken in accordance with the requirements of the Permit to Disturb, this SMP and approval conditions and to ensure no unauthorised disturbance has occurred.</li> <li>Rehabilitation monitoring will be undertaken in accordance with Rehabilitation Monitoring Plan that is required to be prepared in accordance with Condition F13 of the Project's EA (Appendix C).</li> </ul>	<ul style="list-style-type: none"> <li>Should clearing of habitat for MNES exceeds the approved disturbance limits in Table 1 of this SMP and/or occurs outside of the Project footprint, clearing, works are to cease immediately and DoEE notified of the incident within five business days. The incident will be recorded in the Project's environmental and incident reporting system register.</li> <li>Following clearing, the area will be assessed within 20 business days by a suitably qualified expert with corrective actions provided to the DoEE via a Corrective Action Contingency Plan.</li> <li>The Plan will include a schedule to implement the corrective actions.</li> <li>Should rehabilitation and decommissioning fail to meet the objectives and completion criteria of the Rehabilitation Management Plan and the schedule outlined in Table 19 of the Project's EA, the reasons of</li> </ul>

Habitat Management objectives	Performance criteria	Management and mitigation measures	Trigger for further action	Monitoring	Corrective actions
		<p>made aware via toolbox talks and site information sheets, of the sensitive environs they will be working in and around and be advised of specific limitations to construction works being undertaken in or adjacent to threatened fauna habitat. All staff and contractors will be required to report sightings of SMP relevant fauna in the activity area to the EO immediately.</p> <ul style="list-style-type: none"> <li>• An internal 'Permit to Disturb' system will be used by the EO to ensure that all clearing activities are authorised prior to disturbance. Conditions listed in the Permit to Disturb must be implemented.</li> <li>• The EO or delegate will routinely inspect the disturbance limit boundaries to ensure that no clearing or disturbance of vegetation or habitat beyond the approved limits has taken place.</li> <li>• Temporary stockpile sites for soil and equipment, access routes, laydown areas and other associated infrastructure will be located in cleared areas and will not be situated in areas of MNES habitat.</li> <li>• Prior to construction activities commencing, signage, including speed limits, will be erected in the vicinity of exclusion areas to warn of the potential presence of threatened fauna in the area.</li> <li>• Pre-clearance surveys will be undertaken by a suitably qualified ecologist using approved State and Commonwealth survey guidelines within 48 hours before clearing activities commencing.</li> </ul>			<p>the failure will be investigated.</p> <p><b>Corrective Actions:</b></p> <ul style="list-style-type: none"> <li>• The Corrective Actions identified in the Corrective Action Contingency Plan and approved by DoEE will be implemented and may include additional rehabilitation or offsets or provision of additional permanent water sources for the Squatter Pigeon and/or Ornamental Snake prey.</li> <li>• Within 20 business days of a rehabilitation trigger being activated, a Contingency Plan will be developed by a suitably qualified expert to address the reason for the failure and identify appropriate Corrective Actions.</li> </ul>

Habitat Management objectives	Performance criteria	Management and mitigation measures	Trigger for further action	Monitoring	Corrective actions
		<ul style="list-style-type: none"> <li>• The pre-clearance survey will be undertaken in order to:                             <ul style="list-style-type: none"> <li>• Record the location of all hollow bearing trees, log piles and nest using a GPS. Features of tree hollows (diameter, number and whether active/inactive) should be recorded in the Environmental Diary/Register; and</li> <li>• Relocate all captured non-breeding animals to suitable habitat adjacent to the disturbance area and within the Project Area.</li> </ul> </li> <li>• A Fauna Spotter will be present for all clearing activities and will conduct a walk-through survey prior to commencement of clearing and prior to clearing works each day to check vegetation and other fauna habitats.</li> <li>• The Fauna Spotter will reinspect the area of cleared vegetation immediately after clearing to locate any potentially injured fauna that should then be taken to a wildlife carer or veterinarian.</li> <li>• Vegetation clearing will be undertaken progressively and trees will be felled in the direction of the clearance zone to avoid impacts to adjoining retained vegetation and habitat.</li> <li>• Hollow bearing trees will be clearly flagged and surrounding vegetation removed with the hollow bearing tree left standing for at least one night to encourage fauna to relocate of its own accord. Hollow bearing trees will be</li> </ul>			

Habitat Management objectives	Performance criteria	Management and mitigation measures	Trigger for further action	Monitoring	Corrective actions
		<p>inspected to determine if hollows are occupied.</p> <ul style="list-style-type: none"> <li>• If after one night the resident fauna have not moved on, the hollow entrance will be blocked with a towel or similar and the hollow removed by cutting below the hollow section. The hollow with the animal inside will then be installed in nearby similar and adjoining vegetation to be retained at a similar height and orientation with the entrance unblocked at dusk.</li> <li>• If the procedure described above is not possible for any reason, hollow-bearing trees will be felled using a tree grab or similar that can remove the tree in a controlled fashion. If possible and safe to do so, hollow trees will be felled at dusk to allow fauna the opportunity to disperse during their normal activity period. These trees will be felled away from hollow openings. The tree will be knocked at the base several times prior to felling to encourage fauna to relocate of their own accord. Once the tree is felled, it will be inspected for any fauna and any injured fauna rescued and taken to a wildlife carer or veterinarian.</li> <li>• Any fauna that is captured will be relocated into the adjacent habitat at least 200 m from the clearing area if clearing works are yet to be completed.</li> <li>• Where threatened fauna is identified and delaying the clearing of area is not feasible, (i.e. the clearing is critical to the activity schedule), a 50 m exclusion zone will be established and the area must not be</li> </ul>			

Habitat Management objectives	Performance criteria	Management and mitigation measures	Trigger for further action	Monitoring	Corrective actions
		<p>disturbed for a minimum of 24 hours while clearing is undertaken around the exclusion zone. After 24 hours, a Fauna Spotter/Catcher may relocate the breeding animal to suitable habitat at least 200 m away from the disturbance area. Where survival of young or eggs is unlikely as a result of the disturbance, these are to be handed over to a previously identified wildlife carer or veterinarian.</p>			
<p>Prevent habitat degradation and a decline in habitat values within the retained habitat within the Project area.</p>	<p>Maintain habitat quality scores within the retained MNES habitat in relation to baseline habitat quality scores.</p>	<ul style="list-style-type: none"> <li>• Areas of MNES habitat adjacent to the disturbance footprint and within the Project area (i.e. mine lease), will be clearly delineated and shown and labelled on all operational and management drawings and plans. GIS shapefiles will be provided to clearing personnel and/or contractors prior to the commencement of clearing operations.</li> <li>• Site access is only to occur along designated site access tracks. No unauthorised access is permitted.</li> <li>• Prior to commencement of the action signage, including speed limits, will be erected to warn of the potential presence of threatened fauna in the area.</li> <li>• Posters will be developed and displayed in meeting areas that reminds staff and contractors about the MNES present in the Project area.</li> <li>• Prior to entry to the Project area, all site personnel including contractors shall be made aware via toolbox talks and site information sheets, of the sensitive environs they will be working in and around and be</li> </ul>	<p>The habitat quality score in areas of retained MNES are not maintained (e.g. habitat falls below the baseline habitat quality score).</p>	<ul style="list-style-type: none"> <li>• Habitat quality assessments will be undertaken annually for the first three (3) years then every two (2) years thereafter in retained vegetation that provides habitat for MNES including monitoring of the riparian area as required by Condition 10 of the EPBC Act approval. Monitoring will be undertaken in accordance with the Commonwealth survey guidelines and the State guidelines guide for determining terrestrial habitat quality. These methods are outlined in Appendix A and Appendix B.</li> </ul>	<ul style="list-style-type: none"> <li>• Where inadvertent disturbance to MNES habitat occurs, an investigation will be undertaken.</li> <li>• Should a decline in the habitat quality scores be observed, the cause will be investigated, and a Corrective Actions Contingency Plan will be developed by a suitably qualified ecologist within 20 business days of the decline being detected. The Plan will include appropriate corrective actions and an implementation schedule for those actions. The DoEE will be notified within 20 business days of the decline in habitat quality.</li> </ul> <p><b>Corrective Actions:</b></p> <ul style="list-style-type: none"> <li>• Corrective actions identified in the Plan will be</li> </ul>

Habitat Management objectives	Performance criteria	Management and mitigation measures	Trigger for further action	Monitoring	Corrective actions
		<p>advised of specific limitations to construction and/or operational works being undertaken in or adjacent to threatened fauna habitat. All staff and contractors will be required to report sightings of MNES fauna to the EO immediately</p> <ul style="list-style-type: none"> <li>• Where tree hollows that are suspected as being used by Greater Gliders are identified from within the disturbance area, they are to be salvaged to the greatest extent possible and relocated within retained vegetation. As far as practical, the site of the relocation is to be within retained vegetation and replicate the height and orientation of the original breeding or nesting structure. Sections of hollow branch or log will be secured in the new location by mechanical means deemed appropriate by the Fauna Spotter/Catcher (e.g. bolts, metal bands). Relocation is to be undertaken under the supervision of a spotter/catcher.</li> <li>• Selected trees and/or logs will be salvaged and reused as fauna habitat to enhance retained vegetation habitat values (e.g. within Smoky Creek and Billy's Gully). Trees and other habitat features to be salvaged will be identified and flagged by the Fauna Spotter/Catcher during the walk-through survey and/or clearance activities.</li> <li>• If an occupied tree hollow cannot be relocated the breeding habitat should be replaced nearby and in retained vegetation (but at least 200 m away from the disturbance area) in undisturbed habitat, with an artificial</li> </ul>			<p>implemented within 30 days of the trigger being detected. Depending on the cause of the decline in habitat quality scores, potential corrective actions may include:</p> <ul style="list-style-type: none"> <li>○ Rehabilitation of MNES habitat.</li> <li>○ Additional environmental awareness training to workers regarding MNES.</li> <li>○ Increasing pest animal and weed control measures or revising the type of measures implemented.</li> <li>○ Increasing the frequency of dust suppression techniques.</li> <li>○ Repair fences if damaged, or installation of new fencing.</li> <li>• Provision of additional offsets in accordance with the EPBC Act approval Condition 13.</li> </ul>

Habitat Management objectives	Performance criteria	Management and mitigation measures	Trigger for further action	Monitoring	Corrective actions
		<p>nesting structure at a ratio of 1:1 using current best practice nest box design.</p> <ul style="list-style-type: none"> <li>• Implementation of dust suppression techniques in accordance with the Dust Management Plan and the CMSHA and the CMSHR.</li> <li>• Maintenance of existing fences.</li> <li>• Pest animals and weeds will be managed in accordance with the Project's Weed and Pest Management Plan.</li> <li>• Light spill we be directed to the open cut pits to minimise light spill.</li> <li>• The use of low wattage lighting with list spill guards.</li> </ul>			
<p>Minimise risk of weed introduction and/or the spread of existing weed species in habitat area for MNES.</p>	<ul style="list-style-type: none"> <li>• No new weed species are established in areas of MNES habitat based on baseline data.</li> <li>• Spreading of weeds does not occur relative to baseline data.</li> </ul>	<ul style="list-style-type: none"> <li>• Weeds will be managed in accordance with the Project's Weed and Pest Management Plan.</li> <li>• The Plan will include the following: <ul style="list-style-type: none"> <li>○ A site induction program that provides weed management information to staff, contractors and visitors.</li> <li>○ Detailed control measures aimed at eradicating where possible, or otherwise reducing the extent of weeds in accordance with the Queensland Department of Agriculture and Fisheries (DAF) guidelines and the requirements of the <i>Biosecurity Act 2014</i>.</li> <li>○ Weed washdown procedures for all vehicles brought to site that will be traveling beyond the site office carpark.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• An increase in the average percent (%) cover score of weed species from baseline and/or previous monitoring events.</li> <li>• Detection of weed species not previously recorded in the Project area during baseline and/or previous monitoring events.</li> </ul>	<ul style="list-style-type: none"> <li>• Monitoring of weeds outside of the disturbance areas will be undertaken during the habitat quality assessment surveys using similar methodology to the baseline ecological survey (Appendix A) and the habitat quality assessment methodology (Appendix B) and will be undertaken annually for the first three (3) years then every two years (refer to Section 5.0).</li> </ul>	<ul style="list-style-type: none"> <li>• Should an increase in weed cover or presence of new weed species be observed, an investigation will be undertaken to determine the cause. This will involve reviewing adherence to the Weed and Pest Management Plan and an assessment of the distribution of weeds within the Project area in relation to baseline to determine the cause of the incursions.</li> <li>• From the investigation, a Corrective Action Contingency Plan will be developed by a suitably qualified ecologist within 20</li> </ul>



Habitat Management objectives	Performance criteria	Management and mitigation measures	Trigger for further action	Monitoring	Corrective actions
		<ul style="list-style-type: none"> <li>○ Targeted weed control measures within the Project area.</li> </ul>			<p>business days of the trigger being detected. The Contingency Plan will include appropriate corrective actions and an implementation schedule for those corrective actions.</p> <p><b>Corrective Actions:</b></p> <ul style="list-style-type: none"> <li>• Corrective actions identified in the contingency plan will be implemented within 30 days of the trigger being detected.</li> <li>• Potential corrective actions may include:                             <ul style="list-style-type: none"> <li>○ Increasing the frequency and/or duration of weed control efforts.</li> <li>○ Investigating and/or implementing alternate weed management control actions.</li> <li>○ Amending weed hygiene practices.</li> <li>○ Updating the Weed and Pest Management Plan.</li> </ul> </li> </ul>
Reduce habitat degradation and potential predation	<ul style="list-style-type: none"> <li>• No new pest animal species are established in areas of MNES habitat in</li> </ul>	<ul style="list-style-type: none"> <li>• Pest animals will be managed in accordance with the Project's Weed and Pest Management Plan.</li> </ul>	<ul style="list-style-type: none"> <li>• Observed increase in sightings/signs and/or the relative abundance of pest animals in areas of retained</li> </ul>	<ul style="list-style-type: none"> <li>• Monitoring of pest animals in the retained MNES habitat will be undertaken using similar methodology (or an alternate</li> </ul>	<ul style="list-style-type: none"> <li>• Should evidence of pest animals show an increase compared to baseline, undertake an investigation to assess possible reasons</li> </ul>

Habitat Management objectives	Performance criteria	Management and mitigation measures	Trigger for further action	Monitoring	Corrective actions
on MNES by pest animals.	<p>comparison to baseline data.</p> <ul style="list-style-type: none"> <li>Reduction in pest animal numbers in areas of habitat for MNES to below baseline levels.</li> </ul>	<ul style="list-style-type: none"> <li>The Project's Weed and Pest Management Plan includes requirements for: <ul style="list-style-type: none"> <li>Appropriate waste management and waste disposal.</li> <li>A reporting framework to ensure sightings of pest animals are recorded.</li> <li>Site inductions to include information on pest animals including control requirements, importance of appropriate waste management and reporting requirements when pest animals are observed within the Project area during construction and operation activities.</li> <li>Control of pest animals.</li> </ul> </li> <li>Pest management actions outlined in the Weed and Pest Management Plan will primarily focus on those pest animals identified within the Project area and include Cane Toads, Feral Cats, Wild Dogs, House Mice and European Rabbits and that have a potential to impact on MNES and their habitat. Additional pests will be included as necessary if identified as occurring within the Project area during the habitat quality monitoring program (European Foxes and Feral Pigs).</li> <li>Pest management will include a range of best management practice actions including shooting, trapping, fencing and baiting in and will be undertaken in accordance with site safety and health requirements, and DAF guidelines and the requirements of the</li> </ul>	<p>MNES habitat above baseline levels.</p> <ul style="list-style-type: none"> <li>Direct observation or signs of, a pest animal not identified as occurring within the Project area during the baseline surveys.</li> </ul>	<p>methodology proposed by a suitably qualified ecologist) to the baseline ecological survey undertaken for the EPBC referral (Appendix A) as well as the habitat quality assessment methodology (Appendix B) and will be undertaken annually for the first three (3) years then every two (2) years thereafter (refer to Section 5.0).</p> <ul style="list-style-type: none"> <li>Potential predation of MNES will also be assessed during the habitat quality scoring assessment and the riparian monitoring program (Appendix D) outlined above.</li> </ul>	<p>for the increase (e.g. inappropriate waste management leading to increased pest animals).</p> <ul style="list-style-type: none"> <li>Should predation of MNES be observed undertake an investigation to assess possible reasons for the incident(s).</li> <li>Review adherence to the Project's Weed and Pest Management Plan.</li> <li>From the investigation, a Corrective Actions Contingency Plan will be developed by a suitably qualified ecologist within 20 business days of the trigger being detected. The Contingency Plan will include appropriate corrective actions and an implementation schedule for those corrective actions.</li> </ul> <p><b>Corrective Actions:</b></p> <ul style="list-style-type: none"> <li>Corrective actions identified in the contingency plan will be implemented within 30 days of the trigger being detected.</li> <li>Potential corrective actions may include:</li> </ul>

Habitat Management objectives	Performance criteria	Management and mitigation measures	Trigger for further action	Monitoring	Corrective actions
		<p><i>Biosecurity Act 2014</i> and as permitted under the SHMS.</p>			<ul style="list-style-type: none"> <li>○ Increasing the frequency and/or duration of pest animal control efforts.</li> <li>○ Investigating and/or implementing alternate pest animal control methods in consultation with DAF.</li> <li>○ Updating the Weed and Pest Management Plan to include new species where relevant.</li> </ul>
<p>Minimise impacts of dust deposition on habitat for MNES during construction and operation of the Project.</p>	<ul style="list-style-type: none"> <li>• Dust deposition does not exceed 120 mg per square metre per day, averaged over one month when measured at any sensitive receptor as outlined in Condition B2 of the Project EA.</li> <li>• Dust is monitored in accordance with the Dust Management Plan which must be developed in accordance with Condition B5 of the Project's EA.</li> </ul>	<ul style="list-style-type: none"> <li>• Dust suppression will be undertaken in accordance with the Dust Management Plan and include the following actions:                             <ul style="list-style-type: none"> <li>○ Staging vegetation clearing to minimise areas of disturbed and bare ground.</li> <li>○ Progressively rehabilitating disturbed areas.</li> <li>○ Removal and dumping of overburden as soon as reasonably practical following blasting activities</li> <li>○ Regular watering of haul roads and access tracks in accordance with the CMSHR.</li> <li>○ Dust suppression spraying of stockpiles.</li> <li>○ Limiting grading and/or dozing in high dust generating areas.</li> <li>○ Limiting overburden drilling.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Dust deposition levels exceed 120 mg per square metre per day when averaged over one month at sensitive receptors.</li> <li>• Visual inspections of vegetation adjacent to the disturbance areas show visible signs of dust deposition.</li> </ul>	<ul style="list-style-type: none"> <li>• Monitoring of dust deposition will be undertaken in accordance with Condition B2 and the Project's Dust Management Plan as required under Condition B5 of the Project's EA.</li> <li>• Existing monitoring includes visual inspections of vegetation adjacent to the disturbance areas.</li> </ul>	<ul style="list-style-type: none"> <li>• In accordance with Conditions B3 and B4 of the Project's EA, if dust deposition monitoring exceed the trigger value of 120 mg per square metre averaged over one month, Stanmore must investigate whether the exceedance is a result of Project activities and notify the administering authority within seven days of the exceedance occurring.</li> <li>• Should an exceedance of dust deposition levels be attributed to Project activities Stanmore will implement dust abatement measures.</li> </ul> <p><b>Corrective Actions:</b></p>

Habitat Management objectives	Performance criteria	Management and mitigation measures	Trigger for further action	Monitoring	Corrective actions
		<ul style="list-style-type: none"> <li>○ Enforcing speed limits in accordance with the requirements of the CMSHA and CMSHR.</li> </ul>			<ul style="list-style-type: none"> <li>• Corrective actions identified in the Dust Management plan will be implemented within 10 days of the trigger being detected.</li> </ul>
Minimise noise and vibration impacts in areas of MNES habitat.	When measured, noise and vibration levels do not exceed criteria set out in Tables 15 and 16 of the Project EA at sensitive receptors.	<ul style="list-style-type: none"> <li>• Regularly maintaining and servicing all plant equipment to minimise machinery noise.</li> <li>• All engine covers will be kept closed while equipment is operating.</li> <li>• Blasting will only occur between 9am and 7pm.</li> </ul>	<ul style="list-style-type: none"> <li>• When measured at sensitive receptors noise and vibration levels exceed criteria set out in Table 15, Table 16 and Table 17 of the Project's EA.</li> <li>• When blasting occurs outside of the approved blast times.</li> </ul>	<ul style="list-style-type: none"> <li>• Noise and vibration monitoring will be undertaken in accordance with monitoring Conditions outlined in Section D of the Project's EA.</li> </ul>	<ul style="list-style-type: none"> <li>• In accordance with Conditions under Section D of the Project's EA, if noise and vibration monitoring exceed the trigger values outlined, Stanmore must investigate whether the exceedances are the result of the mining activities and notify the administering authority within seven days of the exceedance occurring.</li> <li>• Should exceedance levels be attributed to mining activities, noise and vibration abatement measures will be implemented.</li> </ul> <p><b>Corrective Actions:</b></p> <ul style="list-style-type: none"> <li>• Corrective actions identified during investigations will be implemented within 10 days of the trigger being detected.</li> </ul>
Minimise degradation of habitat for MNES from an increased	No uncontrolled fires within the Project area resulting from Project related activities.	<ul style="list-style-type: none"> <li>• Fire management for coal mining operations in Queensland is governed by the CMSHA and the CMSHR with the CMSHR prescribing management of fires for coal mines.</li> </ul>	<ul style="list-style-type: none"> <li>• An uncontrolled fire occurs within the Project area that is due to mining activities.</li> </ul>	<ul style="list-style-type: none"> <li>• Compliance with the SHMS will be monitored in accordance with the</li> </ul>	<ul style="list-style-type: none"> <li>• Should an uncontrolled fire occur within the Project area, the Project's Emergency Response Plan</li> </ul>

Habitat Management objectives	Performance criteria	Management and mitigation measures	Trigger for further action	Monitoring	Corrective actions
risk of fire due resulting from Project activities.		<ul style="list-style-type: none"> <li>Section 37 of the CMSHR prescribes that the coal mines Safety and Health Management System (SHMS) must include standard operating procedures for action to be taken when a fire is discovered at the mine.</li> <li>Buffers will be maintained around potential ignition sources such as plant and machinery, haul roads and mine infrastructure areas.</li> <li>Prior to site entry, all relevant site personnel, including contractors, will be made aware of fire safety and risks.</li> <li>Fuel loads will be minimised and managed through the weed control measures outlined in the Weed and Pest Management Plan.</li> </ul>	<ul style="list-style-type: none"> <li>Weed cover exceeds baseline levels and groundcover biomass (e.g. vegetation) exceeds benchmark levels.</li> </ul>	<p>requirements of the CMSHA and CMSHR.</p> <ul style="list-style-type: none"> <li>Monitoring of biomass (groundcover including organic litter) for fire management will be undertaken during the habitat quality assessments that will occur annually for the first three (3) years then every two (2) years thereafter (refer to Section 5.0).</li> </ul>	<p>will be enacted. Should any corrective actions and changes to fire management be required, they will be done in accordance with the CMSHA and CMSHR and incorporated into the SHMS.</p> <ul style="list-style-type: none"> <li>Should biomass monitoring indicate that there is a risk of an uncontrolled fire occurring, biomass control measures will be assessed by a suitably qualified ecologist within 20 business days and Corrective Actions suggested. Biomass control measures aimed at reducing fuel loads may include controlled burns, strategic grazing or modified weed management measures.</li> </ul> <p><b>Corrective Actions:</b></p> <p>Any corrective actions identified will be implemented within 30 days of the trigger being detected.</p>
Minimise alteration of Squatter Pigeon, Ornamental Snake and the riparian habitat	<ul style="list-style-type: none"> <li>Water quality does not exceed trigger levels and at any of the monitoring sites</li> </ul>	<ul style="list-style-type: none"> <li>Site stormwater management will be undertaken in accordance with the management plans and programs required by the Project's EA including a Receiving Environment Monitoring Program (REMP) required under Condition C22, Water</li> </ul>	<ul style="list-style-type: none"> <li>Water quality monitoring exceeds the approved receiving environment trigger levels outlined in the REMP and in Table 7 of the Projects EA and mine</li> </ul>	<ul style="list-style-type: none"> <li>Water quality monitoring will be undertaken in accordance with the REMP as required by Conditions</li> </ul>	<ul style="list-style-type: none"> <li>In accordance with Condition C21 of the Project's EA, if water quality characteristics of the downstream monitoring point exceed trigger levels</li> </ul>

Habitat Management objectives	Performance criteria	Management and mitigation measures	Trigger for further action	Monitoring	Corrective actions
from changes to water quality and hydraulic activity.	<p>listed in the Tables in Condition C – Water.</p> <ul style="list-style-type: none"> <li>Water quality monitoring is undertaken in accordance with the Receiving Environment Monitoring Program which must be developed in accordance with Condition C22 of the Project EA.</li> <li>Erosion and sediment control is undertaken in accordance with the Erosion and Sediment Control Plan (ESCP) as required by Condition C38 of the Project EA.</li> </ul>	<p>Management Plan (WMP) required under Condition C31 and an ESCP required under Condition C38.</p> <ul style="list-style-type: none"> <li>The site specific WMP, REMP and ESCP as well as other water management requirements outlined in Section C of the Project's EA will be prepared by a suitably qualified person.</li> <li>Required management plans will be developed with the aim of minimising alterations to receiving environment water quality erosion, minimising mobilisation of sediments and minimising erosion related disturbances to the current hydrological regime.</li> <li>The maintenance and cleaning of any vehicles, plant or equipment must not be carried out in areas from which contaminants can be released into any receiving waters.</li> <li>Spillage of wastes, contaminants or other materials must be cleaned up as quickly as practicable to minimise the release of wastes, contaminants or materials to any stormwater drainage system or receiving waters.</li> </ul>	<p>affected water quality levels exceed the trigger levels outlined in Table 3 of the Project's EA.</p> <ul style="list-style-type: none"> <li>Visual inspections of water management infrastructure show signs of failure.</li> </ul>	<p>C22 and C23 of the Project's EA.</p> <ul style="list-style-type: none"> <li>Monitoring of the effectiveness of the erosion and sediment control devices and the water management will be undertaken in accordance with Conditions C32 of the Project's EA.</li> </ul>	<p>outlined in Table 7 of the EA, and these levels are higher than upstream monitoring locations, Stanmore must investigate the exceedance and the potential for environmental harm and provide a written report to the administering authority as part of the Project's Annual Return.</p> <ul style="list-style-type: none"> <li>Should an exceedance of water quality trigger levels be attributed to Project activities, an assessment on the effectiveness of the WMP and REMP will be undertaken and appropriate Corrective Actions included in Plan revisions and the Annual reports as required under Conditions C24 and C33 of the Project's EA.</li> </ul> <p><b>Corrective Actions:</b></p> <ul style="list-style-type: none"> <li>Corrective actions identified will be implemented within 10 days of the trigger being detected.</li> </ul>
Minimise potential for mortality or injury to MNES from Project activities (e.g. habitat clearing,	No mortality of, or injuries to, MNES as a result of Project activities (e.g. from clearing activities, vehicle strikes etc).	<ul style="list-style-type: none"> <li>Environmental awareness training will be provided to all workers as part of site induction and will include specific topics on MNES, risks and protective measures, and identification of the MNES.</li> </ul>	Injury or mortality to an MNES	<ul style="list-style-type: none"> <li>All personnel will be required to be report any interactions between vehicles and/or /machinery and MNES in the Project area.</li> </ul>	<ul style="list-style-type: none"> <li>Should an injury to, or mortality of, an MNES, an investigation will be undertaken to ascertain the cause of the injury or mortality.</li> </ul>

Habitat Management objectives	Performance criteria	Management and mitigation measures	Trigger for further action	Monitoring	Corrective actions
vehicle strikes etc).		<ul style="list-style-type: none"> <li>• Pre-clearance surveys will be undertaken within 48 hours of clearing activities to assess the presence of MNES within the disturbance area to be cleared.</li> <li>• At least one qualified Fauna Spotter/Catcher will be present during clearing activities.</li> <li>• A wildlife carer will be called to collect any injured fauna.</li> <li>• Speed limits of 60 km/hour will be set and enforced on all internal roads including haul roads</li> <li>• Vehicles must abide by vehicle speed limits and access to any restricted areas or exclusion zones must be limited to critical site-specific activities to minimise threats to MNES.</li> <li>• All injured fauna encountered during the construction and operation of the activity will be taken to a wildlife carer/facility or veterinarian within 24 hours.</li> <li>• Where injured fauna is encountered, and it is unsafe to handle the animals, the following should be undertaken;               <ul style="list-style-type: none"> <li>○ The location of the injured animal will be identified so it can be located again</li> <li>○ The species of animal will be identified if possible and its sex and approximate size determined</li> <li>○ The type of injury sustained will be identified if possible</li> <li>○ The EO shall immediately contact Queensland's Department of</li> </ul> </li> </ul>		<ul style="list-style-type: none"> <li>• Visual observations during normal working hours.</li> <li>• Incidental observations during habitat quality assessments.</li> </ul>	<ul style="list-style-type: none"> <li>• Should the injury or mortality be attributed to mining activities, a Contingency Plan will be developed by a suitably qualified ecologist within 20 business days and will include Corrective Actions and an implementation schedule for the Corrective Actions.</li> </ul> <p><b>Corrective Actions:</b></p> <ul style="list-style-type: none"> <li>• Corrective actions identified in the contingency plan will be implemented within 30 days of the trigger being detected.</li> </ul>

Habitat Management objectives	Performance criteria	Management and mitigation measures	Trigger for further action	Monitoring	Corrective actions
		Environment and Science (DES) and report the animal and arrange for its capture and transportation to a wildlife carer or veterinarian.			



## 5.0 Monitoring

Stanmore commits to implementing a monitoring program to assess the effectiveness of the management measures outlined in Section 4.7 and to make timely decisions on corrective actions to ensure the performance criteria outlined in Sections 4.1 and 4.7 are achieved. The monitoring methods are:

- Specific to the performance criteria being assessed and will determine whether the performance criteria have been achieved or whether corrective actions needed; and
- Quantitative and repeatable such that each monitoring event can be compared to each other to allow changes over time to be. Monitoring has commenced and includes the Riparian Monitoring Program (Appendix D) undertaken to address EPBC Condition 10 and to assess the baseline habitat quality scores of the impact (disturbance) site as part of the Offset Management Plan. Additional monitoring to assess the presence of weeds and pest animals will be undertaken prior to the commencement of the Project to establish a baseline for comparison against subsequent monitoring events. These monitoring events will be combined into an overarching ecological monitoring program to be undertaken annually for the first three (3) years, then every two (2) years thereafter as outlined in Section 5.1.2.

The overarching objectives of the monitoring program are to:

- Evaluate performance of the SMP against performance criteria;
- Identify triggers requiring further action;
- Develop corrective actions if required;
- Inform subsequent reviews and amendments to the SMP and associated management plans.

### 5.1.1 General site inspections

General site inspections of the retained MNES habitat, erosion and sediment control devices, water storages, diversion drains and rehabilitated areas (once commenced) will be undertaken at least twice yearly to assess:

- Signs of erosion;
- Visible changes to water quality;
- Signs of damaged erosion and sediment control devices;
- Confirmation that all exclusion fencing and signage are intact.
- Seepage from water storages;
- Signs of dust deposition on vegetation adjacent to disturbance area;
- Any injured or dead MNES; and
- Incidental observations of weeds and pest animals.

### 5.1.2 Habitat quality monitoring

Baseline ecological surveys were undertaken in September/October 2015 (dry season) and February/March 2016 as part of the Project's approval process (refer to Appendix A) and generally during the timing of the riparian monitoring program required for Conditions 10-14 of the EPBC Act approval (Appendix D). Subsequent habitat quality assessments were also undertaken as follows:

- April 2018 for all vegetation communities within the Project area (mine lease boundary) to assess baseline habitat quality for input into the EPBC offsets calculator and the Offset Management Plan (OMP) as required by EPBC Condition 5; and
- April 2018 for the riparian monitoring area shown on Attachment B of the EPBC Act approval and as a requirement of Condition 10 of the approval.

The first post SMP approval comprehensive habitat quality monitoring event will be undertaken at the end of the 2018/2019 wet season (i.e. March/April depending on rainfall) and annually for the first 3 years of the Project, followed by every second year in March/April for the life of the EPBC Approval. Habitat quality monitoring will be undertaken at the monitoring points which were established during the April 2018 riparian

monitoring event and the April 2018 habitat quality assessment. The number and location of monitoring points for habitat condition assessments is based on the requirements of the Guide to Determining Terrestrial Habitat Quality (DEHP 2017) (referred to as the Guide).

The Guide is used to assess habitat quality for each MNES and is based on the methodology set out in the BioCondition Assessment Manual (Eyre et., al. 2015). A range of habitat variables are assessed using standard methods and compared to benchmarks (undisturbed) sites as a measure of how well a terrestrial ecosystem is functioning for biodiversity.

The guide allows for habitat quality scores to be calculated for each MNES based on three key indicators:

- Site condition: assessment of vegetation compared to benchmark (undisturbed) areas;
- Site context: a geospatial analysis of the assessment area in relation to the surrounding environment; and
- Species habitat index: the ability of assessment area site to support a species.

Habitat quality assessments will be undertaken by suitably qualified ecologists and will include the following methods and be undertaken in accordance with the approved State and Commonwealth fauna survey guidelines:

- Infrared cameras;
- Spotlighting;
- Diurnal bird surveys;
- Active searches;
- Koala/Greater Glider transects and scat searches; and
- Koala call playbacks.

The habitat quality assessments will also include assessments of weed abundance and distribution and an assessment on the presence and relative abundance of pest animals. Relative abundance will be assessed using amongst other methods, number of animals encountered over a standard time frame, or a standard transect length but will be determined by the suitably qualified ecologist undertaking the assessments.

Photo monitoring will be undertaken at each monitoring location during the habitat quality assessments to allow habitat changes to be visually assessed over time. Photos at each photo monitoring point will be taken in a north, east, south and westerly direction. A permanent feature will be included within the photo frame to provide a fixed reference point. A record of the photographs will be maintained, including GPS co-ordinates, date, time, direction and the height above the ground the photograph was taken.

Data from habitat quality assessments and photo monitoring will be recorded on survey sheets and these will be attached to the monitoring reports that will be included in the annual compliance reports.

### **5.1.3 Weed monitoring**

The presence and distribution of weeds was initially assessed during the baseline ecological surveys that were undertaken in September/October 2015 and February/March 2016 (refer to Appendix A) as well as access points, access tracks and roads.

Ongoing weed surveys will be undertaken annually for the first 3 years, followed by every two years for the remainder of the life of the EPBC Approval in conjunction with the habitat quality monitoring outlined in Section 5.1.2. Assessing the presence and abundance of weed cover will be done in accordance with the methodology outlined in the Guide for assessing non-native plant cover. Briefly, this method involves establishing a 50 m x 10m plot and dividing this plot into 20 smaller 5 m x 5 m sub-plots. Percent weed cover will be assessed in each of the 20 sub-plots and the total percent weed cover determined by taking the average from the 20 plots. Photo monitoring will also be undertaken within each plot in the same manner described in Section 5.1.2.

In addition to the permanent weed monitoring sites, all incidental observations of weeds will be recorded from general Project area, including through quarterly inspections of access points, access tracks and roads. This will provide instances of weed infestations that occur away from the permanent weed monitoring sites. If trigger levels for weeds are met or exceeded, additional monitoring will be undertaken and will occur in conjunction with appropriate management measures until the presence and distribution of weeds reduces to baseline levels or below.

#### 5.1.4 Pest animals

An initial assessment of the presence and distribution of pest animals was undertaken during the baseline ecological surveys that were undertaken in September/October 2015 and February/March 2016 (refer to Appendix A) for the Project's EA application and EPBC referral.

Ongoing pest animal surveys will be undertaken annually for the first three (3) years, followed by every two years for the remainder of the life of the EPBC Approval in conjunction with and at the same survey locations as, the habitat quality assessment surveys. Monitoring will primarily entail standardised timed visual observations in a similar manner undertaken for bird surveys as well as infrared camera trap monitoring. Relative abundance will be assessed using amongst other methods, number of animals encountered over a standard time frame, or a standard transect length but will be determined by the suitably qualified ecologist undertaking the assessments.

Evidence of faecal samples and damage cause by pest animals will also be recorded. Pest animals will also be opportunistically surveyed throughout the year outside of monitoring times, including observations for potential new pest animal species that have not been previously recorded, and which are known to prey on MNES or degrade MNES habitat. Any evidence of mortality or injury to MNES as a result of pest animals will also be recorded during the surveys. If trigger levels for any pest animal species are met or exceeded, additional monitoring will be undertaken and will occur in conjunction with appropriate management measures until pest animal presence reduces to baseline levels or below.

#### 5.1.5 Dust

Dust deposition will be monitored in accordance with Conditions B3 and B4 of the Project's EA (Appendix C) and the Project's Dust Management Plan, as developed and implemented by an appropriately qualified person for all stages of the authorised mining activities. Dust monitoring will continue to be undertaken using dust deposition gauges at the eight locations throughout the Project area and at least two additional locations within the retained vegetation at yet to be determined locations. The function of these additional monitoring points will be to assess the impact of dust on retained MNES habitat. Dust within the retained vegetation will also be assessed for visual dust deposition during general site inspections including through quarterly inspections of access points, access tracks and roads.

Where monitoring is requested by the administering authority or as a result of a complaint, the administering authority must be notified of the results 14 days following completion of the monitoring.

#### 5.1.6 Noise and vibration

Noise generated by mining activities will be monitored in accordance with Condition D2 of the Project's EA (Appendix C).

Where monitoring is requested by the administering authority or as a result of a complaint, the administering authority must be notified of the results 14 days following completion of the monitoring. If the monitoring identifies an exceedance of the relevant noise limits at a sensitive receptor shown in Table 15 of the Project's EA, the administering authority must be notified within seven (7) days of the exceedance occurring.

#### 5.1.1 Water and erosion and sediment control

Water quality will be monitored in accordance with the Project's EA (Appendix C) and the required management plans, which includes locations, frequencies and monitoring criteria (trigger levels). Condition C5 outlines water release points, the release limits and the contaminant trigger levels that must be monitored. Conditions C13 – C16 provide notifications timeframes associated with the start and cessation of release events and stipulate reporting requirements. Condition C17 also provides for monitoring of water storages including monitoring locations and frequencies. Monitoring will be undertaken in accordance with Project's REMP which is required by Condition C22. The REMP will also include the additional water quality monitoring point requested by the DoEE in Condition 7 of the EPBC Act approval.

Visual inspection monitoring will be undertaken for all erosion and sediment control devices and water storages immediately prior to the wet season (e.g. August – October) and following rainfall events >70 mm in 24 hours as outlined the Project's ESCP.

#### 5.1.2 Fire

Fire management within the Project area will be undertaken in accordance with the requirements of the CMSHA, CMSHR and the SHMS to mitigate fires from mining activities that have the potential to spread to MNES habitat. The CMSHR includes monitoring and review requirements for the SHMS.

Monitoring of biomass for fire management will be undertaken during the habitat quality assessments as outlined in Section 5.1.2. The site condition attributes associated with ground covers such as grass cover, organic litter, coarse woody debris and weeds are surrogates for biomass. Should these surrogates show an increase beyond benchmark values, suitable management actions aimed at reducing biomass loads will be investigated by a suitably quantified expert in consultation with the site senior executive and within the requirements of the CMSHA, CMSHR and the SHMS.

## 6.0 Data management, reporting, implementation and auditing

### 6.1 Data management

The EO will be responsible for overseeing and managing all of the monitoring activities and programs required as part of this SMP. This will include maintaining data records as per the requirements of Condition 16 of the EPBC Act approval which states that accurate records substantiating all activities associated with or relevant to the conditions of approval must be maintained including measures taken to implement management plans required by the approval. If required, these records must be made available to DoEE upon request.

### 6.2 Reporting

The results of all monitoring programs will be documented in stand-alone progress reports and combined into an annual compliance report as required by Condition 17 of the EPBC Act approval. The annual report will be provided to DoEE within three months of the 12-month anniversary of commencement of the action and be published on Stanmore's website. All reports must remain published for the life of the approval (e.g. 1 November 2040).

Additionally, annual compliance reports are also required to be provided to the Queensland DES as required by the Project's EA conditions as well as any additional reports associated with specific monitoring required where exceedances and/or trigger events occur. The required compliance reports will include as a minimum an introduction, purpose, activities undertaken in the reporting period and a compliance table outlining compliance with approval conditions but also compliance with the management actions outline in Table 7.

### 6.3 Implementation

As outlined in Condition 4 of the EPBC Act approval, Stanmore will not commence clearing of habitat for the MNES listed Table 1 of this SMP until the SMP has been approved by the Minister. Following approval, the SMP will be implemented and will remain effective for the life of the Project.

Habitat quality assessments including monitoring for the presence and distribution of weeds and pest animals will be undertaken at the 11 habitat quality plots established during the Riparian Monitoring Program (as required by EPBC Condition 10 and included in Appendix D) in addition to the 21 habitat quality plots used to assess habitat quality during the April 2018 surveys (Appendix B). Table 8 outlines the monitoring implementation schedule.

**Table 8: Proposed monitoring implantation schedule**

	Year												
	2018	2019	2020	2022	2024	2026	2028	2030	2032	2034	2036	2038	2040
<b>Ecological monitoring program</b>	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

### 6.4 Auditing and review

Internal audits/reviews of management and monitoring activities will be undertaken in response to a trigger for further action being detected (refer to Table 7), potential non-compliance with SMP requirements. External auditing will be undertaken in accordance with Conditions A20 and A21 of the Project's EA which states:

- The environmental authority holder must nominate an appropriately qualified independent, third party auditor to audit compliance with the conditions of this environmental authority. The third-party audit

must be completed by 31 December 2018, and then at regular intervals not exceeding 36 months; and

- Within 90 days of completing the audit, Stanmore is to provide a written report to the DES that has been certified by the appropriately qualified independent third-party auditor, detailing any compliances and non-compliances that were found. If non-compliance issues were found, the report must also address:
  - Actions taken by Stanmore to ensure compliance with the EA; and
  - Actions taken to prevent a recurrence of non-compliances.

In accordance with Condition 19 of the EPBC Act approval, an independent audit of the approval conditions must be commissioned if directed by the Minister and a corresponding audit report submitted to the Minister.

The effectiveness of actions within this SMP will be reviewed after two years of implementation and the SMP will be adapted to include additional or revised actions where necessary. The SMP will then be reviewed every two years and immediately prior to the decommissioning phase of the Project.

The reviews will also assess the available monitoring data to determine the effectiveness of the management measures and the corrective actions outlined in Section 4.7 and Table 7. All monitoring data will be reviewed by suitably qualified ecologists and analysed using appropriate analytical methodologies as determined by the ecologist to assess any non-compliances with the actions outlined in Table 7.

## 7.0 Risk assessment

A risk assessment was undertaken using the risk assessment process provided by the DoEE to assess risks associated with failing to achieve the management objectives outlined in this SMP for mitigating impacts to MNES. For each identified risk, the potential consequence of the risk (Table 9) was assessed against the likelihood of that risk occurring (Table 10) to determine an overall risk rating using the matrix in Table 11.

The consequence and likelihood of each risk occurring was assessed following the implementation of the management and mitigation measures (i.e. control measures) to provide a residual risk rating (Table 12).

**Table 9: Consequence classification**

Qualitative measure of consequences (what will be the consequence/result if the issue does occur)	
<b>Minor</b>	Minor risk of failure to achieve the SMPs objectives. Results in short term delays to achieving plan objectives, implementing low cost, well characterised corrective actions.
<b>Moderate</b>	Moderate risk of failure to achieve the SMPs objectives. Results in short term delays to achieving plan objectives, implementing well characterised, high cost/effort corrective actions.
<b>High</b>	High risk of failure to achieve the SMPs objectives. Results in medium-long term delays to achieving plan objectives, implementing uncertain, high cost/effort corrective actions.
<b>Major</b>	The SMPs objectives are unlikely to be achieved, with significant legislative, technical, ecological and/or administrative barriers to attainment that have no evidenced mitigation strategies.
<b>Critical</b>	The SMPs objectives are unable to be achieved, with no evidenced mitigation strategies.

**Table 10: Likelihood classification**

Qualitative measure of likelihood (how likely is it that this event/circumstances will occur after management actions have been put in place/are being implemented)	
<b>Highly likely</b>	Is expected to occur in most circumstances.
<b>Likely</b>	Will probably occur during the life of the project.
<b>Possible</b>	Might occur during the life of the project.
<b>Unlikely</b>	Could occur but considered unlikely or doubtful.
<b>Rare</b>	May occur in exceptional circumstances.

**Table 11: Risk Rating Matrix**

		Consequence				
		1. Minor	2. Moderate	3. High	4. Major	5. Critical
Likelihood	5. Highly Likely	Medium	High	High	Severe	Severe
	4. Likely	Low	Medium	High	High	Severe
	3. Possible	Low	Medium	Medium	High	Severe
	2. Unlikely	Low	Low	Medium	High	High
	1. Rare	Low	Low	Low	Medium	High

For the purposes of this risk assessment, the risk levels are defined as follows:

- Severe: Unacceptable risk that must not proceed until suitable and comprehensive control measures have been adopted to reduce the level of risk.
- High: Moderate to critical consequences. Works should not proceed without considerations of additional actions to minimising the risk.
- Medium: Acceptable with formal review. Medium level risks require active monitoring due to the level of risk being acceptable.
- Low: Acceptable with active management not considered required.



**Table 12: Risk assessment and management**

Objectives for MNES Management	Risk	Event or Circumstance	Control Strategies	Residual Risk Rating		
				Likelihood	Consequence	Overall Risk Rating.
Limit or avoid loss of MNES and/or habitat for MNES.	<ul style="list-style-type: none"> <li>Clearing of habitat for MNES occurs outside of the approved disturbance limits.</li> <li>A loss of habitat for the Koala and Greater Glider outside of the approved disturbance limits.</li> <li>A loss of permanent water sources for the Squatter Pigeon outside the approved disturbance limits.</li> <li>Disturbed areas are not rehabilitated in accordance with the Rehabilitation Management Plan.</li> </ul>	<ul style="list-style-type: none"> <li>Clearing contractors unaware of the disturbance limits or MNES habitat.</li> <li>Clearing occurs outside of the disturbance limits.</li> <li>Rehabilitation is not undertaken in accordance with the Rehabilitation Management Plan</li> </ul>	<ul style="list-style-type: none"> <li>Infrastructure will be sited in accordance with the State and Commonwealth approval conditions.</li> <li>Areas requiring vegetation removal will be clearly delineated to ensure disturbance to areas being retained is avoided. Limits of clearing are to be delineated using barricading or temporary fencing and signage prior to works commencing. Exclusion areas are to be clearly shown and labelled on all operational and management drawings and plans. GIS shapefiles will be provided to clearing personnel and/or contractors prior to the commencement of clearing operations.</li> <li>Where exclusion fencing is required, consideration shall be given to fauna movement, current land uses and worker safety requirements.</li> <li>Permanent water sources for retention such as farm dams outside of the disturbance limits will be clearly delineated and shown and labelled on all operational and management drawings and plans</li> <li>Avoid where possible and within the constraints of the mining schedule, impacting on MNES habitat during breeding periods through timing of clearing and creek disturbance activities to avoid the main breeding season of impacted MNES (i.e. late dry season to wet season).</li> <li>Prior to entry to the Project area, all site personnel including contractors shall be made aware via toolbox</li> </ul>	2	2	L

Objectives for MNES Management	Risk	Event or Circumstance	Control Strategies	Residual Risk Rating		
				Likelihood	Consequence	Overall Risk Rating.
			<p>talks and site information sheets, of the sensitive environs they will be working in and around and be advised of specific limitations to construction works being undertaken in or adjacent to threatened fauna habitat. All staff and contractors will be required to report sightings of SMP relevant fauna in the activity area to the EO immediately.</p> <ul style="list-style-type: none"> <li>• An internal 'Permit to Disturb' system will be used by the EO to ensure that all clearing activities are authorised prior to disturbance. Conditions listed in the Permit to Disturb must be implemented.</li> <li>• The EO or delegate will routinely inspect the disturbance limit boundaries to ensure that no clearing or disturbance of vegetation or habitat beyond the approved limits has taken place.</li> <li>• Temporary stockpile sites for soil and equipment, access routes, laydown areas and other associated infrastructure will be located in cleared areas and will not be situated in areas of MNES habitat.</li> <li>• Prior to construction activities commencing, signage, including speed limits, will be erected in the vicinity of exclusion areas to warn of the potential presence of threatened fauna in the area.</li> <li>• Pre-clearance surveys will be undertaken by a suitably qualified ecologist using approved State and Commonwealth survey guidelines within 48 hours of clearing activities commencing.</li> <li>• The pre-clearance survey will be undertaken in order to:</li> </ul>			

Objectives for MNES Management	Risk	Event or Circumstance	Control Strategies	Residual Risk Rating		
				Likelihood	Consequence	Overall Risk Rating.
			<ul style="list-style-type: none"> <li>Record the location of all hollow bearing trees, log piles and nest using a GPS. Features of tree hollows (diameter, number and whether active/inactive) should be recorded in the Environmental Diary/Register; and</li> <li>Relocate all captured non-breeding animals to suitable habitat adjacent to the disturbance area and within the Project area.</li> <li>A Fauna Spotter will be present for all clearing activities and will conduct a walk-through survey prior to commencement of clearing and prior to clearing works each day to check vegetation and other fauna habitats.</li> <li>The Fauna Spotter will reinspect the area of cleared vegetation immediately after clearing to locate any potentially injured fauna that should then be taken to a wildlife carer or veterinarian.</li> <li>Vegetation clearing will be undertaken progressively and trees will be felled in the direction of the clearance zone to avoid impacts to adjoining retained vegetation and habitat.</li> <li>Hollow bearing trees will be clearly flagged and surrounding vegetation removed with the hollow bearing tree left standing for at least one night to encourage fauna to relocate of its own accord. Hollow bearing trees will be inspected to determine if hollows are occupied.</li> <li>If after one night the resident fauna have not moved on, the hollow entrance will be blocked with a towel or similar and the hollow removed by cutting below the</li> </ul>			

Objectives for MNES Management	Risk	Event or Circumstance	Control Strategies	Residual Risk Rating		
				Likelihood	Consequence	Overall Risk Rating.
			<p>hollow section. The hollow with the animal inside will then be installed in nearby similar and adjoining vegetation to be retained at a similar height and orientation with the entrance unblocked at dusk.</p> <ul style="list-style-type: none"> <li>• If the procedure described above is not possible for any reason, hollow-bearing trees will be felled using a tree grab or similar that can remove the tree in a controlled fashion. If possible and safe to do so, hollow trees will be felled at dusk to allow fauna the opportunity to disperse during their normal activity period. These trees will be felled away from hollow openings. The tree will be knocked at the base several times prior to felling to encourage fauna to relocate of their own accord. Once the tree is felled, it will be inspected for any fauna and any injured fauna rescued and taken to a wildlife carer or veterinarian.</li> <li>• Any fauna that is captured will be relocated into the adjacent habitat at least 200 m from the clearing area if clearing works are yet to be completed.</li> <li>• Where threatened fauna is identified and delaying the clearing of area is not feasible, (i.e. the clearing is critical to the activity schedule), a 50 m exclusion zone will be established and the area must not be disturbed for a minimum of 24 hours while clearing is undertaken around the exclusion zone. After 24 hours, a Fauna Spotter/Catcher may relocate the breeding animal to suitable habitat at least 200 m away from the disturbance area. Where survival of young or eggs is unlikely as a result of the disturbance, these are to be handed over to a previously identified wildlife carer or veterinarian.</li> </ul>			

Objectives for MNES Management	Risk	Event or Circumstance	Control Strategies	Residual Risk Rating		
				Likelihood	Consequence	Overall Risk Rating.
Prevent habitat degradation and a decline in habitat values within the retained habitat in the Project area.	<ul style="list-style-type: none"> <li>Habitat quality score within the retained MNES habitat falls below the baseline habitat quality score.</li> </ul>	<ul style="list-style-type: none"> <li>Increased weed abundance or an introduction of new weed species due to mining activities.</li> <li>Increased pest animal abundance or new pest animal species occur due to mining activities.</li> <li>Uncontrolled fire from mining activities.</li> <li>Increased dust deposition resulting from mining activities.</li> </ul>	<ul style="list-style-type: none"> <li>Areas of MNES habitat adjacent to the disturbance footprint and within the Project area (i.e. mine lease), will be clearly delineated and shown and labelled on all operational and management drawings and plans. GIS shapefiles will be provided to clearing personnel and/or contractors prior to the commencement of clearing operations.</li> <li>Site access is only to occur along designated site access tracks. No unauthorised access is permitted.</li> <li>Prior to commencement of the action signage, including speed limits, will be erected to warn of the potential presence of threatened fauna in the area.</li> <li>Posters will be developed and displayed in meeting areas that reminds staff and contractors about the MNES present in the Project area.</li> <li>Prior to entry to the Project area, all site personnel including contractors shall be made aware via toolbox talks and site information sheets, of the sensitive environs they will be working in and around and be advised of specific limitations to construction and/or operational works being undertaken in or adjacent to threatened fauna habitat. All staff and contractors will be required to report sightings of MNES fauna to the EO immediately</li> <li>Where tree hollows that are suspected as being used by Greater Gliders are identified from within the disturbance area, they are to be salvaged to the greatest extent possible and relocated within retained vegetation. As far as practical, the site of the relocation is to be within retained vegetation and</li> </ul>	3	2	M

Objectives for MNES Management	Risk	Event or Circumstance	Control Strategies	Residual Risk Rating		
				Likelihood	Consequence	Overall Risk Rating.
			<p>replicate the height and orientation of the original breeding or nesting structure. Sections of hollow branch or log will be secured in the new location by mechanical means deemed appropriate by the Fauna Spotter/Catcher (e.g. bolts, metal bands). Relocation is to be undertaken under the supervision of a spotter/catcher.</p> <ul style="list-style-type: none"> <li>Selected trees and/or logs will be salvaged and reused as fauna habitat to enhance retained vegetation habitat values (e.g. within Smoky Creek and Billy's Gully). Trees and other habitat features to be salvaged will be identified and flagged by the Fauna Spotter/Catcher during the walk-through survey and/or clearance activities.</li> <li>If an occupied tree hollow cannot be relocated the breeding habitat should be replaced nearby and in retained vegetation (but at least 200 m away from the disturbance area) in undisturbed habitat, with an artificial nesting structure at a ratio of 1:1 using current best practice nest box design.</li> <li>Implementation of dust suppression techniques in accordance with the Dust Management Plan and the CMSHA and the CMSHR.</li> <li>Maintenance of existing fences.</li> <li>Pest animals and weeds will be managed in accordance with the Project's Weed and Pest Management Plan.</li> <li>Light spill we be directed to the open cut pits to minimise light spill.</li> </ul>			

Objectives for MNES Management	Risk	Event or Circumstance	Control Strategies	Residual Risk Rating		
				Likelihood	Consequence	Overall Risk Rating.
			<ul style="list-style-type: none"> <li>The use of low wattage lighting with list spill guards.</li> </ul>			
Minimise risk of weed introduction and/or the spread of existing weed species in habitat area for MNES.	<ul style="list-style-type: none"> <li>Spread of existing weed species within Project area.</li> <li>New weed species being established in areas of MNES habitat.</li> </ul>	<ul style="list-style-type: none"> <li>Weed management not undertaken for the Project or a Weed and Pest Management Plan not developed.</li> <li>Vehicle weed washdowns not occurring.</li> <li>Targeted weed control not undertaken or ineffective.</li> </ul>	<ul style="list-style-type: none"> <li>Weeds will be managed in accordance with the Project's Weed and Pest Management Plan.</li> <li>The Plan will include the following: <ul style="list-style-type: none"> <li>A site induction program that provides weed management information to staff, contractors and visitors.</li> <li>Detailed control measures aimed at eradicating where possible, or otherwise reducing the extent of weeds in accordance with the Queensland Department of Agriculture and Fisheries (DAF) guidelines and the requirements of the <i>Biosecurity Act 2014</i>.</li> <li>Weed washdown procedures for all vehicles brought to site that will be traveling beyond the site office carpark.</li> <li>Targeted weed control measures within the Project area.</li> </ul> </li> </ul>	32	2	L
Reduce habitat degradation and potential predation on MNES by pest animals.	<ul style="list-style-type: none"> <li>Increase in the relative abundance of (or signs of) pest animals in habitat for MNES.</li> <li>Observation of (or signs of) a pest animal species not previously recorded in the Project site.</li> </ul>	<ul style="list-style-type: none"> <li>Pest animal management not undertaken for the Project or a Weed and Pest Management Plan not developed.</li> <li>Pest animals within the Project area are not controlled.</li> </ul>	<ul style="list-style-type: none"> <li>Pest animals will be managed in accordance with the Project's Weed and Pest Management Plan.</li> <li>The Project's Weed and Pest Management Plan includes requirements for: <ul style="list-style-type: none"> <li>Appropriate waste management and waste disposal.</li> <li>A reporting framework to ensure sightings of pest animals are recorded.</li> </ul> </li> </ul>	2	2	L

Objectives for MNES Management	Risk	Event or Circumstance	Control Strategies	Residual Risk Rating		
				Likelihood	Consequence	Overall Risk Rating.
	<ul style="list-style-type: none"> <li>• Predation of MNES by pest animals.</li> </ul>		<ul style="list-style-type: none"> <li>○ Site inductions to include information on pest animals including control requirements, importance of appropriate waste management and reporting requirements when pest animals are observed within the Project area during construction and operation activities.</li> <li>○ Control of pest animals.</li> <li>• Pest management actions outlined in the Weed and Pest Management Plan will primarily focus on those pest animals identified within the Project area and include Cane Toads, Feral Cats, Wild Dogs, House Mice and European Rabbits and that have a potential to impact on MNES and their habitat. Additional pests will be included as necessary if identified as occurring within the Project area during the habitat quality monitoring program (European Foxes and Feral Pigs).</li> <li>• Pest management will include a range of best management practice actions including shooting, trapping, fencing and baiting in and will be undertaken in accordance with site safety and health requirements, and DAF guidelines and the requirements of the <i>Biosecurity Act 2014</i> and as permitted under the SHMS.</li> </ul>			
Minimise impacts of dust deposition on habitat for MNES during construction and operation of the Project.	Dust deposition exceeds 120 mg per square meter per day, averaged over one month when measured at any sensitive receptor.	<ul style="list-style-type: none"> <li>• Vegetation not progressively cleared and excessive disturbed areas left exposed.</li> <li>• Progressive rehabilitation not undertaken.</li> </ul>	<ul style="list-style-type: none"> <li>• Dust suppression will be undertaken in accordance with the Dust Management Plan and include the following actions:                             <ul style="list-style-type: none"> <li>○ Staging vegetation clearing to minimise areas of disturbed and bare ground.</li> <li>○ Progressively rehabilitating disturbed areas.</li> </ul> </li> </ul>	3	1	L



Objectives for MNES Management	Risk	Event or Circumstance	Control Strategies	Residual Risk Rating		
				Likelihood	Consequence	Overall Risk Rating.
		<ul style="list-style-type: none"> <li>Requirements of the Dust Management Plan not implemented.</li> <li>Speed limits not observed or enforced.</li> </ul>	<ul style="list-style-type: none"> <li>Removal and dumping of overburden as soon as reasonably practical following blasting activities</li> <li>Regular watering of haul roads and access tracks in accordance with the CMSHR.</li> <li>Dust suppression spraying of stockpiles.</li> <li>Limiting grading and/or dozing in high dust generating areas.</li> <li>Limiting overburden drilling.</li> <li>Enforcing speed limits in accordance with the requirements of the CMSHA and CMSHR.</li> </ul>			
Minimise noise and vibration impacts in areas of MNES habitat.	When measured, noise and vibration levels exceed criteria set out in Tables 15 and 16 of the Project's EA.	<ul style="list-style-type: none"> <li>Mining operations not undertaken to minimise night time noise.</li> <li>Machinery is poorly maintained.</li> <li>Engines covers are left off or open during operation.</li> <li>Blasting occurs outside the approved timeframes.</li> </ul>	<ul style="list-style-type: none"> <li>Regularly maintaining and servicing all plant equipment to minimise machinery noise.</li> <li>All engine covers will be kept closed while equipment is operating.</li> <li>Blasting will only occur between 9am and 7pm.</li> </ul>	2	1	L
Minimise degradation of habitat for MNES from an increased risk of fire due resulting from Project activities.	An uncontrolled fire occurs because of project activities.	<ul style="list-style-type: none"> <li>Fire prevention as outlined in the SHMS is not adhered to.</li> </ul>	<ul style="list-style-type: none"> <li>Fire management for coal mining operations in Queensland is governed by the CMSHA and the CMSHR with the CMSHR prescribing management of fires for coal mines.</li> <li>Section 37 of the CMSHR prescribes that the coal mines Safety and Health Management System</li> </ul>	2	2	L

Objectives for MNES Management	Risk	Event or Circumstance	Control Strategies	Residual Risk Rating		
				Likelihood	Consequence	Overall Risk Rating.
		<ul style="list-style-type: none"> <li>• Fire prevention mechanism are faulty or not maintained.</li> <li>• Buffers around ignition sources are not maintained.</li> <li>• Groundcover fuel loads increase past benchmark levels and are not managed.</li> </ul>	<p>(SHMS) must include standard operating procedures for action to be taken when a fire is discovered at the mine.</p> <ul style="list-style-type: none"> <li>• Buffers will be maintained around potential ignition sources such as plant and machinery, haul roads and mine infrastructure areas.</li> <li>• Prior to site entry, all relevant site personnel, including contractors, will be made aware of fire safety and risks.</li> <li>• Fuel loads will be minimised and managed through the weed control measures outlined in the Weed and Pest Management Plan.</li> </ul>			
<p>Minimise alteration of Squatter Pigeon, Ornamental Snake and the riparian habitat from changes to water quality and hydraulic activity.</p>	<ul style="list-style-type: none"> <li>• Water quality exceeds trigger level values at any or all monitoring sites listed in the Tables in Condition C – Water.</li> <li>• Water quality monitoring is not undertaken as required by the REMP.</li> </ul>	<ul style="list-style-type: none"> <li>• Water releases exceed trigger levels.</li> <li>• ESCP devices not functional or damaged.</li> <li>• Water management not undertaken in accordance with the RMP or WMP.</li> </ul>	<ul style="list-style-type: none"> <li>• Site stormwater management will be undertaken in accordance with the management plans and programs required by the Project’s EA including a Receiving Environment Monitoring Program (REMP) required under Condition C22, Water Management Plan (WMP) required under Condition C31 and an ESCP required under Condition C38.</li> <li>• The site specific WMP, REMP and ESCP as well as other water management requirements outlined in Section C of the Project’s EA will be prepared by a suitably qualified person</li> <li>• Required management plans will be developed with the aim of minimising alterations to receiving environment water quality erosion, minimising mobilisation of sediments and minimising erosion related disturbances to the current hydrological regime.</li> </ul>	2	2	L

Objectives for MNES Management	Risk	Event or Circumstance	Control Strategies	Residual Risk Rating		
				Likelihood	Consequence	Overall Risk Rating.
			<ul style="list-style-type: none"> <li>The maintenance and cleaning of any vehicles, plant or equipment must not be carried out in areas from which contaminants can be released into any receiving waters.</li> <li>Spillage of wastes, contaminants or other materials must be cleaned up as quickly as practicable to minimise the release of wastes, contaminants or materials to any stormwater drainage system or receiving waters.</li> </ul>			
Minimise potential for mortality or injury to MNES from Project activities (e.g. habitat clearing, vehicle strikes etc).	Injury or mortality of an MNES occurs because of Project activities.	<ul style="list-style-type: none"> <li>MNES are injured and/or killed from mining related activities.</li> <li>Speed limits not adhered to.</li> </ul>	<ul style="list-style-type: none"> <li>Environmental awareness training will be provided to all workers as part of site induction and will include specific topics on MNES, risks and protective measures, and identification of the MNES.</li> <li>Pre-clearance surveys will be undertaken within 48 hours of clearing activities to assess the presence of MNES within the disturbance area to be cleared.</li> <li>At least one qualified Fauna Spotter/Catcher will be present during clearing activities.</li> <li>A wildlife carer will be called to collect any injured fauna.</li> <li>Speed limits of 60 km/hour will be set and enforced on all internal roads including haul roads</li> <li>Vehicles must abide by vehicle speed limits and access to any restricted areas or exclusion zones must be limited to critical site-specific activities to minimise threats to MNES.</li> </ul>	2	2	L

Objectives for MNES Management	Risk	Event or Circumstance	Control Strategies	Residual Risk Rating		
				Likelihood	Consequence	Overall Risk Rating.
			<ul style="list-style-type: none"> <li>• All injured fauna encountered during the construction and operation of the activity will be taken to a wildlife carer/facility or veterinarian within 24 hours.</li> <li>• Where injured fauna is encountered, and it is unsafe to handle the animals, the following should be undertaken;               <ul style="list-style-type: none"> <li>○ The location of the injured animal will be identified so it can be located again</li> <li>○ The species of animal will be identified if possible and its sex and approximate size determined</li> <li>○ The type of injury sustained will be identified if possible</li> <li>○ The EO shall immediately contact Queensland's Department of Environment and Science (DES) and report the animal and arrange for its capture and transportation to a wildlife carer or veterinarian.</li> </ul> </li> </ul>			

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# IPE Terrestrial Ecological Report



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**TERRESTRIAL ECOLOGY ASSESSMENT REPORT  
FOR THE ISAAC PLAINS EAST PROJECT**

**Prepared for Hansen Bailey  
on behalf of Stanmore Coal Pty Ltd**

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**October 2016**



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The preparation of this report has been in accordance with the brief provided by the Client and relies upon data collected under limitations, as specified within the report. Specifically, Hansen Bailey provided relevant descriptions of the project and mitigation proposed. All findings, conclusions or recommendations contained within the report are based on the aforementioned circumstances and represent the professional opinions of Ecological Survey & Management. The report has been prepared for use by the Client and no responsibility for its use by other parties is accepted by Ecological Survey & Management.

Ecological Survey & Management would like to thank Samantha Davis, Environment and Community Superintendent of Stanmore IP Coal Pty Ltd, for her assistance with the field surveys.

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## Document History and Status

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Document:	15046 Rpt01d
Author(s):	Meredith Watherston
Reviewed by:	Steve Marston/Chris Hansen
Approved by:	Steve Marston
Signed :	

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Date issued:	14 October 2016
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## Contents

1	Introduction .....	1
1.1	Overview .....	1
1.2	Study objectives .....	2
1.3	Regional context .....	2
1.4	Description of the ecology study area .....	2
2	Regulatory framework .....	4
2.1	Commonwealth Environment Protection and Biodiversity Conservation Act 1999 .....	4
2.2	Queensland Vegetation Management Act 1999 .....	4
2.3	Queensland Nature Conservation Act 1992 .....	5
2.4	Queensland Biosecurity Act 2014 .....	6
2.5	Queensland Environmental Protection Act 1994 .....	6
2.6	Biodiversity Planning Assessments .....	7
2.7	International treaty obligations on migratory species .....	7
2.8	Government mapping .....	8
2.8.1	Map of Referable Wetlands .....	8
2.8.2	Vegetation Management Wetlands Map .....	8
2.8.3	Vegetation Management Watercourse Map .....	9
2.8.4	Groundwater dependent ecosystem mapping .....	9
2.8.5	Queensland Wetland Data Springs mapping .....	9
2.8.6	Queensland Essential Habitat mapping .....	9
2.9	Commonwealth Environmental Offsets Policy .....	9
2.10	Queensland Environmental Offsets Policy .....	10
3	Methodology .....	12
3.1	Nomenclature and taxonomy .....	12
3.1.1	Flora .....	12
3.1.2	Fauna .....	12
3.2	Desktop study .....	12
3.2.1	Database searches and government mapping .....	12
3.2.2	Literature review and previous studies .....	13
3.2.3	Review of aerial photography .....	14
3.2.4	Regional ecosystem mapping .....	14
3.2.5	Geological mapping .....	14

3.2.6	Soil mapping .....	14
3.3	Terrestrial ecology field surveys.....	14
3.3.1	Survey team.....	14
3.3.2	Permits .....	15
3.3.3	Coordinate system and map datum .....	15
3.3.4	Survey timing .....	15
3.3.5	Climatic conditions .....	15
	Rainfall patterns .....	15
	Weather conditions during the surveys .....	16
3.3.6	Flora field survey methods.....	19
	Site selection.....	19
	Secondary sites .....	20
	Tertiary sites .....	20
	Quaternary sites .....	21
	Threatened ecological community surveys .....	21
	Targeted species surveys .....	22
	Vegetation mapping .....	22
	Random traverses.....	22
	Ancillary information .....	23
	Flora inventory and abundance .....	23
3.3.7	Fauna field survey methods .....	23
	Overview of survey effort.....	23
	Systematic trap sites.....	25
	Supplementary survey sites .....	30
	Spotlighting .....	33
	Call playback .....	33
	Infrared cameras .....	34
	Bird surveys .....	34
	Active searches.....	34
	Anabat .....	34
	Harp traps .....	34
	Koala transects.....	35
	Opportunistic observations .....	35
	Habitat assessment.....	35
3.3.8	Field survey standards .....	36
3.3.9	Likelihood of occurrence.....	37

Ecological community assessment.....	37
Significant species assessment .....	37
3.3.10 Threatened species habitat mapping .....	38
3.3.11 Assessment of impacts .....	38
3.3.12 Limitations.....	39
4 Desktop results.....	40
4.1 Overview of environmental values.....	40
4.1.1 Geology .....	40
4.1.2 Soils .....	41
4.1.3 Surface water .....	41
4.2 Ecological communities.....	41
4.2.1 EPBC Act listed TECs.....	41
4.2.2 Queensland Government vegetation mapping .....	42
Vegetation management wetlands .....	43
Groundwater dependent ecosystems .....	43
Referable wetlands.....	44
4.3 Significant flora species .....	44
4.3.1 EPBC Act listed flora .....	45
4.3.2 NC Act listed flora.....	45
Protected plants high risk areas .....	45
Essential habitat .....	45
4.4 Significant fauna species.....	45
4.4.1 EPBC Act listed fauna.....	46
Threatened fauna.....	46
Migratory fauna .....	46
4.4.2 NC Act listed fauna .....	47
Threatened fauna.....	47
Special least concern fauna .....	47
Near threatened fauna.....	47
Essential habitat .....	47
4.5 Critical habitat.....	47
4.6 Biodiversity Planning Assessment Mapping.....	48
4.7 Previous studies in the region.....	48
5 Field flora results .....	50
5.1 Overview .....	50
5.2 Vegetation communities .....	50

5.2.1	Overview.....	50
5.2.2	EPBC Act listed communities.....	52
	Brigalow TEC.....	52
	SEVT TEC.....	53
	Weeping Myall Woodlands TEC.....	53
	Natural Grasslands TEC.....	53
5.2.3	VM Act listed communities.....	54
	RE 11.3.2.....	54
	RE 11.3.4.....	55
	RE 11.9.7a.....	56
	Wetland vegetation communities.....	57
5.3	Flora species.....	57
	5.3.1 EPBC Act listed flora.....	58
	5.3.2 NC Act listed flora.....	58
5.4	Exotic flora species.....	58
	5.4.1 Nationally declared species.....	58
	5.4.2 State declared species.....	59
	5.4.3 Non-declared species.....	59
6	Field fauna results.....	61
	6.1 Habitat and landscape connectivity.....	61
	6.2 Habitat assessment.....	61
	Cleared and disturbed areas.....	62
	6.3 Fauna diversity.....	62
	6.3.1 Amphibians.....	63
	6.3.2 Reptiles.....	63
	6.3.3 Birds.....	64
	6.3.4 Mammals.....	64
	6.4 Threatened and migratory fauna species.....	65
	6.4.1 EPBC Act listed threatened fauna.....	65
	Species recorded within the study area.....	65
	Species assessed as likely to occur in the study area.....	69
	6.4.2 EPBC Act listed migratory fauna.....	71
	Species recorded within the study area.....	72
	Species assessed as having a moderate potential to occur in the study area.....	73
	6.4.3 NC Act listed fauna.....	74

Special least concern fauna species .....	74
6.5 Feral animals.....	75
7 Impact assessment .....	76
7.1 Introduction .....	76
7.2 Direct impacts .....	76
7.2.1 Impacts to vegetation communities .....	77
EPBC Act Vegetation Communities .....	78
VM Act vegetation communities .....	78
7.2.2 Impacts to threatened flora species .....	79
EPBC Act flora species .....	79
NC Act flora species .....	79
7.2.3 Impacts to significant fauna species.....	79
EPBC Act listed fauna species .....	80
NC Act listed fauna species .....	83
7.2.4 Summary of impacts.....	84
7.3 Indirect impacts.....	85
7.3.1 Habitat fragmentation and edge effects.....	85
7.3.2 Pest animals and plants .....	86
7.3.3 Dust .....	86
7.3.4 Noise and vibration.....	87
7.3.5 Light.....	87
7.3.6 Vehicle Strike.....	88
7.3.7 Erosion and sedimentation .....	88
7.4 Duration and timing of impacts.....	89
8 Mitigation.....	90
8.1 Measures to avoid impacts .....	90
8.2 Measures to mitigate impacts .....	90
8.2.1 Permit to Disturb Process .....	90
8.2.2 Construction in watercourses .....	91
8.2.3 Mine rehabilitation.....	91
8.2.4 Weed and feral animal management.....	92
8.2.5 Soil erosion and sedimentation.....	92
9 Residual impacts and offset liability.....	94
9.1 Introduction .....	94
9.2 Matters of national environmental significance.....	94
9.3 Matters of state environmental significance .....	95

10 References ..... 96

## List of Tables

Table 1: Monthly recorded rainfall for the local area ..... 16  
Table 2: Daily weather conditions recorded at the BoM Moranbah Airport Weather Station (034035) preceding and during the ecology surveys ..... 17  
Table 3: Fauna survey effort ..... 24  
Table 4: Descriptions of habitat at each systematic fauna trap site..... 27  
Table 5: Description of supplementary survey sites ..... 31  
Table 6: Criteria to assess potential for species to occur in the study area .. 37  
Table 7: Criteria to determine if assessment of significance of impacts from the project is required for significant species ..... 39  
Table 8: Surface geology mapping within the study area ..... 40  
Table 9: Queensland Government mapped REs within the study area ..... 42  
Table 10: Field-validated remnant regional ecosystems in the ecology study area 51  
Table 11: Condition and status of field-validated non-remnant Brigalow vegetation 52  
Table 12: Condition and status of field-validated grassland vegetation ..... 54  
Table 13: State declared pests in the project site ..... 59  
Table 14: Feral animals in the study area ..... 75  
Table 15: Remnant vegetation communities within the disturbance footprint. 77  
Table 16: Suitable fauna habitat within the disturbance footprint ..... 80  
Table 17: Summary of impacts..... 84

## List of Figures

Figure 1: Project location ..... 108  
Figure 2: Project layout and Disturbance Footprint ..... 109  
Figure 3: Project setting ..... 110  
Figure 4: Flora survey sites in the ecology study area ..... 111  
Figure 5: Fauna survey sites in the ecology study area ..... 112  
Figure 6: Geology mapping for the ecology study area..... 113  
Figure 7: Queensland Government regional ecosystem mapping for the ecology study area ..... 114  
Figure 8: Bureau of Meteorology Groundwater Dependent Ecosystem mapping for the ecology study area..... 115  
Figure 9: Biodiversity Planning Assessment mapping for the ecology study area 116  
Figure 10: Field-validated regional ecosystem mapping for the ecology study area 117  
Figure 11: *Bertya pedicellata* records for the ecology study area ..... 118  
Figure 12: Notable weeds identified in the project site ..... 119

Figure 13: Broad habitat types in the ecology study area ..... 120  
Figure 14: Squatter Pigeon records and potential habitat mapping within the ecology study area ..... 121  
Figure 15: Greater Glider records and potential habitat within the ecology study area 122  
Figure 16: Ornamental Snake record for the ecology study area ..... 123  
Figure 17: Potential Koala habitat within the ecology study area ..... 124  
Figure 18: Field-validated regional ecosystems proposed to be impacted by the project 125  
Figure 19: Squatter Pigeon habitat proposed to be impacted by the project 126  
Figure 20: Greater Glider habitat proposed to be impacted by the project . 127  
Figure 21: Potential Koala habitat proposed to be impacted by the project 128



## **Appendices**

- Appendix A: EPBC Act Protected Matters Search Report
- Appendix B: Queensland Wildlife Online Database search results
- Appendix C: Queensland Herbarium (HERBRECS) Database search results
- Appendix D: Queensland Museum Database search results
- Appendix E: BirdLife Atlas Database search results
- Appendix F: Protected Plants Flora Survey Trigger Map for the study area
- Appendix G: Study team
- Appendix H: Commonwealth and State recommended survey guidelines
- Appendix I: Assessment of likelihood for significant flora species to occur in the study area
- Appendix J: Assessment of likelihood for significant fauna species to occur in the study area
- Appendix K: Regional Ecosystems recorded within the study area
- Appendix L: Flora species recorded during seasonal surveys of the study area
- Appendix M: Fauna species recorded during seasonal surveys of the study area
- Appendix N: EPBC Act critical habitat assessment for the Koala
- Appendix O: Summary of impacts table
- Appendix P: EPBC Act significance assessment
- Appendix Q: Terrestrial MNES and MSES likely to require environmental offsets
- Appendix R: EO Act significance assessments
- Appendix S: Output of Landscape Fragmentation and Connectivity Tool

## Symbols and Abbreviations

*	(Preceding a plant species name) plant species not native to Australia
±	With or without, more or less
BAMM	Biodiversity Assessment and Mapping Methodology
BoM	Bureau of Meteorology
BPA	Biodiversity Planning Assessment
CHPP	Coal Handling and Preparation Plant
DAF	(Queensland) Department of Agriculture and Fisheries
DotE	(Commonwealth) Department of the Environment
DSITI	(Queensland) Department of Science, Information Technology and Innovation
DSITIA	Former (Queensland) Department of Science, Information Technology and the Arts
EA	Environmental Authority
EAR	Environmental Assessment Report
EDL	Ecologically Dominant Layer
EHP	(Queensland) Department of Environment and Heritage Protection
EIS	Environmental Impact Statement
EO Act	(Queensland) <i>Environmental Offsets Act 2014</i>
EP Act	(Queensland) <i>Environmental Protection Act 1994</i>
EPBC Act	(Commonwealth) <i>Environment Protection and Biodiversity Conservation Act 1999</i>
ESA	Environmentally Sensitive Area
GDE	Groundwater dependent ecosystem
GES	General ecological significance
GPS	Global positioning system
ha	Hectares
HES	High ecological significance
km	Kilometres
ML	Mining lease
MLES	Matters of local environmental significance (EO Act)
MNES	Matters of national environmental significance (EPBC Act)
MSES	Matters of state environmental significance (EO Act)

Mtpa	Million Tonnes per annum
NC Act	(Queensland) <i>Nature Conservation Act 1992</i>
NC Regulation	(Queensland) Nature Conservation (Wildlife) Regulation 2006
NC WM Regulation	(Queensland) Nature Conservation (Wildlife Management) Regulation 2006
NRM	(Queensland) Department of Natural Resources and Mines
QEOP	Queensland Environmental Offsets Policy 2014
RE	Regional Ecosystem as defined under the Queensland Vegetation Management Regulation 2000
REDD	Regional Ecosystem Description Database
ROM	Run of mine
SPRAT	Species Profile and Threats Database
SRI Guideline	Queensland Environmental Offsets Policy Significant Residual Impact Guideline
TEC	Threatened Ecological Community
TSSC	Threatened Species Scientific Committee
VM Act	(Queensland) <i>Vegetation Management Act 1999</i>
WoNS	Weeds of National Significance
WPA	Wetland protection areas

## Glossary

Term	Definition
Biodiversity Status	<p>This is an EHP classification dependent on condition of remnant vegetation <i>in addition</i> to the criteria used to determine class under the Queensland <i>Vegetation Management Act 1999</i>. This classification is used for a range of planning and management applications, i.e. to determine environmentally sensitive areas. A regional ecosystem is listed as 'endangered' if:</p> <ul style="list-style-type: none"> <li>▪ Less than 10 % of its pre-clearing extent remains unaffected by severe degradation and/or biodiversity loss; or</li> <li>▪ 10-30 % of its pre-clearing extent remains unaffected by severe degradation and/or biodiversity loss and the remnant vegetation is less than 10,000 ha; or</li> <li>▪ It is a rare regional ecosystem subject to a threatening process.</li> </ul> <p>A regional ecosystem is listed as 'of concern' if:</p> <ul style="list-style-type: none"> <li>▪ 10-30 % of its pre-clearing extent remains unaffected by moderate degradation and/or biodiversity loss.</li> </ul> <p>A regional ecosystem is listed as 'no concern at present' if:</p> <ul style="list-style-type: none"> <li>▪ The degradation criteria listed above for 'endangered' or 'of concern' regional ecosystems is not met.</li> </ul>
Benchmark condition	<p>Benchmark condition describes the standard or typical condition of a particular RE in an undisturbed condition and is determined from an average value from mature and long undisturbed reference of 'Best on Offer' sites (Eyre et al. 2011). Benchmarks are developed by the EHP for various vegetation communities, but not all at this stage.</p>
Bioregion	<p>A geographically distinct biological region, which is a reporting unit for assessing the status of native ecosystems and their level of protection. Australia is divided into 89 bioregions. Bioregions form part of the regional ecosystem classification code system. The ecology study area is located in the Northern Bowen Basin sub-region of the Brigalow Belt Bioregion.</p>
Ecology study area	<p>An area defined for the purposes of this baseline study and impact assessment, which comprises the project site (the proposed mining lease boundary for the project) and the proposed haul road connections (shown on Figure 2).</p>
Endangered	<p>Prescribed to a threatened ecological community, regional ecosystem or species under the Queensland <i>Vegetation Management Act 1999</i>, <i>Nature Conservation Act 1992</i> or Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>.</p>
Environmentally Sensitive Area (ESA)	<p>Defined under the Environmental Protection Regulation 2008, a Category A Environmentally Sensitive Area is:</p> <ul style="list-style-type: none"> <li>▪ a national park, conservation park or forest reserve under the <i>Nature Conservation Act 1992</i></li> <li>▪ the wet tropics area under the <i>Wet Tropics World Heritage Protection and Management Act 1992</i></li> </ul>

Term	Definition
	<ul style="list-style-type: none"> <li>▪ the Great Barrier Reef Region under the <i>Great Barrier Reef Marine Park Act 1975</i></li> <li>▪ a marine park under the <i>Marine Parks Act 2004</i>.</li> </ul> <p>A Category B Environmentally Sensitive Area is:</p> <ul style="list-style-type: none"> <li>▪ a coordinated conservation area, a wilderness area, a World Heritage management area, an international agreement area, an area of critical habitat or major interest identified under a conservation plan or an area subject to an interim conservation order under the <i>Nature Conservation Act 1992</i></li> <li>▪ an area subject to the Bonn, Ramsar or Paris Conventions</li> <li>▪ a zone of a marine park under the <i>Marine Parks Act 2004</i></li> <li>▪ an area to the seaward side of the highest astronomical tide</li> <li>▪ a place of cultural heritage significance or a registered place under the <i>Queensland Heritage Act 1992</i></li> <li>▪ an area recorded in the Aboriginal Cultural Heritage Register under the <i>Aboriginal Cultural Heritage Act 2003</i></li> <li>▪ a feature protection areas, State forest park or scientific area under the <i>Forestry Act 1959</i></li> <li>▪ a declared fish habitat or place of a marine plant area under the <i>Fisheries Act 1994</i></li> <li>▪ an endangered regional ecosystem identified in the database known as the 'Regional ecosystem description database'.</li> </ul>
<p>EPBC Act conservation status</p>	<p>The <i>Environment Protection and Biodiversity Conservation Act 1999</i> lists species and communities:</p> <p>Extinct in the wild:</p> <ul style="list-style-type: none"> <li>▪ It is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or</li> <li>▪ It has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a timeframe appropriate to its life cycle and form.</li> </ul> <p>Critically Endangered:</p> <ul style="list-style-type: none"> <li>▪ It is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.</li> </ul> <p>Endangered:</p> <ul style="list-style-type: none"> <li>▪ It is not critically endangered; and it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.</li> </ul> <p>Vulnerable:</p> <ul style="list-style-type: none"> <li>▪ It is not critically endangered or endangered; and</li> <li>▪ It is facing a high risk of extinction in the wild in the medium term future, as determined in accordance with the prescribed criteria.</li> </ul> <p>Migratory:</p> <ul style="list-style-type: none"> <li>▪ Migratory species which are native to Australia and are included in the appendices to the Bonn Convention</li> </ul>

Term	Definition
	<p>(Convention on the Conservation of Migratory Species of Wild Animals Appendices I and II);</p> <ul style="list-style-type: none"> <li>▪ Migratory species included in annexes established under the Japan-Australia Migratory Bird Agreement (JAMBA) and the China-Australia Migratory Bird Agreement (CAMBA);</li> <li>▪ Native, migratory species identified in a list established under, or an instrument made under, an international agreement approved by the Minister, such as the Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA).</li> </ul>
Least Concern	Prescribed to regional ecosystems listed under the Queensland <i>Vegetation Management Act 1999</i> .
MNES	<p>A matter protected under the EPBC Act, including:</p> <ul style="list-style-type: none"> <li>▪ World heritage properties</li> <li>▪ National heritage places</li> <li>▪ Wetlands of international importance</li> <li>▪ Listed threatened species and ecological communities</li> <li>▪ Migratory species</li> <li>▪ Commonwealth marine areas</li> <li>▪ The Great Barrier Reef Marine Park</li> <li>▪ Nuclear actions</li> <li>▪ A water resource, in relation to coal seam gas development and large coal mining development.</li> </ul>
MSES	<p>A matter of State environmental significance listed in Schedule 2 of the Queensland Environmental Offsets Regulation 2014 including:</p> <ul style="list-style-type: none"> <li>▪ Regulated vegetation</li> <li>▪ Connectivity areas</li> <li>▪ Wetlands and watercourses</li> <li>▪ High preservation areas of wild river areas</li> <li>▪ Protected wildlife habitat</li> <li>▪ Protected areas</li> <li>▪ Highly protected zones of State marine parks</li> <li>▪ Fish habitat areas</li> <li>▪ Waterways providing for fish passage</li> <li>▪ Marine plants</li> <li>▪ Legally secured offset areas.</li> </ul>

Term	Definition
MLES	A matter described in Section 5(3) of the Queensland Environmental Offset Regulation 2014 as a matter of local environmental significance for which an environmental offset is required under a local planning instrument.
NC Act conservation status	<p>Under the <i>Nature Conservation Act 1992</i>, native wildlife may be prescribed as:</p> <p>Extinct in the wild:</p> <ul style="list-style-type: none"> <li>▪ There have been thorough searches conducted for the wildlife; and</li> <li>▪ The wildlife has not been seen in the wild over a period that is appropriate for the life cycle or form of the wildlife.</li> </ul> <p>Endangered:</p> <ul style="list-style-type: none"> <li>▪ There have not been thorough searches conducted for the wildlife and the wildlife has not been seen in the wild over a period that is appropriate for the life cycle or form of the wildlife; or</li> <li>▪ The habitat or distribution of the wildlife has been reduced to an extent that the wildlife may be in danger of extinction; or</li> <li>▪ The population size of the wildlife has declined, or is likely to decline, to an extent that the wildlife may be in danger of extinction; or</li> <li>▪ The survival of the wildlife in the wild is unlikely if a threatening process continues.</li> </ul> <p>Vulnerable:</p> <ul style="list-style-type: none"> <li>▪ The population size or distribution of the wildlife has declined, or is likely to decline, to an extent that the wildlife may become endangered because of a threatened process; or</li> <li>▪ The population size of the wildlife has been seriously depleted and the protection of the wildlife is not secured; or</li> <li>▪ The population of the wildlife is low or localised and dependent on habitat that has been, or is likely to be, adversely affected, in terms of quantity or quality, by a threatening process.</li> </ul> <p>Near Threatened:</p> <ul style="list-style-type: none"> <li>▪ The population size or distribution of the wildlife is small and may become smaller; or</li> <li>▪ The population size of the wildlife has declined, or is likely to decline, at a rate higher than the usual rate for population changes for the wildlife; or</li> <li>▪ The survival of the wildlife in the wild is affected to an extent that the wildlife is in danger of becoming vulnerable.</li> </ul> <p>Least Concern:</p> <ul style="list-style-type: none"> <li>▪ The Wildlife is common or abundant and is likely to survive in the wild.</li> </ul>
Near Threatened	Prescribed to species listed under the Queensland <i>Nature Conservation Act 1992</i> .

Term	Definition
Of Concern	Prescribed to regional ecosystems listed under the Queensland <i>Vegetation Management Act 1999</i> .
Project site	The proposed mining lease boundary for the project (shown on Figure 2).
Region	The local area surrounding the project site, including the landscape within 25 km of the project site.
Regional ecosystem	A vegetation community within a bioregion that is consistently associated with a particular combination of geology, landform and soils.
Regulated vegetation	Vegetation regulated through the <i>Sustainable Planning Act 2009</i>
Remnant vegetation	Defined under the Queensland <i>Vegetation Management Act 1999</i> as, woody vegetation that has not been cleared or vegetation that has been cleared but where the dominant canopy has >70% of the height and >50 % of the cover relative to the undisturbed height and cover of that stratum and is dominated by species characteristic of the vegetation's undisturbed canopy.
Significant species and vegetation	Refers to: <ul style="list-style-type: none"> <li>▪ Species listed as Endangered, Vulnerable or Near Threatened under the Queensland Nature Conservation (Wildlife) Regulation 2006 or Critically Endangered, Endangered or Vulnerable under the Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i></li> <li>▪ Threatened ecological community listed as Critically Endangered, Endangered or Vulnerable under the Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i></li> <li>▪ Regional ecosystems with an Endangered or Of Concern biodiversity status or <i>Vegetation Management Act 1999</i> status.</li> </ul>
Special least concern	Defined under the Queensland Nature Conservation (Wildlife) Regulation 2006 as: <ol style="list-style-type: none"> <li>a) the echidna (<i>Tachyglossus aculeatus</i>)</li> <li>b) the platypus (<i>Ornithorhynchus anatinus</i>)</li> <li>c) a least concern bird to which any of the following apply – <ol style="list-style-type: none"> <li>i. Agreement Between the Government of Australia and the Government of Japan for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment (JAMBA)</li> <li>ii. Agreement Between the Government of Australia and the Government of the People's Republic of China for the Protection of Migratory Birds and their Environment (CAMBA)</li> <li>iii. Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention).</li> </ol> </li> </ol>
Threatened ecological community	A community listed under the provisions of the Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> .



Term	Definition
Vegetation management Act status	<p>This is a statutory classification under the Queensland <i>Vegetation Management Act 1999</i>. A regional ecosystem is listed as 'endangered' if:</p> <ul style="list-style-type: none"> <li>▪ Remnant vegetation for the regional ecosystem is less than 10% of its pre-clearing extent across the bioregion; or 10-30% of its pre-clearing extent remains and the remnant vegetation for the regional ecosystem is less than 10,000 ha.</li> </ul> <p>A regional ecosystem is listed as 'of concern' if:</p> <ul style="list-style-type: none"> <li>▪ Remnant vegetation for the regional ecosystem is 10-30% of its pre-clearing extent across the bioregion; or more than 30% of its pre-clearing extent remains and the remnant vegetation extent for the regional ecosystem is less than 10,000 ha.</li> </ul> <p>A regional ecosystem is listed 'least concern' if:</p> <ul style="list-style-type: none"> <li>▪ Remnant vegetation for the regional ecosystem is over 30% of its pre-clearing extent across the bioregion, and the remnant vegetation area for the regional ecosystem is greater than 10,000 ha.</li> </ul>
Vulnerable	<p>Prescribed to a threatened ecological community or species under the Queensland <i>Nature Conservation Act 1992</i> or Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>.</p>

# 1 Introduction

## 1.1 Overview

Ecological Survey & Management was commissioned by Hansen Bailey, on behalf of Stanmore IP Coal Pty Ltd (the proponent), to complete a terrestrial ecology assessment which forms part of the Environmental Assessment Report (EAR) for the Isaac Plains East Project (the project). The EAR is being used in support of an application to amend the Isaac Plains Mine Environmental Authority (EA). Relevant information from the EAR will also be used in support of a referral for the project under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The Isaac Plains Mine is an operating open cut coal mine located approximately 5 km north-east of Moranbah township in Central Queensland (Figure 1). The Isaac Plains Mine commenced operation in 2006 and produces export coking coal. The mine has approval to produce up to 4 Million tonnes per annum (Mtpa) of Run of Mine (ROM) coal which equates to approximately 2.8 Mtpa of product coal.

The Isaac Plains Mine was acquired by the proponent in late 2015 and recommenced open cut mining operations in early 2016 after a period of approximately 12 months on care and maintenance. The open cut mining operations at the Isaac Plains Mine are currently scheduled to cease in late 2018. Current mining operations include removal of overburden by dragline with truck and shovel pre-stripping. ROM coal is hauled by truck from the open cut pits to an on-site Coal Handling and Preparation Plant (CHPP) for washing and processing. Product coal is loaded to trains for transport from site via an on-site rail loop and train loading facility.

The project involves the development of open cut pits in an adjoining area to the east of the existing Isaac Plains mining lease (Figure 2). A new mining lease will be required for this area. The project will be operated as an extension of the Isaac Plains Mine and will utilise the existing Isaac Plains Mine infrastructure, mining equipment and workforce. It will extend the life of the Isaac Plains Mine by approximately 7 years.

The project open cut mining operations will be similar to operations at the existing Isaac Plains Mine. New infrastructure for the project will be limited to:

- haul roads and access roads, including connections to the existing Isaac Plains Mine road network
- ROM coal stockpile areas at the top of the open cut pit ramps, including vehicle parking areas and mobile crib huts
- minor laydown areas and a substation
- stormwater drains, pit water pipelines and sediment control works.

## 1.2 Study objectives

This report assesses the potential ecological impacts of the project and specifically:

- describes the regulatory requirements relevant to the project
- summarises the results of seasonal terrestrial flora and fauna surveys, which were designed based on the flora and fauna survey methodologies of the Commonwealth Department of the Environment (DotE) and the Queensland Department of Environment and Heritage Protection (EHP)
- provides a comprehensive flora and fauna inventory of the project site
- provides regional ecosystem (RE) mapping developed in accordance with the Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland, Version 3.2 (Neldner et al. 2012)
- assesses the presence of any groundwater dependent ecosystems (GDEs)
- assesses the likelihood of occurrence, and identifies and maps habitat for, matters of national and state environmental significance (MNES and MSES), including species and communities protected under the Commonwealth EPBC Act, Queensland *Vegetation Management Act 1999* (VM Act) and Queensland *Nature Conservation Act 1992* (NC Act)
- assesses the potential impacts of the project on MNES and MSES ecological matters
- provides mitigation and management strategies to reduce impacts on flora and fauna
- confirms the requirements for any offsets under the EPBC Act and / or under the Queensland *Environmental Offsets Act 2014* (EO Act).

## 1.3 Regional context

The project site is located within the Bowen Basin in central Queensland within the Isaac River drainage sub-basin of the Fitzroy Drainage Basin. The region experiences sub-tropical conditions with average temperatures ranges recorded in Moranbah of between 21.1°C and 34.0°C in the summer months, and 9.9°C and 23.7°C in the winter months (BoM 2016). The region receives an annual average rainfall of approximately 614.2 mm with a pronounced wet season. Approximately 70% of the annual rainfall is typically recorded between November and March (BoM 2016).

The predominant land use within the project site is cattle grazing. No World Heritage Areas or other conservation areas are located in the region.

## 1.4 Description of the ecology study area

The project ecology study area (study area) encompasses the proposed mining lease boundary for the project, and associated haul road connections to the

existing Isaac Plains Mine road network (Figure 2). The study area covers an area of approximately 1,269 ha.

The study area contains scattered patches of remnant vegetation comprising woodland to open forest communities interspersed with areas cleared for cattle grazing.

The topography within the study area is relatively flat with a low rise in the central portion of the site. Two drainage systems, Smoky Creek and Billy's Gully, traverse the study area from east to west, in the north and south of the study area, respectively. These watercourses enter the Isaac River approximately 10 km south-west of the study area. The Goonyella Railway line adjoins the study area's northern boundary, and the Peak Downs Highway adjoins the study area's southern boundary.

Cattle grazing is the dominant land use within the study area.

## 2 Regulatory framework

### 2.1 Commonwealth Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act is the Commonwealth Government's principal piece of environmental legislation, and is administered by the DoE. It is designed to protect national environmental assets, known as MNES, which include threatened species of flora and fauna, threatened ecological communities (TECs), migratory species as well as other protected matters. Among other things, it defines the categories of threat for threatened flora and fauna, identifies key threatening processes to their survival and provides for the preparation of recovery plans for threatened flora and fauna.

Approval is required under the EPBC Act for any action (which includes a development, project or activity) that is likely to have a significant impact on MNES (including nationally threatened ecological communities and species, and listed migratory species).

An EPBC Act referral was lodged for the Isaac Plains Mine in May 2005 (EPBC 2005/2070). The Isaac Plains Mine was found to be "not a controlled action", meaning that approval under the EPBC Act is not required for the mine. A separate referral under the EPBC Act will be made for the project.

### 2.2 Queensland Vegetation Management Act 1999

The VM Act is administered by the Queensland Department of Natural Resources and Mines (DNRM). The VM Act, in conjunction with the Queensland *Sustainable Planning Act 2009* (SP Act), regulates the clearing of native vegetation in Queensland. The VM Act's objectives include the preservation of remnant endangered ecosystems and vegetation in areas of high nature conservation value or lands vulnerable to land degradation. Permits under either the VM Act or SP Act for vegetation clearing are not required for the project, given it is located within a ML, and therefore vegetation clearing for the project will be regulated by the EA issued under the *Environmental Protection Act 1994*.

The VM Act provides for the classification of remnant vegetation into regional ecosystems (REs) which form the basis of the assessment of vegetation communities. REs are defined by (Sattler and Williams 1999) as vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil. The Queensland Government maintains RE maps illustrating the distribution of REs throughout Queensland and these are updated periodically to reflect refinements that have been made through ground-truthing these communities.

Remnant vegetation is referred to under the VM Act as vegetation where the dominant canopy has >70% of the height and >50% of the cover, relative to the height and canopy cover of the pristine (undisturbed) vegetation community. Remnant vegetation must also be dominated by species characteristic of the vegetation community in its pristine condition.

REs are assigned one of the following three categories under the VM Act (Sattler and Williams 1999):

- endangered: Remnant vegetation that is less than 10% of its pre-clearing extent across the bioregion; or 10 - 30% of its pre-clearing extent remains and the remnant area is less than 10,000 ha
- of concern: Remnant vegetation that is 10 - 30% of its pre-clearing extent across the bioregion; or more than 30% of its pre-clearing extent remains and the remnant area is less than 10,000 ha
- least concern: Remnant vegetation that is over 30% of its pre-clearing extent across the bioregion and the remnant area is greater than 10,000 ha.

The Queensland government also assigns a biodiversity status to each RE, in addition to the status under the VM Act. The biodiversity status has no formal regulatory meaning under the VM Act but is used for a variety of planning and management applications.

### **2.3 Queensland Nature Conservation Act 1992**

The NC Act is the key piece of legislation in Queensland relating to the protection and management of biodiversity and threatened species. It establishes a framework for the identification, gazettal and management of protected areas (such as National Parks) and the protection of native flora and fauna (protected wildlife) listed under the Queensland *Nature Conservation (Wildlife) Regulation 2006*. The NC Act is administered by the EHP.

The NC Act classifies native flora and fauna species into categories of conservation significance including extinct in the wild, endangered, vulnerable, near threatened, special least concern and least concern in recognition of how threatened they are and what action needs to be taken to protect them.

Impacts to, and offsetting for species listed as endangered, vulnerable and special least concern (non-migratory species) under the NC Act are considered in detail within this report. There is no requirement under the EO Act to offset impacts to least concern, near threatened or special least concern (migratory) species. However, special least concern (migratory species) that are concurrently listed under the EPBC Act and which have been recorded or have a high or moderate likelihood of occurrence in the study area have been assessed and considered within this report.

The NC Act and associated regulations require that the following approvals be obtained, where relevant to the project:

- Where there is a requirement for the clearing of plants protected under the NC Act (including endangered, vulnerable and near threatened species) a clearing permit under the NC Act will be required.
- Where the activities of the proponent may cause disturbance to animal breeding places, the proponent must prepare a Species Management Program under section 332 of the Queensland *Nature Conservation*

(*Wildlife Management*) Regulation 2006 (NC WM Regulation) and obtain approval from the EHP.

- Any spotter catcher employed by the project must be in possession of a Rehabilitation Permit (spotter catcher endorsement) for managing fauna during clearing activities (section 207 of NC WM Regulation).
- If it is necessary to remove animals posing a threat to human health or property, a Damage Mitigation Permit under section 181 of the NC WM Regulation is required.

## **2.4 Queensland Biosecurity Act 2014**

The Queensland *Biosecurity Act 2014* (Biosecurity Act) provides a framework for the control and management of pests, weeds, diseases, and contaminants, along with creating an overarching general biosecurity obligation for the State. The key principle of the Act is shared responsibility for the mitigation of biosecurity risks.

The Biosecurity Act lists biosecurity matters as either prohibited or restricted. Prohibited matters are biosecurity matters that are not yet found in Queensland. Restricted matters are biosecurity matters found in Queensland that require restrictions to reduce, control or contain the matter. The Act details seven categories of restricted matters, based on the level on mitigation required. The seven categories of restricted matters are:

- Category 1 and 2 must be reported to the Department of Agriculture and Fisheries (DAF) within 24 hours of becoming aware of their presence
- Category 3 must not be distributed or released into the environment
- Category 4 must not be moved or spread into other areas of the State
- Category 5 are those that have a high risk of negatively impacting the environment, and must not be kept
- Category 6 must not be kept or fed
- Category 7 must be killed and disposed of if caught or found.

Some restricted matters fall into multiple categories, and therefore require several different management measures for their control.

Further to prohibited or restricted matters declared under the Act, the Biosecurity Act also recognises other invasive species (such as Cane Toads) as species which fall under a general biosecurity obligation (GBO). A GBO means that, while there is no legal requirement for control of these pests, reasonable and practical steps must be undertaken to minimise their spread.

The Biosecurity Act is administered by DAF.

## **2.5 Queensland Environmental Protection Act 1994**

The EP Act is administered by the EHP and was established to protect Queensland's environment, while allowing for development that improves the total quality of life, both now and in the future.

The EP Act uses a number of mechanisms to achieve its objectives, including the following that are relevant to this report:

- requirement for mining projects to obtain an EA prior to operation
- requirement for an environmental impact assessment process in support of an EA application.

## **2.6 Biodiversity Planning Assessments**

The Biodiversity Assessment and Mapping Methodology (BAMM) has been prepared to provide a consistent approach for assessing biodiversity values at the landscape scale in Queensland using vegetation mapping data generated or approved by the Queensland Herbarium as a fundamental basis. It is being used by EHP to generate Biodiversity Planning Assessments (BPAs) for each of Queensland's bioregions, including the Brigalow Belt Bioregion where the project is located.

BPAs are developed in two stages:

- 1) diagnostic criteria: involves the integration of ecological criteria using BAMM to determine the relative Biodiversity Significance
- 2) supplementary/expert panel criteria: allows for the refinement of the mapped information from Stage 1 by incorporating local knowledge and expert opinion.

The methodology has application for identifying areas with various levels of significance solely for biodiversity reasons. These include threatened ecosystems or taxa, large tracts of habitat in good condition and buffers to wetlands or other types of habitat important for the maintenance of biodiversity or ecological processes.

## **2.7 International treaty obligations on migratory species**

Australia is signatory to several agreements relating to migratory species. Migratory species listed under the following agreements and conventions are protected in Australia through being listed as MNES (Migratory Controlling Provision) under the EPBC Act:

- China–Australia Migratory Bird Agreement (CAMBA)
- Japan–Australia Migratory Bird Agreement (JAMBA)
- Republic of Korea–Australia Migratory Bird Agreement (ROKAMBA)
- Convention on the conservation of migratory species of wild animals (Bonn Convention).

The JAMBA, CAMBA and ROKAMBA agreements list terrestrial, water and shorebird species which migrate between Australia and the respective countries. In all cases, the majority of listed species are shorebirds (DotE 2016a).

All agreements require the parties to protect migratory birds by:

- limiting the circumstances under which migratory birds are taken or traded



- protecting and conserving important habitats
- exchanging information
- building cooperative relationships.

The JAMBA agreement also includes provisions for cooperation on the conservation of threatened birds.

Australian Government and non-government representatives meet every two years with Japanese and Chinese counterparts to review progress in implementing the agreements and to explore new initiatives to conserve migratory birds (DotE 2016a).

The ROKAMBA formalises Australia's relationship with the Republic of Korea in respect to migratory bird conservation and provides a basis for collaboration on the protection of migratory shorebirds and their habitat (DotE 2016a).

In addition to these bilateral agreements, Australia is also a signatory of the Bonn Convention. This convention aims to conserve terrestrial, aquatic and avian migratory species throughout their range (CMS 2016).

## **2.8 Government mapping**

### ***2.8.1 Map of Referable Wetlands***

EHP has a range of policies and programs to manage wetlands. As part of a broader policy of wetland protection, and in accordance with schedule 12, part 2 of the Queensland *Environmental Protection Regulation 2008* (EP Regulation), the EHP has prepared a map of referable wetlands. The map of referable wetlands includes:

- wetland protection areas (WPAs), which comprise:
  - wetlands of high ecological significance (HES wetlands) located within Great Barrier Reef catchments
  - trigger areas that represent the area of hydrological influence of HES wetlands. Outside urban areas, the trigger area is 500 m from the edge of a HES wetland
- wetlands of general ecological significance (GES wetlands).

WPAs and HES wetlands contain wetland environmental values as listed under section 81A of the EP Regulation. WPAs are derived using a mapping method developed by the EHP called the Aquatic Biodiversity Assessment and Mapping Method. Significant residual impacts on WPAs are required to be offset in accordance with the Queensland Environmental Offsets Framework.

### ***2.8.2 Vegetation Management Wetlands Map***

The Queensland government has produced a vegetation management wetlands map under section 20AA of the VM Act. This map shows wetlands, as defined under the VM Act. It is used primarily to regulate vegetation clearing in areas mapped as wetlands.

Significant residual impacts on REs that intersect with an area shown as a wetland on the vegetation management wetlands map are required to be offset (to the extent of the intersection).

### ***2.8.3 Vegetation Management Watercourse Map***

The Queensland Government has produced a vegetation management watercourse map under section 20AB of the VM Act. This map shows watercourses, as defined under the VM Act. It is used primarily to regulate vegetation clearing in proximity of watercourses. The map is produced based on desktop information and includes stream order mapping under the Strahler method.

Significant residual impacts on REs located within a defined distance of watercourses are required to be offset.

### ***2.8.4 Groundwater dependent ecosystem mapping***

The Commonwealth Bureau of Meteorology (BoM) has produced a Groundwater Dependent Ecosystem (GDE) Atlas, which provides ecological and hydrogeological information on known GDEs and ecosystems that could potentially use groundwater. The GDE Atlas collates information from a number of sources into a central database, including published research and interpreted remote sensing data.

### ***2.8.5 Queensland Wetland Data Springs mapping***

The Queensland Government has prepared the Queensland Wetland Data Springs mapping, which show the location of springs in the state. These springs are dependent on the surface expression of groundwater and their locations are used to infer the location of potential GDEs.

### ***2.8.6 Queensland Essential Habitat mapping***

Essential habitat is mapped by the EHP and is vegetation in which a species that is endangered, vulnerable or near threatened has been known to occur.

## **2.9 Commonwealth Environmental Offsets Policy**

Under the EPBC Act Environmental Offsets Policy 2012 (EPBC Act Environmental Offsets Policy), environmental offsets are actions taken to counterbalance significant residual impacts on MNES. Offsets are used as a last resort in instances where an action will give rise to significant residual impacts, even after the application of management measures.

The EPBC Act Environmental Offsets Policy came into force in October 2012 and provides guidance on the role of offsets in environmental impact assessments and how DotE considers the suitability of a proposed offset package (SEWPaC 2012).

According to the policy, an offsets package is a *“suite of actions that a proponent undertakes in order to compensate for the residual significant impact of a*

project" (SEWPaC 2012). It can comprise a combination of direct offsets and other compensatory measures.

## 2.10 Queensland Environmental Offsets Policy

The *Queensland Environmental Offsets Policy (Version 1.2)* (QEOP) (EHP 2016a) came into force in June 2016. The EO Act, *Environmental Offsets Regulation 2014* (EO Regulation) and QEOP comprise the Queensland Environmental Offsets Framework. According to this framework, it is necessary to provide offsets for any significant, residual impacts on Matters of State Environmental Significance (MSES). However, as stated in the EO Act, an offset for a prescribed environmental matter which has been assessed under the EPBC Act is not subject to offset conditions under the EO Act.

The EO Regulation prescribes a number of MSES that are potentially relevant to terrestrial ecology. These include:

- regulated vegetation under the VM Act that are:
  - endangered REs
  - of concern REs
  - REs that intersect with wetlands identified on the vegetation management wetlands map
  - REs that comprise an area of essential habitat, in accordance with the VM Act, for protected wildlife
  - REs located within a defined distance from the defining banks of a relevant watercourse
- connectivity areas, comprising remnant REs that contain an area of land that is required for ecosystem functioning (i.e. a connectivity area)
- wetlands in a WPA or a HES wetland as shown on the map of referable wetlands
- a designated precinct in a strategic environmental area
- high risk areas identified on the flora survey trigger map that contains flora species that are listed as endangered or vulnerable under the NC Act
- areas not identified as a high risk area on the flora survey trigger map, to the extent that the area contains flora species that are listed as endangered or vulnerable under the NC Act
- a non-juvenile koala habitat tree located in an area shown as bushland habitat, high value rehabilitation habitat or medium value rehabilitation habitat on the map called 'Map of Assessable Development Area Koala Habitat Values' that applies under the South East Queensland Koala Conservation State Planning Regulatory Provisions is a matter of State environmental significance
- habitat for terrestrial fauna species that are listed as special least concern (as defined within the EO Regulation), vulnerable or endangered under the NC Act
- protected areas

- legally secured offset areas.

The MSES relevant to the project are discussed in Section 9.3.

EHP released guidelines, Queensland Environmental Offsets Policy Significant Residual Impact Guideline (SRI Guideline) (EHP 2014a), in December 2014, which have been used where relevant in this report, and have been used to determine if offsets are required.

## 3 Methodology

### 3.1 Nomenclature and taxonomy

#### 3.1.1 Flora

Application of flora scientific names in this report follows Bostock and Holland (2010). In the first occurrence in the text, common names (if one exists) will be followed by its scientific name. Common names for flora were derived from Harden et al. (2006), Brooker and Kleinig (2008), Maslin (2001), Hacker (1990), Tothill and Hacker (1996), Sharp and Simon (2002), and Auld and Medd (2002). Use of an asterisk (\*) indicates the species is not native to Queensland, e.g. Common Lantana (\**Lantana camara* var. *camara*). Following the first in-text reference, species will be referred to by common name only, where one exists.

#### 3.1.2 Fauna

Taxonomy and nomenclature for fauna species within this report follows the following references:

- amphibians – Tyler and Knight (2011)
- reptiles – Wilson and Swann (2013)
- birds – Pizzey et al. (2012)
- mammals (except bats) – Menkhorst and Knight (2011)
- bats – Churchill (2009).

Common names are used where a species has an accepted common name with the scientific name provided at the first instance of the name appearing in the text. Common names for fauna are sourced from the references listed above or where no common name is provided, searches are made for other widely accepted common names.

### 3.2 Desktop study

#### 3.2.1 Database searches and government mapping

Commonwealth and state database searches were undertaken for the study area to identify records or potential occurrences of threatened, near threatened, migratory and/or special least concern flora and fauna species and TECs. Database searches were undertaken within a 25 km radius of the boundary of the project site. The search radius is considered to be representative of the broader region.

Desktop searches covered the following databases and government mapping sources:

- EPBC Act Protected Matters Search Tool, accessed 6 July 2016 (DotE 2016b) (Appendix A)
- Queensland Wildlife Online database, accessed 6 July 2016 (DSITI 2016) (Appendix B)

- Queensland Herbarium HERBRECS database, accessed 10 September 2015 (Queensland Herbarium 2015a) (Appendix C)
- Queensland Museum Zoology Database, accessed 3 September 2015 (Queensland Museum 2015) (Appendix D)
- The Atlas of Australian Birds, accessed 2 September 2015 (BirdLife Australia 2015a) (Appendix E)
- The Atlas of Living Australia<sup>1</sup>, accessed 6 July 2016 (CSIRO 2016a)
- Regulated Vegetation Management Map, Vegetation Management Supporting Map Version 8.0, Remnant 2013 regional ecosystem mapping Version 9.0 and Essential Habitat Mapping and Database Version 4.0, maps at 1:100 000 scale (NRM 2016a)
- Protected Plants Flora Survey Trigger Map, accessed 6 July 2016 (EHP 2016b) (Appendix F)
- Biodiversity Planning Assessments – Brigalow Belt Version 1.3 (EPA 2008)
- Geological Survey of Queensland 1:100 000 mapping (NRM 2011)
- Map of referable wetlands, accessed 7 July 2016 (EHP 2016c)
- Atlas of Groundwater Dependent Ecosystems, accessed 7 July 2016 (National Water Commission 2016)
- Queensland Wetland Data Springs Mapping (NRM 2016b)
- Environmentally Sensitive Area mapping, accessed 7 July 2016 (EHP 2016d).

### ***3.2.2 Literature review and previous studies***

Available literature was reviewed to establish whether findings of recent and nearby studies are relevant to the vegetation and habitat that occurs in the study area. Studies within, adjacent to or in the region, i.e. <25 km of the project site were reviewed where available, including:

- Integrated Isaac Plains Project Environmental Impact Statement, Flora and Fauna Assessment (Ecotone Environmental Services 2005).
- Millennium Mine Expansion Project Environmental Impact Statement (Peabody Energy 2010)
- Grosvenor Project Amended Flora and Fauna Assessment (Ecotone Environmental Services and Hansen Bailey 2011)
- Terrestrial Flora and Fauna Report for Moranbah South Project (Ecological Survey & Management 2013)
- Red Hill Mining Lease Flora Survey Report (URS 2013a)
- Red Hill Mining Lease Terrestrial Fauna Technical Report (URS 2013b)

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<sup>1</sup> The Atlas of Living Australia is a publically available database that is populated by a wide range of contributors including 'citizen-based' contributors. The database does not allow for every individual observation to be validated, therefore, this database has been used as secondary supporting information.

- Caval Ridge Coal Mine Project Environmental Impact Statement (BAAM 2009)
- Daunia Coal Mine Project Environmental Impact Statement (SKM 2009)
- Eagle Downs Project Flora and Fauna Impact Assessment (Hansen Bailey 2009).

The location of these mines and projects is shown Figure 3.

### ***3.2.3 Review of aerial photography***

The most recent aerial photography (flown September 2015) was provided by the proponent for this assessment. Digital Globe photography was viewed in relation to relevant biodiversity spatial layers. Aerial photography was used to identify features for ground-truthing during the field surveys, to identify appropriate survey locations and for determining and characterising potential terrestrial flora and fauna habitats.

### ***3.2.4 Regional ecosystem mapping***

The Queensland Government produces regulated vegetation maps and supporting RE maps showing the distribution of remnant REs throughout Queensland. These published maps are produced using Landsat satellite imagery, aerial photography and field based ground-truthing. Review of version 8.0 (statutory regulated vegetation mapping) RE maps was undertaken prior to field surveys to assist in the verification of RE types mapped in the study area. The Queensland Herbarium has also produced informal, non-statutory RE mapping, *Remnant 2013 – regional ecosystem mapping - Version 9.0*. This mapping was also reviewed prior to field surveys to inform survey locations.

### ***3.2.5 Geological mapping***

A review of geological mapping of the study area has been undertaken and is provided in Section 4.1.1. The geological mapping was reviewed in order to gain an understanding of the geology within the study area and to provide an indication of likely land zones for assigning REs.

### ***3.2.6 Soil mapping***

A review of the soil mapping for the study area has been undertaken and is provided in Section 4.1.2. The soil mapping was reviewed in order to correlate vegetation types and habitat preferences of particular flora and fauna, to soil types present in the study area. Soils information was also used to assist in ground-truthing and verifying REs within the study area.

## **3.3 Terrestrial ecology field surveys**

### ***3.3.1 Survey team***

Five ecologists undertook the field surveys and preparation of this terrestrial ecology assessment. The team and their qualifications are outlined in Appendix G. Site environmental personnel from the Isaac Plains Mine assisted with the field survey.

### **3.3.2 Permits**

Surveys were undertaken under the following permits and approvals:

- Scientific Purposes Permit: WISP151475414 (valid from 25 October 2014 to 24 October 2019)
- Animal Ethics Committee Approval: CA2015/09/898 (valid from 1 October 2015 to 25 August 2018).

### **3.3.3 Coordinate system and map datum**

Positional data was collected using a geographic positioning system with an accuracy of 3 to 5 m. Positional locations were recorded using the Latitude and Longitude coordinate system. All locations presented in this report are within zone 55K. The map datum used was WGS84.

### **3.3.4 Survey timing**

Dry and wet season terrestrial flora and fauna surveys were conducted in order to field-validate the type, distribution and remnant status of vegetation communities and develop an inventory of flora and fauna species present. The following surveys were conducted:

- flora surveys:
  - dry season = 4 days (22 - 24 September 2015 and 20 October 2015, inclusive)
  - wet season = 5 days (24 February – 28 February 2016, inclusive)
- fauna surveys:
  - dry season = 8 days (14 - 21 October 2015, inclusive)
  - wet season = 7 days (4 – 10 March 2016, inclusive).

Field surveys were completed at these times in order to capture the effects of seasonality and rainfall on the abundance of flora and fauna species. The timing of the field surveys is in accordance with the fauna survey standards specified in Appendix H.

### **3.3.5 Climatic conditions**

Climatic data has been collected since 1972 from the (now decommissioned) Bureau of Meteorology (BoM) weather station at the Moranbah Water Treatment Plant (WTP) (Station No.: 034038), which is the closest long-term BoM meteorological station to the study area. This weather station was closed in 2012, and was relocated to the Moranbah Airport (Station No.: 034035).

#### ***Rainfall patterns***

Monthly rainfall averages recorded at the BoM Moranbah WTP weather station are provided in Table 1. Given the rainfall records at this station cover a period of 40 years, the data are considered to reflect regional rainfall patterns.

Actual monthly rainfall totals recorded in 2014 to 2016 at the BoM Moranbah Airport weather station are also provided in Table 1. These data were used to



show average regional rainfall information at the time of the surveys and in the preceding year.

As can be seen from Table 1, below average rainfall was received in the eight months (i.e. between February and September 2015) leading up to the dry season surveys in September and October 2015. Above average falls were received in the region in November 2015. Below average rainfall was again received in December 2015 and January 2016. In contrast, the region experienced a significant rainfall event in early February 2016 preceding the wet season surveys.

**Table 1: Monthly recorded rainfall for the local area**

Month	Moranbah WTP Weather Station (034038) Mean Rainfall (mm)	Moranbah Airport Weather Station (034035)		
		Actual Total Rainfall 2014 (mm)	Actual Total Rainfall 2015 (mm)	Actual Total Rainfall 2016 (mm)
January	103.8	57.0	206.6	52.6
February	100.7	128.6	77.6	260.6
March	55.4	65.0	4.0	53.6
April	36.4	24.8	1.2	0.0
May	34.5	2.8	2.0	5.0
June	22.1	10.4	2.2	85.0
July	18.0	0.8	3.2	123.6
August	25.0	37.8	5.6	-
September	9.1	44.2	0.0	-
October	35.7	2.0	1.8	-
November	69.3	33.4	101.8	-
December	103.9	141.8	53.0	-

Source: (BoM 2016)

### ***Weather conditions during the surveys***

Daily weather conditions recorded at the BoM's weather station at Moranbah Airport for the week preceding, as well as during the period of the ecology surveys, are presented in Table 2.

Daytime weather conditions experienced during the dry season fauna survey period were warm with maximum daily temperatures between 31.4°C and 34.0°C. Evenings were cooler, with minimum temperatures ranging from 13.6 to 17.3°C. These temperatures are generally conducive to the detection of most animal groups.

Milder daytime temperatures were experienced during the wet season fauna survey, with maximum temperatures between 26.2°C and 32.5°C. Night time temperatures during the wet season fauna survey were still warm, with the minimum being 21.0°C. The warm overnight temperatures during the wet season survey, coupled with the rainfall in early February, made conditions favourable for the detection of all animal groups.

No rainfall was recorded at Moranbah during, or for the two weeks preceding, the dry season survey period, and consequently conditions were not favourable

for the detection of amphibians and wetland birds. As a result, a low species richness and absence of annual forbs and grasses in the groundcover layer, of the vegetation types throughout the project site was observed at the time of the dry season surveys. The residual groundcover vegetation was mostly 'hayed-off' and generally lacking fertile material (i.e. inflorescence).

More favourable conditions were experienced during the wet season survey, which allowed a more complete inventory of flora in the project site and assessment of ecological condition, particularly of the groundcover vegetation. In excess of 300 mm was recorded at the BoM Moranbah Airport weather station between 25 January and 8 February prior to the wet season field survey, with 169 mm recorded on 6 February (BoM 2016). The hot conditions and substantial rainfall experienced in the region in the month prior to the flora survey created optimal conditions for the detection and identification of flora species, including cryptic species.

**Table 2: Daily weather conditions recorded at the BoM Moranbah Airport Weather Station (034035) preceding and during the ecology surveys**

Date	Temp Min (°C)	Temp Max (°C)	Rainfall (mm)
<b><i>Dry Season Surveys</i></b>			
6 September 2015	10.2	28.6	0
7 September 2015	13.2	29.0	0
8 September 2015	10.1	30.9	0
9 September 2015	17.1	28.1	0
10 September 2015	12.3	27.7	0
11 September 2015	11.9	28.4	0
12 September 2015	12.8	28.5	0
13 September 2015	10.9	28.8	0
14 September 2015	12.7	25.8	0
15 September 2015	12.1	30.6	0
16 September 2015	15.2	31.5	0
17 September 2015	11.2	33.5	0
18 September 2015	17.5	28.5	0
19 September 2015	9.9	28.5	0
20 September 2015	12.5	30.1	0
21 September 2015	13.2	30.7	0
22 September 2015 ^	13.8	31.8	0
23 September 2015 ^	13.0	30.3	0
24 September 2015 ^	9.7	27.1	0
25 September 2015	11.0	27.6	0
26 September 2015	10.6	28.7	0
27 September 2015	10.7	30.1	0
28 September 2015	11.0	31.0	0
29 September 2015	10.5	30.2	0
30 September 2015	15.2	31.7	0
1 October 2015	12.7	32.8	0

Date	Temp Min (°C)	Temp Max (°C)	Rainfall (mm)
2 October 2015	13.6	32.5	0
3 October 2015	14.8	30.4	0
4 October 2015	13.0	30.1	0
5 October 2015	14.4	32.9	0
6 October 2015	12.7	32.9	0
7 October 2015	13.9	32.3	0
8 October 2015	14.3	30.3	0
9 October 2015	16.4	29.8	0
10 October 2015	14.5	29.7	0
11 October 2015	15.5	30.1	0
12 October 2015	13.6	31.7	0
13 October 2015	11.2	33.2	0
14 October 2015*	14.2	32.4	0
15 October 2015*	16.1	31.4	0
16 October 2015*	14.7	32.0	0
17 October 2015*	14.7	31.4	0
18 October 2015*	13.6	32.2	0
19 October 2015*	17.3	31.5	0
20 October 2015* ^	14.9	31.7	0
21 October 2015*	15.2	34.0	0
<b>Wet Season Survey</b>			
10 February 2016	20.0	31.3	0
11 February 2016	21.3	32.1	0
12 February 2016	19.8	33.0	0
13 February 2016	29.0	33.1	0
14 February 2016	18.0	34.7	0
15 February 2016	19.3	36.9	0
16 February 2016	18.6	38.2	0
17 February 2016	21.7	38.6	0
18 February 2016	22.1	39.7	0
19 February 2016	22.5	38.4	0
20 February 2016	21.6	36.2	0
21 February 2016	23.3	33.3	0
22 February 2016	24.7	31.8	0
23 February 2016	22.3	32.6	0
24 February 2016 ^	19.9	32.3	0
25 February 2016 ^	19.7	33.2	0
26 February 2016 ^	18.5	37.0	0
27 February 2016 ^	21.1	38.5	0
28 February 2016 ^	22.9	36.8	0
29 February 2016	22.1	34.2	4.6
1 March 2016	21.8	32.9	0
2 March 2016	23.3	34.2	0

Date	Temp Min (°C)	Temp Max (°C)	Rainfall (mm)
3 March 2016	22.8	32.5	2.0
4 March 2016*	22.3	30.0	0
5 March 2016*	21.4	28.6	7.2
6 March 2016*	22.1	26.2	0.4
7 March 2016*	21.7	29.5	4.6
8 March 2016*	21.9	29.3	2.0
9 March 2016*	21.3	30.0	0.2
10 March 2016*	21.0	32.5	2.8

Source: (BoM 2016)

Survey Dates indicated in grey highlight: \* indicates fauna survey dates, ^ indicates flora survey dates.

### **3.3.6 Flora field survey methods**

The flora field survey methods described in this section were developed based on the results of database searches for the study area, as presented in Section 4.3.

#### **Site selection**

The field flora survey methods were developed in order to:

- validate existing Queensland government RE vegetation mapping, and better define the distribution and proportionate composition of REs within mixed polygons of more than one RE type
- target significant flora species and communities (listed under Commonwealth and State legislation) and their habitats identified from database searches
- produce a comprehensive floral inventory for all vegetation assessment sites and the project site as a whole.

The field flora surveys were carried out in compliance with the Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland, Version 3.2 (Neldner et al. 2012). Assessment sites were performed throughout the entire project site so as to thoroughly assess Queensland government mapped remnant vegetation.

The validation and mapping of remnant vegetation was undertaken at a total of 95 vegetation assessment sites and 36 photo monitoring points during the dry season and wet season flora surveys (Figure 4). Multiple sites were conducted within each RE type across the study area.

Of the 95 vegetation assessment sites, 24 were detailed secondary sites, 35 tertiary sites and 36 modified quaternary sites (Figure 4). The less detailed sampling (tertiary and quaternary assessment sites) was conducted to provide additional information relating to the vegetative structure and composition and to assist in mapping the extent and distribution of the identified REs within the study area.

Detailed flora species lists were collated at all secondary sites (Figure 4) and traverse lists were compiled to account for additional species that were recorded outside of the secondary site plots.

Additional data pertaining to groundcover characteristics (e.g. cover, species composition) and the cover of woody vegetation was used in conjunction with floral inventories from selected secondary sites to assess several areas of vegetation communities against the condition thresholds of relevant Commonwealth listed TECs returned in database searches (discussed further, later in this section).

### ***Secondary sites***

Data at each secondary site was collected in accordance with the Queensland Herbarium's secondary site assessment methodology (Neldner et al. 2012). Data recorded at each secondary site (Figure 4) included:

- date and precise location (with reference to handheld GPS)
- soils, slope, aspect and landform observations
- ground-layer, mid-stratum and canopy species composition and abundance
- structural characteristics
- condition and disturbance of existing vegetation communities (including distribution of weed species)
- quantitative and qualitative species composition within a 1,000 m<sup>2</sup> quadrat, and documentation of ancillary species identified within the immediate area or during foot traverse
- basal area of vegetation (Bitterlich Stick methodology)
- photographs of the community (north, east, south, west, groundcover and soils).

### ***Tertiary sites***

Data recorded at each tertiary site (Figure 4) included:

- date and precise location (with reference to handheld GPS)
- soils, slope, aspect and landform observations
- ground-layer, mid-stratum and canopy species composition and abundance
- structural characteristics
- basal area of vegetation (Bitterlich Stick methodology)
- condition and disturbance of existing vegetation communities (including distribution of weed species)
- photographs of the community.

### ***Quaternary sites***

Data recorded at each quaternary site (Figure 4) included:

- precise location (with reference to handheld GPS)
- ground-cover, mid-stratum and canopy species composition and abundance
- structural characteristics of the ecologically dominant layer (EDL)
- condition
- limited photographs of the community.

### ***Threatened ecological community surveys***

Detailed transects were undertaken in the study area to assess the structure and ecological condition of vegetation communities that could potentially represent TECs. The transects focussed on the Brigalow and the Natural Grassland TECs, given DotEE has specific condition thresholds and diagnostic criteria that are required to be met for a vegetation community to form a part of these TECs. (Section 4.2.1 discusses the TECs that database searches have indicated may be present within the study area).

#### *Brigalow TEC*

A patch of Brigalow low woodland in the north-eastern portion of the study area (validated in the field as non-remnant) was surveyed using detailed transects to determine if it satisfied the diagnostic criteria and condition thresholds (as provided in conservation advice, (TSSC 2013a) to form a part of the Brigalow (*Acacia harpophylla* dominant and co-dominant) TEC (Brigalow TEC). Two transects were undertaken for the assessment, and the location of these transects are shown on Figure 4.

Within each transect, the cover-intercept or projected canopy cover of woody vegetation was recorded for each vegetation stratum, except the groundcover layer. The cover-intercept was determined by measuring the proportion of the 100 m long transect that was intercepted by the foliage of woody vegetation within the shrub and tree layers.

The composition of the groundcover layer was then determined by measuring the percentage of groundcover parameters within ten 1 m<sup>2</sup> quadrats along a 100 m long transect. The nested quadrats were measured every 10 m after starting at the 5 m mark on the 100 m transect. The groundcover parameters included: native grasses; native herbs; native shrubs less than 1 m in height; native ferns; native aquatic vegetation; cryptogams; non-native grasses; non-native herbs, shrubs and graminoids; bare ground; litter; rocks; and, timber.

#### *Natural Grassland TEC*

Non-statutory Queensland Government mapping (Queensland Herbarium, Version 9.0) indicates the possible presence of a patch of RE 11.8.11 (natural grassland) in the northern portion of the study area.

This area of the study area was surveyed using detailed transects to determine if it satisfied the diagnostic criteria and condition thresholds (as provided in conservation advice, (TSSC 2008a)) to form a part of the Natural Grasslands of the Central Queensland Highlands and Northern Fitzroy Basin TEC (Natural Grasslands TEC). Three transects were undertaken for the assessment, and the location of these transects are shown on Figure 4. These transects were used to ascertain groundcover composition and cover, number of indicator species and tussock number per hectare.

### ***Targeted species surveys***

Significant flora species listed under the EPBC Act and/or NC Act that were recorded or predicted to occur from database searches (Section 3.2.1 and 4.3) were reviewed and, where relevant, formed the focus of targeted flora species surveys. A list of these species is provided in Section 4.3.

Detailed traverses of habitat that was considered suitable for significant flora species were undertaken. Given the proximity of known records, targeted surveys focussed on the endangered *Solanum adenophorum* and were conducted in the areas of non-remnant Brigalow present within northern portions of the study area. King Bluegrass (*Dichanthium queenslandicum*) and *Dichanthium setosum* (no common name) were also targeted in non-remnant grassland communities in the northern portion of the study area.

One significant species was recorded along the eastern boundary of the study area, *Bertya pedicellata*, and quantification of this population was undertaken during the dry season survey and re-addressed during the wet season survey. The population of this species is described in Section 5.3.2.

### ***Vegetation mapping***

Queensland Government mapped REs in the study area were validated in the field using the survey data previously described, and utilised the latest geology mapping (NRM 2011). The boundaries of vegetation types were mapped in the field using a GPS and/or aerial photograph interpretation.

An area of vegetation mapping has been undertaken outside the project site within the existing Isaac Plains mining lease. This area involves two proposed haul road connections between the Isaac Plains Mine and the project site (Figure 2 and 4), which were designed during the detailed design phase of the project and after the seasonal surveys were undertaken. Mapping in this area outside the project site was undertaken through aerial photograph interpretation, observation during field surveys, and a review of photographs provided by mine site personnel.

### ***Random traverses***

In addition to secondary, tertiary and quaternary assessment sites, large portions of the study area were traversed on foot and the random meander technique applied (Cropper 1993). The purpose of random traverses was to ensure adequate site coverage and to establish a comprehensive floral species

list. This method is also essential for the detection of cryptic, pest and other significant species.

### ***Ancillary information***

Other field characteristics such as areas of weed infestation, habitat areas for significant species and regional connectivity were recorded and described. Photographic records were taken throughout the study area, capturing each community type, habitat type and the broader landscape.

### ***Flora inventory and abundance***

A comprehensive flora species list, including native and introduced species, was compiled for the project site. Relative abundance of flora species was assessed on a site-by-site basis, with detailed inventories compiled at all secondary assessment sites.

In relation to vegetation structure, abundance estimates were determined for species within each stratum of the community, with particular focus on the EDL as it is by these species that the community is defined, and from this, the RE determined (Neldner et al. 2012).

The remnant status of existing vegetation was determined by comparing the existing predominant canopy with the undisturbed predominant canopy. The Queensland Herbarium defines the predominant canopy under the VM Act, as the EDL, namely, that stratum of the vegetation that contains the most above ground biomass. The EDL can be defined in terms of growth form, height, cover density and species. In the majority of cases, the EDL is equivalent to the upper stratum (Walker and Hopkins 1990).

The crown cover definitions and associated crown separation descriptions (e.g. sparse) were also applied to the lower strata to allow a consistent description of the spatial distribution of the respective vegetation layers.

The landform description upon which the field validated vegetation communities occurred was based on simple erosional landform patterns characterised by relief and modal slope and described by Speight (1990).

The relative abundance of species was based on the Braun-Blanquet technique, (Mueller-Dombois and Ellenberg 2003 Whittaker 1975).

### ***3.3.7 Fauna field survey methods***

The fauna field survey methods described in this section were developed based on the results of database searches for the search area, as presented in Section 4.4.

### ***Overview of survey effort***

A variety of faunal survey methods were used, including systematic trap sites, spotlighting, call playback, infrared cameras, active searching, supplementary survey sites, harp traps, Anabat survey sites and observation (e.g. bird surveys and opportunistic observations).



Sites selected for each of the survey methods were determined through desktop review of aerial photography, RE mapping and database search results in order to stratify survey effort across major habitat types for species likely to occur in the study area. Major habitat types were identified through broad vegetation groups (BVGs) mapped for the study area. BVGs were developed by the Queensland Herbarium to group vegetation communities at a high level, and are included in the RE spatial dataset (NRM 2016a). Desktop review indicated that BVGs for the study area at a 1 million scale could be divided into seven major habitat types:

- BVG11a: Moist to dry open forests to woodlands dominated by Mountain Coolabah (*Eucalyptus orgadophila*)
- BVG16a: *Eucalyptus* spp. dominated open forests and woodland drainage lines and alluvial plains
- BVG17a: Poplar Box (*Eucalyptus populnea*) or Silver-leaved Ironbark (*E. melanophloia*) (or White's Ironbark (*E. whitei*)) dry woodlands to open woodlands on sandplains or depositional plains
- BVG18b: Dry eucalypt woodlands to open woodlands primarily on sandplains or depositional plains
- BVG24a: *Acacia* spp. on residuals. Species include *A. clivicola* (no common name), *A. sibirica* (no common name), Lancewood (*A. shirleyi*), Bowyakka (*A. microsperma*), Bendee-bendee (*A. catenulata*), Ringy Rosewood (*A. rhodoxylon*)
- BVG25a: Brigalow (*Acacia harpophylla*) sometimes with Belah (*Casuarina cristata*) open forests to woodlands on heavy clay soils
- BVG30b: Tussock grasslands dominated by Mitchell Grass (*Astrebla* spp.) or Bluegrass (*Dichanthium* spp.) often with *Iseilema* spp. on undulating downs or clay plains (Neldner et al. 2015).

These major habitat types were initially used to design the survey, which was then refined where necessary in the field, once an on-ground appreciation for the vegetation communities and habitat features (e.g., locations of rocky jump-ups) could be obtained.

Table 3 details the survey effort conducted during the survey periods. The following sections describe the methods used during the surveys and locations of the survey sites.

**Table 3: Fauna survey effort**

Survey Technique	Survey Effort			Target Fauna
	Dry Season	Wet Season	Total	
Elliot Traps	400 trap nights	400 trap nights	800 trap nights	Small mammals, some reptiles
Pitfall Traps	64 trap nights	48 trap nights	112 trap nights	Small mammals, reptiles and frogs

Survey Technique	Survey Effort			Target Fauna
	Dry Season	Wet Season	Total	
Funnel Traps	96 trap nights	128 trap nights	224 trap nights	Small mammals, reptiles (including Ornamental Snake) and frogs
Spotlighting (including by vehicle)	15.5 person hours on foot and 10.5 person hours from slow moving vehicle	9 person hours on foot and 9.5 person hours from slow moving vehicle	24.5 person hours on foot and 20 person hours from slow moving vehicle	Mammals (including Koala, Greater Glider, Short-beaked Echidna), reptiles (including Ornamental Snake), nocturnal birds
Call Playback	11 sessions	9 sessions	20 sessions	Owls and Koala
Infrared Cameras	191 trap nights	16 trap nights	207 trap nights	Medium to large mammals (including Koala, Short-beaked Echidna), and reptiles
Bird Survey	27 person hours	28 person hours	55 person hours	Birds (including Squatter Pigeon, Migratory birds)
Opportunistic / Incidental Bird Survey	98 diurnal person hours and 50 nocturnal person hours	82 diurnal person hours and 40 nocturnal person hours	180 diurnal person hours and 90 nocturnal person hours	Birds (including Squatter Pigeon, Migratory birds) medium to large reptiles
Active Searching	11 person hours	11 person hours	22 person hours	All conservation significant species, including small mammals reptiles, and birds
Anabat	8 nights	8 nights	16 nights	Bats
Harp Trap	6 trap nights	8 trap nights	14 trap nights	Bats
Koala transects	11 transects (92.8 ha)	1 transect (11.4 ha)	104.2 ha (27.5% of Koala habitat)	Koalas

### ***Systematic trap sites***

A total of eight systematic trap sites (T1 – T8) were established in areas of native vegetation throughout the study area during the season terrestrial fauna surveys (Figure 5).

Each systematic trap site consisted of:

- 25 small Elliot traps
- 4 pitfall traps
- 3 sets of two funnel traps
- 1 infrared camera.

The exception was trap site T5 where rocky ground conditions meant that it was not possible to dig pitfall traps. Instead an additional four pairs of funnel traps were used. The combined surveys comprised a total of 1,168 trap nights (trap nights refers to the total number of traps that were open for a total number of nights e.g. 4 traps open for 5 nights equates to 20 trap nights).

Elliot traps were baited with a mixture of rolled oats, honey, peanut butter and banana. Banana is added to the bait mixture as it has been found to be effective bait for the Yakka Skink (*Egernia rugosa*). Traps were located 5 to 10 m apart and positioned close to suitable microhabitat features such as fallen logs, dense grass tussocks or areas of surface rock (e.g. exposed rocky outcrops). Traps were checked early in the morning and any animals captured were identified and immediately released. Pitfall and funnel traps were also checked in the afternoon and opportunistically during the day.



Pitfall traps comprised three 20 L buckets dug into the ground to rim level, with a drift fence that intersected the mouth of each bucket and extended beyond the line of buckets to guide fauna towards the buckets. A water soaked sponge, leaf litter and a small piece of polystyrene foam was placed in each bucket to provide moisture and shelter for animals captured. The polystyrene foam is able to be used as a flotation device for captured animals so that they do not drown in the event of heavy rain.



Three sets of two funnel traps were also located along the drift fence to capture larger lizards and snakes that could escape or avoid the buckets. Funnel traps were covered with a towel to provide shelter for captured animals.



A minimum of one person hour of spotlighting and active searching was conducted at each systematic trap site. A minimum of one person hour of early morning bird surveys was also conducted at each trap site, each morning while traps were being checked. One infrared camera was also placed at each systematic trap site.



A brief description of the location and habitat attributes of each of the systematic trap sites is provided in Table 4.

**Table 4: Descriptions of habitat at each systematic fauna trap site**

Survey Site ID	Site Location (refer Figure 5)	Vegetation Description and Representative Photograph
T1	Central eastern portion of the study area	<p>Lancewood (<i>Acacia shirleyi</i>) woodland with scattered emergent Clarkson's Bloodwood (<i>Corymbia clarksoniana</i>) and Carbeen (<i>Corymbia tessellaris</i>) on minor lateritic rises (RE 11.7.2). Lateritic scalds (exposed ground) were present throughout. Most trees having a diameter at breast height (DBH) of &lt;150 mm. The community had a fragmented canopy and has undergone historic clearing/thinning/ timber harvesting and likely frequent fires. The area has a moderate to high level of fallen timber (generally &lt;150 mm DBH) and moderate level of leaf litter cover. Weed cover is generally low. Substantial surface rocks and boulders are present on scarp edges and slopes.</p> 
T2	Western portion of the study area	<p>Poplar Box (<i>Eucalyptus populnea</i>) woodland with occasional Narrow-leaved Red Ironbark (<i>Eucalyptus crebra</i>) and Clarkson's Bloodwood woodland on Cainozoic sand plains (RE 11.5.3). Most trees with a DBH of &lt;300 mm with occasional hollows. Sparse fallen timber and limited leaf litter. Native grasses interspersed with patches of exotic grasses.</p> 

Survey Site ID	Site Location (refer Figure 5)	Vegetation Description and Representative Photograph
T3	Central northern portion of the study area nearby Smoky Creek	<p>Poplar Box and occasional Dawson River Gum (<i>Eucalyptus cambageana</i>) shrubby woodland on fine-grained sediments (RE 11.9.7a) close to Smoky Creek. Low abundance of hollow bearing trees, low cover of exotic grasses, some fallen timber and few areas of deep leaf litter. The DBH of trees was generally &lt;300 mm.</p> 
T4	South-eastern portion of the study area along Billy's Gully	<p>Mixed Eucalypt and Corymbia riparian forest with River Red Gum (<i>Eucalyptus camaldulensis</i>) prevalent on channels (RE 11.3.25). Moderate abundance of microhabitat features such as fallen timber including some large diameter logs and litter. However, large hollow-bearing trees were limited due to historic clearing. Exotic grasses were prevalent.</p> 

Survey Site ID	Site Location (refer Figure 5)	Vegetation Description and Representative Photograph
T5	Central portion of the study area	<p>Mountain Coolabah with occasional taller Variable-barked Bloodwood (<i>Corymbia erythrophloia</i>) on basalt rise (RE 11.8.5). Groundcover was primarily exotic with patches of native grasses. Very few hollow-bearing trees were present due to fragmentation and fallen timber and leaf litter was limited. Basalt outcrops and surface rock was prevalent.</p> 
T6	Unnamed tributary of Smoky Creek	<p>River Red Gum and Queensland Blue Gum (<i>Eucalyptus tereticornis</i>) with River Oak (<i>Casuarina cunninghamiana</i>) riparian vegetation (RE 11.3.25). Occasional mature, hollow-bearing trees. Dense exotic grass cover was present and most vegetation had been cleared to the top of the high bank. There was a low level of fallen timber and little leaf litter.</p> 

Survey Site ID	Site Location (refer Figure 5)	Vegetation Description and Representative Photograph
T7	Central portion of the study area	<p>Clarkson's Bloodwood with Carbeen and occasional Poplar Box open woodland on sand plains (RE 11.5.12). The groundcover was dominated by exotic grasses. Moderate level of large, hollow-bearing trees. Low abundance of fallen timber and leaf litter.</p> 
T8	Western portion of the study area	<p>Poplar Box woodland with occasional Narrow-leaved Red Ironbark (<i>Eucalyptus crebra</i>) and Clarkson's Bloodwood woodland on Cainozoic sand plains (RE 11.5.3). Most trees with a DBH of &lt;300 mm with limited hollows. Sparse fallen timber and limited leaf litter. Native grasses interspersed with patches of exotic grasses.</p> 

### **Supplementary survey sites**

A total of 25 supplementary survey sites (S1 – S25) were completed during the field surveys (Figure 5). Techniques employed at supplementary sites included spotlighting, call playback, infrared cameras, bird survey and/or active searching.

A description of the location, survey techniques and vegetation types of the supplementary survey sites is provided in Table 5.

**Table 5: Description of supplementary survey sites**

Survey Site ID	Site Location (Refer Figure 5)	Survey Techniques	Vegetation Description
<b>Dry season survey</b>			
S1	North-western portion of the study area along Smoky Creek	Bird survey and active search	Narrow fringing River Red Gum, Brigalow and Black Tea Tree ( <i>Melaleuca bracteata</i> ) along Smoky Creek (RE 11.3.25). Some fallen timber, moderate level of flood debris and some areas of deep leaf litter.
S2	Northern portion of the study area along Smoky Creek	Spotlight and Koala call playback	Mature River Red Gums and Black Tea Tree along narrow stretch of Smoky Creek (RE 11.3.25). Some fallen timber, moderate level of flood debris and some areas of deep leaf litter.
S3	South-western portion of the study area	Spotlight and call playback	Poplar Box woodland (RE 11.5.3). Open habitat with a number of hollow trees.
S4	Central-southern portion of the study area	Spotlight and call playback	Sparse woodland of Clarkson's Bloodwood with a dense mid-storey of Bitter Bark ( <i>Alstonia constricta</i> ), Lancewood ( <i>Acacia shirleyi</i> ), Red Ash ( <i>Alphitonia excelsa</i> ) and mostly native grass (RE 11.5.12).
S5	Central portion of the study area	Bird survey and active search	Sparse woodland of Clarkson's Bloodwood (RE 11.5.12). Some fallen timber, few large mature trees and mostly native grasses.
S6	Northern portion of the study area	Bird survey, active search, spotlighting and call playback	Rocky basalt rise with sparse Mountain Coolabah (RE 11.8.5).
S7	Northern portion of the study area	Spotlight and call playback	Open Poplar Box woodland (RE 11.5.3). Very few hollow trees, mostly Buffel Grass ( <i>*Pennisetum ciliare</i> ) in the groundcover layer and sparse fallen timber.
S8	South-eastern portion of the study area	Bird survey and active search	Narrow-leaved Red Ironbark and Clarkson's Bloodwood woodlands (ecotone of REs 11.5.8b and 11.5.12). Very little fallen timber or leaf litter. Groundcover was a mix of native and exotic grasses.
S9	Far eastern edge of the study area	Bird survey and active search	Lancewood woodland with a lot of fallen timber and deep leaf litter in places (RE 11.7.2). Mostly native grasses in the groundcover layer.
S10	Central portion of the study area	Bird survey and active search	Clarkson's Bloodwood woodland with understory of Bitter Bark (RE 11.5.12). Sparse fallen timber with mostly native grasses in the groundcover layer.
S11	Central-western portion of the study area	Bird survey and active search	Poplar Box woodland (RE 11.5.3). Moderate levels of fallen timber, some hollow bearing trees and a mix of Buffel Grass and native grasses in the groundcover layer.



Survey Site ID	Site Location (Refer Figure 5)	Survey Techniques	Vegetation Description
S12	Southern portion of the study area along Billy's Gully	Spotlight and call playback	River Red Gum and Carbeen riparian vegetation (RE 11.3.25). Moderate number of hollow trees and minimal fallen timber. Mostly Buffel Grass in the groundcover layer.
S13	Central portion fo the study area	Spotlight and call playback	Clarkson's Bloodwood woodland with understory of Bitter Bark (RE 11.5.12). Few hollow trees, minimal fallen timber and mostly native grasses in the groundcover layer.
<b>Wet season survey</b>			
S14	Central-western edge of the study area	Bird survey	Open cleared areas with scattered trees and long grass near a dam.
S15	Central portion of the study area	Bird survey and active search	Poplar Box woodland (RE 11.5.3). Some mature trees, sparse fallen timber and deep leaf litter. Mostly exotic grasses in the groundcover layer.
S16	Southern portion of the study area along Billy's Gully	Spotlight and call playback	Mixed <i>Eucalyptus</i> and <i>Corymbia</i> species riparian forest with River Red Gum (RE 11.3.25). Moderate fallen timber and leaf litter. Large hollow trees limited. Exotic grasses prevalent in groundcover layer.
S17	Central-southern portion of the study area	Spotlight and call playback	Clarkson's Bloodwood woodland (RE 11.5.12). Some mature trees, sparse fallen timber and leaf litter. A mix of exotic and native grasses in the groundcover layer.
S18	Central-eastern edge of the study area	Bird survey, active search (diurnal), spotlight and call playback	Lancewood and some Clarkson's Bloodwood (RE 11.7.2). Abundant fallen timber, some areas of deep leaf litter. Mostly native grasses in the groundcover layer.
S19	Southern portion of the study area along Billy's Gully	Bird survey and active search	Mixed <i>Eucalyptus</i> and <i>Corymbia</i> species riparian forest with River Red Gum (RE 11.3.25). Moderate fallen timber and leaf litter. Large hollow trees limited. Exotic grasses prevalent in groundcover layer.
S20	North-eastern corner of the study area along Smoky Creek	Spotlight and call playback	Narrow fringing eucalypt and Brigalow along Smoky Creek (RE 11.3.25). Some piles of timber debris, some large mature trees.
S21	South-eastern portion of the study area	Spotlight and call playback	Narrow-leaved Red Ironbark woodland with some River Red Gum closer to Billy's Gully (RE 11.5.8b). Moderate abundance of hollow trees, sparse fallen timber and deep leaf litter.
S22	Western portion of the study area	Bird survey and active search	Poplar Box woodland (RE 11.5.3). Some mature trees, mostly Buffel Grass in the groundcover layer. Sparse fallen timber and almost no areas of deep leaf litter.

Survey Site ID	Site Location (Refer Figure 5)	Survey Techniques	Vegetation Description
S23	Central portion of the study area	Bird survey and active search	Clarkson's Bloodwood woodland (RE 11.5.12). Some mature trees, sparse fallen timber and leaf litter. A mix of native and exotic grasses in the groundcover layer.
S24	South-eastern portion of the study area	Bird survey and active search	Non-remnant dense regenerating shrubland, dominated by Bitter Bark, Red Ash and scattered Narrow-leaved Red Ironbark. Moderate cover of small diameter timber, moderate leaf litter and a mix of native and exotic grasses in the groundcover layer.
S25	Central-southern portion of the study area	Bird survey and active search	Poplar Box and Clarkson's Bloodwood woodland (ecotone of REs 11.5.12 and 11.5.3). Mostly Buffel Grass in the groundcover layer, sparse fallen timber and leaf litter. Some mature trees.

### **Spotlighting**

Spotlighting was undertaken on foot for a total of 10 person hours in the vicinity of each systematic trap site, and a total of 14.5 person hours at 12 of the supplementary sites (Tables 3 and 5).

Spotlighting was also undertaken from a slow moving vehicle for a total of 20 person hours along tracks where it was safe to do so. Fauna were located from eye shine or direct observation and identified. The distinctive calls of some fauna were also used to identify their presence.

### **Call playback**

Call playback involved broadcasting a recorded call of an owl or arboreal mammal through a megaphone in an effort to elicit a territorial response from any animals that hear the call. Animals either call in response to the recording and/or move into the location that the call was played from. The call is played and then approximately 2 to 3 minutes are spent listening for a response and looking for animals that have moved into the area without calling. Call playback was undertaken in the vicinity of each systematic trap site and 12 supplementary sites, totalling 20 sessions over both surveys. Following the call playback session, spotlighting was conducted of the immediate area to locate any owls that had flown into the area without calling and had not been seen during the call playback.

The calls of the following species were played:

- Barking Owl (*Ninox connivens*)
- Masked Owl (*Tyto novaehollandiae*)
- Barn Owl (*Tyto alba*)
- White-throated Nightjar (*Eurostopodus mystacalis*)
- Koala (*Phascolarctos cinereus*).

### ***Infrared cameras***

A Reconyx HC500 infrared camera was set up at each of the eight systematic trap sites and at another five camera site locations (Figure 5). The cameras were set on a bait station of chicken, apple and sweet potato.

Cameras were set at systematic trap sites (T1 to T8) for a total duration of four nights each, and for 35 nights at each of the additional five camera sites (C1 to C5) during the dry season survey. This is a total of 207 nights for infrared cameras.

### ***Bird surveys***

During the checking of traps at each systematic trap site, bird surveys were conducted along the trap transect, with records made of all birds seen and heard. The order in which systematic trap sites were checked varied each morning to ensure that sites were surveyed for birds at slightly different times each day. Five person hours were spent in total at each of the eight systematic trap sites (i.e. 40 hours in total) and 1 person hour was spent conducting bird surveys at 15 supplementary sites resulting in a total survey time of 55 person hours. Opportunistic records of birds were also made while undertaking other activities throughout the project site. Approximately 270 person hours were spent undertaking opportunistic diurnal and nocturnal bird observations during the field surveys.

### ***Active searches***

Active searching was conducted to detect reptiles, frogs and small ground dwelling mammals. It involved the searching of suitable microhabitat such as logs, bark, deep leaf litter, surface rocks and shedding bark. Active searching was undertaken for 22 person hours, including 1 person hour at each systematic trap sites and 1 person hour at 14 supplementary sites (Tables 3 and 5).

### ***Anabat***

The Anabat surveys involved the use of an SD1 Anabat detector to record the echolocation calls of micro bats as they forage. A sonogram was then produced using software that allows for comparison against reference calls for identification. Unfortunately, some species of bat have very similar and/or quiet calls and cannot be positively distinguished via Anabat (e.g. *Nyctophilus* species). Therefore, a probability rating is provided for calls identified. All Anabat calls were analysed by Greg Ford, a specialist in analysing Anabat recordings.

Anabat units were deployed for one night from dusk until dawn at 16 locations (A1 – A16) (Figure 5). Anabat survey sites were selected on the basis of having suitable flyways, flowering trees that attract insects or water that attracts insects and bats.

### ***Harp traps***

Harp Traps were used to capture bats during the survey and were set at seven locations within the study area (H1 – H7) (Figure 5). Harp traps were each set

for 2 nights during the surveys resulting in a total of 14 harp trap nights. Harp traps were located in suitable flyways such as small waterways or tracks. Harp traps comprise two banks of vertical microfilament line offset from one another. Bats fly into one of these wires and drop into a bag beneath the trap where they can be collected for identification. Captured bats were kept in a quiet cool location and released on the night following their capture.

### ***Koala transects***

The EPBC Act Protected Matters Search Report and Wildlife Online search for the study area and surrounding areas, indicates the Koala and/or its habitat is known from the search area. Therefore, targeted line transects were conducted in the study area during the seasonal surveys to provide information in relation to the use of the study area by this species. In line with the EPBC Act referral guidelines for the vulnerable koala (combined populations of Queensland, New South Wales and the Australian Capital Territory (DotE 2014), line transects were stratified across the study area to establish an estimate of population density, distribution and habitat preferences (Figure 5). Based on field-validated vegetation mapping described in Section 3.3.6, only communities that contained Koala food trees were sampled.

The methodology employed for the line transects generally involved two ecologists walking a distance of 25 m apart for a length of 500 m on one side of a centreline and then returning along the other side of the 500 m centreline also remaining a distance of 25 m apart, while inspecting each tree along this transect. This approach results in a search area of 5 ha (500 m x 100 m search area) for each transect. A total of 12 line transects were conducted, with this approach applied to 9 of these transects. The remaining 3 transects were conducted in the same manner but traversed the full length of each of the watercourses, rather than stopping at 500 m (Figure 5). The 12 transects resulted in 104.2 ha of potential habitat actively searched.

### ***Opportunistic observations***

Records of fauna were also made opportunistically while undertaking other activities, such as moving between trap sites, throughout the survey period.

### ***Habitat assessment***

The quality of fauna habitat in the study area was assessed on the basis of the following criteria:

- **Low:** Many fauna habitat elements in low quality areas have been removed or altered such as mature, hollow-bearing trees, fallen timber and deep leaf litter. Remnants are often small in size, support substantial weed infestations of high or moderate threat weeds (e.g. Buffel Grass) and are poorly connected to other areas of remnant vegetation.
- **Moderate:** Some habitat components are present but others are lacking. For example a remnant may have a reasonably intact understorey but lack mature canopy species and fallen timber. Some weed infestations are

present but are relatively small in size or comprise species of low to moderate threat. Linkages with other remnant habitats in the landscape may be lacking or somewhat tenuous.

- **High:** Most habitat components are present (e.g. old-growth trees, fallen timber, lack of weeds and deep leaf litter), the remnant is large enough to support species that are typically associated with large intact areas of habitat (e.g. Masked Owl) and it is well connected or contiguous with other areas of native vegetation.

These criteria were adapted for treeless habitat types such as grasslands or wetlands as appropriate.

### ***3.3.8 Field survey standards***

A number of guidelines have been consulted in development of survey methods for this project, particularly with regard to survey timing and techniques employed to target threatened and migratory species and TECs most likely to occur within the study area.

Appendix H provides a comparison of published Commonwealth and Queensland threatened species and communities survey guidelines against the survey effort undertaken for the terrestrial flora and fauna surveys within the study area. Appendix H only includes those species and ecological communities, which were determined as having a moderate or high likelihood of occurrence within the study area prior to the commencement of the field surveys (refer to Sections 3.3.9, 4.3 and 4.4).

Threatened species survey guidelines used to inform the requirements of the terrestrial flora and fauna surveys included:

- Commonwealth guidelines:
  - Survey guidelines for Australia's threatened birds (DEWHA 2010a)
  - Survey guidelines for Australia's threatened bats (DEWHA 2010b)
  - Survey guidelines for Australia's threatened reptiles (SEWPaC 2011a)
  - Survey guidelines for Australia's threatened mammals (SEWPaC 2011b)
  - EPBC Act referral guidelines for the vulnerable koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) (DotE 2014)
  - Draft Referral guidelines for the nationally listed Brigalow Belt reptiles (SEWPaC 2011c)
  - SPRAT databases for relevant EPBC Act listed species and communities, accessed on 14 July 2016.

- Queensland guidelines:
  - Flora Survey Guidelines – Protected Plants Nature Conservation Act 1992 (EHP 2014b)
  - Terrestrial Vertebrate Fauna Survey Guidelines for Queensland (Eyre et al. 2014).

The Commonwealth guidelines provide specific survey guidelines for individual threatened flora and fauna species and ecological communities listed under the EPBC Act, while the Queensland survey guidelines provide general guidance on the survey methodology and minimum effort advice for detection of all species. For all target species, a combination of two or more recommended survey techniques were employed.

### **3.3.9 Likelihood of occurrence**

#### ***Ecological community assessment***

Flora surveys were conducted at a scale and intensity to sufficiently identify ecological communities present. Ecological communities not recorded during the field surveys were therefore considered to have a low likelihood to occur within the study area.

An assessment of impacts was undertaken for communities identified as present within the study area during the field surveys.

#### ***Significant species assessment***

Database searches identified threatened, migratory and special least concern species that potentially occur in the study area. The likelihood of these species occurring was then assessed based on the results of the field surveys.

The likelihood of species occurring in the study area was classified using the criteria presented in Table 6. The assessment was based on the species' known ranges and habitat preferences, which were assessed against the characteristics of the study area observed during field surveys.

**Table 6: Criteria to assess potential for species to occur in the study area**

<b>Likelihood to Occur</b>	<b>Definition</b>
Present	The species was recorded in the study area during the field surveys.
High	The species was not recorded within the study area during the field surveys but is known to occur within the surrounding area, and habitat of suitable quality exists within the study area.
Moderate	The species was not recorded in the study area during the field surveys, although it is known to occur in the wider region. Habitat was identified for the species in the study area during the field surveys; however, it is marginal, fragmented and/or small in size, or degraded.
Low	The species was not recorded in the study area during the field surveys. The species is either: a) unlikely to occur in the wider region and due to the lack of, or extremely poor quality habitat in the study area, the species is not expected to occur in the study area; or b) may forage periodically in the wider region and may overfly the study area, but the habitat in the study area is generally not suitable.

### **3.3.10 Threatened species habitat mapping**

Habitat mapping was undertaken for threatened flora and fauna species that were recorded as being present in the study area or that were assessed as having a high or moderate likelihood to occur in the study area (refer to Sections 5.3, 6.4 and Appendices I and J).

Habitat mapping was based on detailed field-validated RE mapping to assign areas of habitat based on known habitat preferences, field observations from the study area and previous experience, where applicable.

Habitat preferences for the Squatter Pigeon, Koala and Ornamental Snake were derived from the recent Red Hill Project EPBC Act approval (DotE 2015a), which contains detailed habitat definitions for those species. The definitions from the Red Hill Project EPBC Act approval were used because:

- The habitat definitions in the Red Hill EPBC Act approval relate to general habitat features (e.g. land zones, distances to water etc.), rather than specific locations on the Red Hill Project Site. The habitat definitions are therefore not unique to the Red Hill Project Site and are equally applicable to other projects in the bioregion.
- The Red Hill EPBC Act approval was recently issued (in September 2015).
- The Red Hill Project survey area is located in close proximity to the study area (17 km to the north-west) (refer Figure 3).
- The Red Hill Project survey area and the study area contain similar fauna species, broad vegetation types and habitat features;

Habitat preferences for the Greater Glider were derived from information contained in the conservation advice and SPRAT profile for this species (DotE 2015a). The habitat mapping criteria for each species are described in Section 6.4.

### **3.3.11 Assessment of impacts**

For MNES listed under the EPBC Act, the significance of impacts was assessed in accordance with the Significant Impact Guidelines (DotE 2013). For MSES listed under the EO Act, the Significant Residual Impact (SRI) Guideline (EHP 2014a) was used to assess significance of impacts. The Landscape Fragmentation and Connectivity (LFC) Tool, referred to in the SRI Guideline was used to assess impacts to connectivity. MLES are not defined for the region.

A conservative, risk-based approach was adopted to determine the need for a significance assessment of species under the EPBC Act or EO Act (i.e., an assessment of impacts using the Significant Impact Guidelines, or the SRI Guideline). This approach considers both the likelihood of occurrence of the species within the study area and the potential for habitat loss or disturbance (directly or indirectly) resulting from the project's impacts. This approach ensures that potential project-related impacts on threatened, migratory or special least concern species, which were recorded within the study area or had a moderate or high likelihood to occur within the study area were considered. The criteria for determining if a significance assessment is required are presented in Table 7.

**Table 7: Criteria to determine if assessment of significance of impacts from the project is required for significant species**

Likelihood to Occur	No potential for habitat loss or disturbance from the project	Potential for habitat loss or disturbance from the project
Present	NO	YES
High	NO	YES
Moderate	NO	YES
Low	NO	NO

### 3.3.12 Limitations

The timing of the dry season survey did not provide optimal conditions for the identification of many flora species, particularly grasses and herbaceous species, which require reproductive material for identification. Similarly, dry conditions during and preceding the dry season fauna survey period limited amphibian activity. Any limitations related to these dry conditions were, however, overcome during the wet season surveys. The wet season flora and fauna surveys were conducted following significant rainfall in the Moranbah region during February (Tables 1 and 2).

The fauna survey was conducted within the optimal survey timing for the Brigalow Belt bioregion (i.e. March and mid-May) according to the Terrestrial Vertebrate Fauna Survey Guidelines for Queensland (Eyre et al. 2014). This is most relevant for detection of the Brigalow Belt reptiles (Ornamental Snake and Dunmall's Snake). Conditions during the wet season survey were conducive to the detection of these species, particularly given there were large numbers of frogs present in riparian areas.

Similarly, the conditions during the wet season flora survey resulted in a significantly increased level of observed flora species richness and plant vigor, particularly within the groundcover layer. Numerous annual herbs and grasses that were absent during the dry season survey were recorded during the wet season survey. Conditions were also conducive to the detection of threatened grasses *Dichanthium setosum* (no common name) and King Bluegrass, which were targeted as part of this assessment.

Nonetheless, ecological survey often fails to record all species of flora and fauna present on a site for a variety of reasons, including seasonal absence or reduced activity during certain seasons or very large home ranges of some animals. Furthermore, the ecology and nature of significant and/or cryptic species means that such species are potentially not recorded during short survey periods. This assessment overcomes these limitations by assessing impacts not only on species recorded during the field surveys, but also on species that are potentially present (based on known distribution and habitat availability).



## 4 Desktop results

### 4.1 Overview of environmental values

#### 4.1.1 Geology

As shown on Figure 6 and listed in Table 8, the surface geology of the study area comprises:

- Cainozoic (i.e. Quaternary and Tertiary age) alluvium associated with local drainage features
- a veneer of Tertiary Suttor Formation sediments and associated colluvium
- a highly variable and heterogeneous Tertiary basalt flow
- Triassic sediments of the Rewan Group
- Permian coal measures including the Rangal Coal Measures and Fort Cooper Coal Measures.

Equivalent Land Zones (as defined under the VM Act and in Wilson and Taylor, 2012) are also listed in Table 8, as these are relevant to assigning field-validated vegetation communities to REs within the study area.

**Table 8: Surface geology mapping within the study area**

Map Symbol	Geological Unit	Lithology	Dominant Rock Type	Equivalent Land Zone
<b>Qa</b>	Quaternary Alluvium	Clay, silt, sand, gravel deposits	Alluvium	3
<b>Qr</b>	Colluvium	Clay, silt, sand, gravel and soil; colluvium and residual deposits	Colluvium and Regolith	4 or 5
<b>TQa</b>	Tertiary – Quaternary Alluvium	Locally red-brown mottled, poorly consolidated sand, silt clay, minor gravel; high-level alluvial deposits	Alluvium	5
<b>Tu</b>	Suttor Formation	Quartz sandstone, clayey sandstone, mudstone and conglomerate; fluvial and lacustrine sediments; minor interbedded basalt.	Sedimentary	9
<b>Tb</b>	Basalt	Mostly olivine basalt flows.	Basalt	8 and 4, where deeply weathered in situ)
<b>Rr</b>	Rewan Group	Lithic sandstone, pebbly lithic sandstone, green to reddish brown mudstone and minor volcanolithic pebble conglomerate (at base).	Sedimentary	9

Map Symbol	Geological Unit	Lithology	Dominant Rock Type	Equivalent Land Zone
Pwt	Fort Cooper Coal Measures	Lithic sandstone, conglomerate, mudstone, carbonaceous shale, coal, tuff, tuffaceous (cherty) mudstone.	Sedimentary	9
Pwj	Rangal Coal Measures	Calcareous sandstone, Calcareous shale, mudstone, coal, concretionary limestone.	Sedimentary	9

#### 4.1.2 Soils

Seven soil types have been identified as occurring within the study area (refer to the EAR Rehabilitation Section). Clay-dominant vertosols, sodosols and dermasols cover the majority of the study area. Localised brown sodosols comprising duplex sandy loams overlying hard, structured clays are present in association within Smoky Creek and its unnamed tributary. Soil types are relevant for assigning vegetation communities to REs within the study area, and are useful for determining areas of preferential habitat for various species.

#### 4.1.3 Surface water

The study area is located in the Isaac River catchment. There are three ephemeral watercourses that traverse the study area, namely Billy's Gully, Smoky Creek and an unnamed tributary of Smoky Creek, which are classified as watercourses under the Water Act and VM Act. Smoky Creek is a fourth order watercourse, and Billy's Gully and the unnamed tributary of Smoky Creek are third order watercourses.

The northern portion of the study area is traversed by Smoky Creek and an unnamed tributary of Smoky Creek. Billy's Gully traverses the southern portion of the study area. The watercourses drain westward towards the Isaac River. During the wet season survey neither watercourse contained flowing water, and only Smoky Creek was noted to contain small isolated pools of water.

A number of water points (farm dams) occur in the study area that are likely to hold water all year round (Figure 5).

### 4.2 Ecological communities

#### 4.2.1 EPBC Act listed TECs

The EPBC Act Protected Matters Report (Appendix A) listed four TECs, as defined under the EPBC Act, as potentially occurring within the study area, namely:

- Brigalow TEC
- Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions (SEVT)
- Weeping Myall Woodlands

- Natural Grasslands TEC.

All of these communities are listed as endangered under the EPBC Act.

#### 4.2.2 Queensland Government vegetation mapping

Approximately one third of the study area is mapped by the Queensland Government as supporting remnant vegetation (Figure 7).

A total of eight REs have been mapped by the Queensland Government as occurring within the study area. This includes six least concern, one of concern and one endangered REs as defined by the VM Act. The status and short descriptions for each of these REs is provided below in Table 9.

The Queensland Government regulated vegetation mapping listed in Table 9 indicates that, within the study area, there are two REs that could potentially form part of TECs listed under the EPBC Act (Section 4.2.1), namely:

- RE 11.3.2 has the potential to form a part of the Weeping Myall Woodland TEC
- RE 11.4.9 has the potential to form a part of the Brigalow TEC

**Table 9: Queensland Government mapped REs within the study area**

RE Code	Short Description (Queensland Herbarium 2015b)	Conservation Status			BVG (1 M)
		EPBC Act Status <sup>1</sup>	VM Act Status <sup>2</sup>	Biodiversity Status <sup>2</sup>	
11.3.2	<i>Eucalyptus populnea</i> woodland on alluvial plains. Contains palustrine wetland (e.g. in swales)	Endangered ( <u>only</u> where Weeping Myall ( <i>Acacia pendula</i> ) is a dominant component)	Of concern	Of concern	17a
11.3.7	<i>Corymbia</i> spp. woodland on alluvial plains	Not listed	Least concern	Of concern	9e
11.3.25	<i>Eucalyptus tereticornis</i> or <i>E. camaldulensis</i> woodland fringing drainage lines. Riverine wetland or fringing riverine wetland	Not listed	Least concern	Of concern	16a
11.4.9	<i>Acacia harpophylla</i> shrubby woodland with <i>Terminalia oblongata</i> on Cainozoic clay plains. Contains palustrine wetland (e.g. in swales)	Endangered ( <u>only</u> if this RE meets the condition thresholds and key diagnostic criteria for the Brigalow TEC)	Endangered	Endangered	25a

RE Code	Short Description (Queensland Herbarium 2015b)	Conservation Status			BVG (1 M)
		EPBC Act Status <sup>1</sup>	VM Act Status <sup>2</sup>	Biodiversity Status <sup>2</sup>	
11.5.3	<i>Eucalyptus populnea</i> +/- <i>E. melanophloia</i> +/- <i>Corymbia clarksoniana</i> woodland on Cainozoic sand plains and/or remnant surfaces	Not listed	Least concern	No concern at present	17a
11.5.9c	<i>Eucalyptus crebra</i> +/- <i>Corymbia intermedia</i> +/- <i>E. moluccana</i> +/- <i>C.</i> <i>dallachiana</i> woodland	Not listed	Least concern	No concern at present	18b
11.7.2	<i>Acacia</i> spp. woodland on Cainozoic lateritic duricrust. Scarp retreat zone	Not listed	Least concern	No concern at present	24a
11.8.5	<i>Eucalyptus orgadophila</i> open woodland on Cainozoic igneous rocks	Not listed	Least concern	No concern at present	11a

<sup>1</sup> EPBC Act status is only relevant if the RE meets the EPBC Act condition thresholds and key diagnostic criteria for the relevant TEC (TEC status current as at July 2016). Queensland REs are not individually listed under the EPBC Act, but may form part of a TEC listed under the EPBC Act.

<sup>2</sup> VM Act and Biodiversity status defined under the Regional Ecosystem Description Database (REDD) (Queensland Herbarium 2015b).

### ***Vegetation management wetlands***

The Queensland Government Vegetation Management Supporting Map indicates that there are no vegetation management wetland areas, within the study area (Figure 7).

### ***Groundwater dependent ecosystems***

The Australian Groundwater Dependent Ecosystem Toolbox (GDE Toolbox), prepared by the National Water Commission (2011), defines groundwater dependent ecosystems (GDEs) as:

*“Ecosystems that require access to groundwater to meet all or some of their water requirements so as to maintain the communities of plants and animals, ecological processes they support, and ecosystem services they provide”.*

The potential for GDEs to be present within the study area was reviewed, with the review consisting of:

- a search of the Queensland Springs Database;
- a search of the Bureau of Meteorology’s (BoM) GDE Atlas; and
- Groundwater field investigations (as described in the EAR Groundwater Report).

A search of the Queensland Springs Database indicated that no spring wetlands are located within the study area.

The BoM GDE mapping (refer Figure 8) indicates several potential GDEs in the study area, including riparian vegetation along Billy's Gully, Smoky Creek and its unnamed tributary, and also areas of remnant vegetation. The EAR Groundwater Section includes a comprehensive description of the groundwater regime. The groundwater assessment was based on the results of fieldwork and monitoring data, and the assessment also included the preparation of a numerical groundwater model.

The EAR Groundwater Report includes water quality data collected from the shallow groundwater within the study area. The shallow groundwater was found to be moderately to highly saline, with an electrical conductivity ranging from approximately 5,000 to 24,000  $\mu\text{S}/\text{cm}$ . The groundwater quality within the study area is generally consistent with regional groundwater data collected from equivalent geology. Saline groundwater does not represent a suitable water supply for the vegetation that occurs within the study area.

Consequently, BoM's GDE mapping of the study area does not appear to be consistent with the hydrogeological setting of the study area (i.e. the study area does not contain a suitable shallow groundwater supply). It is concluded that there are no GDEs within the study area and GDEs are not considered further in this report.

### ***Referable wetlands***

As part of the Queensland Government's management of wetlands, the EHP has prepared a map of referable wetlands which includes:

- Wetland protection area (WPAs) within the Great Barrier Reef catchment comprising;
  - Wetland of high ecological significant (HES) wetlands
  - Trigger areas that represent the area of hydrological influence of HES wetlands
- Wetlands of general ecological significance (GES).

A search of the referable wetlands map shows there are no WPAs or GES wetlands within or adjacent to the study area. GES wetlands are mapped for the purpose of establishing environmental values, and are not protected wetlands.

### **4.3 Significant flora species**

Database searches encompassing the study area (i.e. at least 25 km radius from the project site boundary) identified a total of nine significant flora species as potentially occurring within the study area. A discussion of the significant flora species identified from database results listed under the EPBC Act and NC Act are provided in Sections 4.3.1 and 4.3.2. Database search results are presented in Appendices A, B and C.

#### **4.3.1 EPBC Act listed flora**

Database searches identified two endangered and three vulnerable flora species listed under the EPBC Act as potentially occurring within the study area, as follows:

- *Dichanthium setosum* (no common name) - listed as vulnerable under the EPBC Act
- Black Ironbox (*Eucalyptus raveretiana*) – listed as vulnerable under the EPBC Act
- King Bluegrass (*Dichanthium queenslandicum*) - listed as endangered under the EPBC Act and vulnerable under the NC Act
- Marlborough Blue (*Cycas ophiolitica*) – listed as endangered under the EPBC Act and NC Act
- *Samadera bidwillii* (no common name) – listed as vulnerable under the EPBC Act and NC Act.

These species, along with a description of their preferred habitat, and likelihood of occurrence within the study area are outlined in Appendix I.

#### **4.3.2 NC Act listed flora**

In addition to the five EPBC Act listed species discussed in Section 4.3.1, database searches identified the following two endangered and two near threatened species that are listed under the NC Act:

- *Bertya pedicellata* (no common name) –near threatened
- *Cerbera dumicola* (no common name) –near threatened
- *Kelita uncinella* (no common name) –endangered
- *Solanum adenophorum* (no common name) –endangered.

A description of the preferred habitat of these species and assessment of the likelihood of occurrence within the study area is outlined in Appendix I.

#### **Protected plants high risk areas**

No high risk areas (HRAs) are mapped within the study area on the Protected Plants Flora Survey Trigger Map (Appendix F) (EHP 2016b).

#### **Essential habitat**

No essential habitat for significant flora is mapped for the study area.

### **4.4 Significant fauna species**

Database searches encompassing the study area (i.e. at least 25 km radius from the project site boundary) identified various listed threatened, migratory and special least concern fauna species as potentially occurring within the study area. A discussion of the fauna species identified from database results and listed under the EPBC Act and NC Act are provided in Sections 4.4.1 and 4.4.2. Database search results are provided in Appendices A, B, D, and E, respectively.

#### **4.4.1 EPBC Act listed fauna**

##### ***Threatened fauna***

Database searches identified a total of 15 threatened fauna species listed under the EPBC Act as follows:

- Allan's Lerista (*Lerista allanae*) - listed as endangered under the EPBC Act and NC Act
- Australian Painted Snipe (*Rostratula australis*) - listed as endangered under the EPBC Act and vulnerable under the NC Act
- Corben's Long-eared Bat (*Nyctophilus corbeni*) - listed as vulnerable under the EPBC Act and NC Act
- Curlew Sandpiper (*Calidris ferruginea*) – listed as critically endangered under the EPBC Act
- Dunmall's Snake (*Furina dunmalli*) - listed as vulnerable under the EPBC Act and NC Act
- Ghost Bat (*Macroderma gigas*) – listed as vulnerable under the EPBC Act and NC Act
- Greater Glider (*Petauroides volans*) – listed as vulnerable under the EPBC Act and least concern under the NC Act
- Koala (*Phascolarctos cinereus*) - listed as vulnerable under the EPBC Act and NC Act
- Northern Quoll (*Dasyurus hallucatus*) - listed as endangered under the EPBC Act and least concern under the NC Act
- Ornamental Snake (*Denisonia maculata*) - listed as vulnerable under the EPBC Act and NC Act
- Painted Honeyeater (*Grantiella picta*) – listed as vulnerable under the EPBC Act and NC Act
- Red Goshawk (*Erythrotriorchis radiatus*) - listed as vulnerable under the EPBC Act and endangered under the NC Act
- Squatter Pigeon (southern subspecies) (*Geophaps scripta scripta*) - listed as vulnerable under the EPBC Act and NC Act
- Star Finch (*Neochmia ruficauda ruficauda*) - listed as endangered under the EPBC Act and NC Act
- Yakka Skink (*Egernia rugosa*) - listed as vulnerable under the EPBC Act and NC Act.

A description of the preferred habitat of these species and an assessment of the likelihood of occurrence within the study area is outlined in Appendix J.

##### ***Migratory fauna***

Database searches (Appendices A, B, D and E) identified a total of 11 birds listed as migratory under the EPBC Act as potentially occurring in the database search area. A description of the preferred habitat of these species and an assessment of the likelihood of occurrence within the study area is outlined in Appendix J.

A number of species listed under the marine provisions of the EPBC Act were also identified in database searches (Appendices A, B, D and E). However, no marine habitat or marine areas occur within 25 km of the project site, therefore, these species have not been considered further.

#### **4.4.2 NC Act listed fauna**

##### ***Threatened fauna***

Thirteen threatened fauna species identified from database searches (Appendices A, B, D and E) are listed as being of conservation significance under the NC Act. Twelve of these species are also listed under the EPBC Act, and are noted in Section 4.4.1. An additional species, the Common Death Adder (*Acanthophis antarcticus*) is listed as vulnerable under the NC Act only.

##### ***Special least concern fauna***

One special least concern species, the Short-beaked Echidna (*Tachyglossus aculeatus*) was identified from the database searches (Appendices B, D and E) as potentially occurring in the search area.

A number of special least concern migratory birds were also identified in database search results as potentially occurring in the study area (Appendices A, B, D and E). Special least concern animals recorded or considered likely to occur in the study area are discussed in Section 6.4.3.

##### ***Near threatened fauna***

No fauna species listed as near threatened under the NC Act were identified from database searches for the search area.

##### ***Essential habitat***

No essential habitat for significant fauna is mapped for the study area (Figure 7).

#### **4.5 Critical habitat**

The study area is not within an area identified as Critical Habitat under the NC Act.



## 4.6 Biodiversity Planning Assessment Mapping

The EHP has prepared a Biodiversity Planning Assessment (BPA) for the region. This draws on remnant vegetation mapping and database information to characterise areas into one of three biodiversity significance levels:

- State biodiversity significance – areas assessed as being significant for biodiversity at the bioregional or state scales
- regional biodiversity significance – areas assessed as being significant for biodiversity at the sub-bioregional scale
- local biodiversity significance and/or other values – local values that are of significance at the local government scale.

The BPA mapping is for planning purposes and does not provide any specific statutory protection.

BPA mapping indicates that Smoky Creek and its unnamed tributary in the north of the study area are classified as being of State Biodiversity Significance (Figure 9). Other smaller areas, including Billy's Gully are mapped as being of Regional Biodiversity Significance. The large tract of remnant vegetation in the central portion of the study area is mapped as being of Local Biodiversity Significance.

The study area contributes to a regional landscape of moderately fragmented vegetation, with loosely connecting local tracts of remnant vegetation near to larger State Biodiversity Corridors, e.g. the Isaac River to the south-west of the study area. In the broader landscape these stepping stones and the Isaac River provide corridors to even larger State Biodiversity Corridors to the south and south-west associated with the Denham and Peak Ranges and to the north-east in the Carborough and Kerlong Ranges and beyond, with the Leichhardt and Clark Ranges. In such a fragmented landscape, the larger order watercourses, provide a primary biodiversity connective function.

Section 6.1 describes the value of the study area as a biodiversity corridor (based on site specific fieldwork and mapping).

## 4.7 Previous studies in the region

A large number of flora and fauna studies have been undertaken within a 25 km radius of the project site over the last several years, as a part of EISs for various other mining projects. These have included the Integrated Isaac Plains Project, Red Hill Project, Millennium Mine Expansion Project, Moranbah South Project, Grosvenor Mine, Caval Ridge Mine, Eagle Downs Mine and Daunia Mine (refer Figure 3).

These surveys identified the following listed threatened fauna species, as relevant to the study area, as being present or likely to be present in the region:

- Squatter Pigeon
- Koala
- Ornamental Snake

- Short-beaked Echidna
- Greater Glider.

The surveys also noted that large areas of land had been cleared in the past for grazing activities. Areas of remnant vegetation were noted to typically comprise Eucalypt and Acacia woodland. The Brigalow TEC was also frequently recorded in the region.

## 5 Field flora results

### 5.1 Overview

The study area was found to include approximately:

- 345 ha of remnant vegetation, comprising mostly *Eucalyptus* and *Corymbia* woodland species;
- 35 ha of non-remnant, regenerating shrubby woodland which supports emergent Eucalypt species; and
- 889 ha of cleared and disturbed areas that do not support native vegetation communities.

The distribution of remnant vegetation in the study area is shown in Figure 10. Figure 13 shows broad habitat types, including non-remnant, regenerating shrubby woodland. This figure also shows the extent of cleared and disturbed areas.

Of the areas of remnant vegetation, Clarkson's Bloodwood woodland and Poplar Box woodlands comprise the majority of remnant communities. Historic clearing for agricultural land uses has resulted in a fragmented distribution of remnant vegetation within the study area, however, the vegetation immediately fringing Billy's Gully, Smoky Creek and its unnamed tributary has largely remained intact.

### 5.2 Vegetation communities

#### 5.2.1 Overview

In accordance with EHP guidance (EHP 2016e), ground-truthing surveys were undertaken to accurately assess the RE type, condition and ecological value of the vegetation proposed to be significantly disturbed by the project. The survey methodology was designed to ensure consistency with relevant State and Commonwealth guidelines, and vegetation communities were identified according to the Queensland Government's Regional Ecosystem Description Database (REDD). The remainder of this report, including the impact assessment, therefore discusses ground-truthed RE mapping, rather than government RE mapping.

Remnant vegetation comprising 10 REs was identified during field surveys in the study area, and is presented in Table 10 and shown on Figure 10. A detailed description of these communities is provided in Appendix K.

**Table 10: Field-validated remnant regional ecosystems in the ecology study area**

RE Code	Short Descriptions	Conservation status			Other	Area (ha)
		EPBC Act Status <sup>1</sup>	VM Act Status <sup>2</sup>	Biodiversity Status <sup>2</sup>		
11.3.2	Poplar Box alluvial woodland	- [confirmed to not be a component of Weeping Myall TEC within the study area]	Of concern	Of concern	Contains palustrine wetland in swales	1.2
11.3.4	Queensland Blue Gum alluvial woodland	-	Of concern	Of concern	Floodplain (other than floodplain wetlands)	0.5
11.3.25	Mixed eucalypt riparian woodland	-	Least concern	Of concern	Riverine wetland or fringing riverine wetland	48.1
11.5.3	Poplar Box woodland	-	Least concern	No concern at present	-	105.2
11.5.8b	Narrow-leaved Red Ironbark-Queensland Blue Gum woodland	-	Least concern	No concern at present	-	3.4
11.5.9	Narrow-leaved Red Ironbark woodland	-	Least concern	No concern at present	-	9.7
11.5.12	Clarkson's Bloodwood woodland	-	Least concern	No concern at present	-	142.2
11.7.2	Lancewood woodland	-	Least concern	No concern at present	-	14.6
11.8.5	Mountain Coolabah woodland	-	Least concern	No concern at present	-	11.8
11.9.7a	Poplar Box and Dawson River Gum woodland	-	Of concern	Of concern	-	8.5
<b>Total</b>						<b>345.2</b>

1 EPBC Act status is only relevant if the RE meets the EPBC Act condition thresholds and key diagnostic criteria for the relevant TEC (TEC status current as at July 2016). Queensland REs are not individually listed under the EPBC Act, but may form part of a TEC listed under the EPBC Act.

2 VM Act and Biodiversity status defined under the REDD (Queensland Herbarium 2015b).

The proposed haul road connections within the Isaac Plains Mine (i.e., beyond the project site, but within the study area) were also inspected. Only a small portion of the proposed haul road connections were found to support remnant vegetation (Figure 10). This is consistent with the Queensland Government remnant mapping of these areas (Figure 7) as well as ground-truthed vegetation

mapping undertaken by Ecotone Environmental Services as part of the Integrated Isaac Plains Project EIS in 2005 and 2006. Approximately 0.9 ha of remnant least concern mixed eucalypt riparian woodland (RE 11.3.25) is present within the haul road connection along the unnamed tributary of Smoky Creek (Figure 10). This amount of remnant vegetation is included in the figures presented in Table 10.

### 5.2.2 EPBC Act listed communities

Database searches (Appendix A, and discussed in Section 4.2.1) indicated that the following endangered TECs may be present within the study area:

- Brigalow (*Acacia harpophylla* dominant and co-dominant) (Brigalow)
- Semi-evergreen vine thickets of the Brigalow Belt (north and South) and Nandewar Bioregions (SEVT)
- Weeping Myall Woodlands
- Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin (Natural Grasslands).

None of the vegetation communities within the study area satisfied the key diagnostic criteria or condition thresholds to be considered a TEC under the EPBC Act. This is discussed further below.

#### **Brigalow TEC**

According to the Brigalow Conservation Advice (TSSC 2013b), Brigalow communities that have greater than 50% perennial weed cover as a percentage of total perennial cover, or Brigalow REs that are not dominated, or co-dominated by Brigalow (*A. harpophylla*), do not satisfy the condition thresholds or key characteristics that are required for the patch to form part of the Brigalow TEC.

Although Brigalow (*A. harpophylla*) trees were identified in the study area during the field surveys, none formed a dominant canopy layer, and no REs representing Brigalow vegetation were found to be present. Survey transects were conducted in non-remnant areas where Brigalow trees were found to be more common in the north of the study area (at sites S12 and T25 – refer Figure 4). At this location the groundcover layer was dominated by exotic grasses, primarily Buffel Grass (Table 11). Therefore, this vegetation in the study area does not meet the diagnostic criteria of the Brigalow TEC.

**Table 11: Condition and status of field-validated non-remnant Brigalow vegetation**

Parameter	Non-remnant Brigalow survey transects	
	S12	T25
Height (m)		
T1	14.0	9.2
T2	11.0	n/a
S1	5.7	4.2

Parameter	Non-remnant Brigalow survey transects	
	S12	T25
<b>Woody Cover (%)</b>		
T1	19.8	10.9
T2	49.2	<i>n/a</i>
S1	39.6	18.7
<b>Non-woody (relative %)</b>		
Groundcover - native	0	15.4
Groundcover - exotic	100	84.6
<b>TEC Condition Thresholds</b>	<b>Fail</b>	<b>Fail</b>

### **SEVT TEC**

Although mixed polygons containing SEVT RE 11.8.13 are mapped just outside the eastern boundary of the study area (Figure 7), no vegetation in the study area was found to represent SEVT communities. Small patches of vine thicket generalist species were identified within the northern portion of RE 11.5.12 (at Q7) and the south-western extent of RE 11.8.5 (at Q21), and as scattered individuals or very small clumps in RE 11.7.2. However, these patches did not constitute a vine thicket RE.

There are no specific diagnostic criteria or condition thresholds referred to in the DotE SPRAT Profile for the SEVT TEC, although reference is made to the Queensland remnant RE mapping methodology with regard to survey methods for SEVT (DotE 2016c).

### **Weeping Myall Woodlands TEC**

A small patch of Poplar Box woodland on alluvial plains (i.e. RE 11.3.2) is mapped in the north-western corner of the study area along a tributary of Smoky Creek (Figure 10). This RE is listed in the EPBC Act Policy Statement 3.17 - Weeping Myall Woodlands (DEWHA 2009), as potentially supporting small patches of the Weeping Myall Woodlands TEC. Condition thresholds for this TEC require that Weeping Myall (*Acacia pendula*) dominate the tree canopy (DEWHA 2009). No Weeping Myall were identified within the patches of RE 11.3.2 or the study area more broadly.

It has therefore been determined that the Weeping Myall Woodlands TEC does not occur in the study area.

### **Natural Grasslands TEC**

There were no REs identified within the study area that corresponded to the Natural Grasslands TEC (as listed in the Listing Advice for this TEC) (e.g. RE 11.8.11), and there were no natural grassland areas or communities identified that met the key diagnostic characteristics and condition thresholds for this TEC.

Non-statutory Queensland Government mapping (Queensland Herbarium, Version 9.0) indicates the possible presence of a patch of RE 11.8.11 (natural grassland) in the northern portion of the study area. Survey transects were

conducted in this area (Figure 4) to determine if the diagnostic criteria and condition thresholds for the TEC would be satisfied (TSSC 2008a).

Table 12 presents the results of each of the three transects located in this area. Field surveys confirmed this area was predominantly dominated by exotic grasses and infestations of Parthenium Weed. The results show that this area fails to meet the definition of Natural Grassland TEC as a result of there being greater than 30% of exotic cover in these areas.

**Table 12: Condition and status of field-validated grassland vegetation**

Parameter	Non-remnant grassland survey transects <sup>1</sup>		
	1 (S8)	2 (T18)	3
Area	>5ha	>5ha	>5ha
Indicator Species	<b>2</b>	<b>2</b>	6
Tussock Number (per hectare)	<b>&lt;2000</b>	<b>&lt;2000</b>	<b>&lt;2000</b>
Woody Shrub Cover (%)	0	0	0
Native Species Cover (%)	15.1	27.5	57.3 <sup>2</sup>
Exotic Species Cover (%)	<b>84.9</b>	<b>77.5</b>	<b>42.7</b>
<b>TEC Condition</b>	<b>Fail</b>	<b>Fail</b>	<b>Fail</b>

<sup>1</sup> The parameter(s) highlighted in bold indicate failed criterion.

<sup>2</sup> The high value of native species cover was primarily attributed to Woolly Glycine (*Glycine tomentella*). Native annual and perennial grasses contributed < 1.3 % of the total vegetative cover.

### 5.2.3 VM Act listed communities

The majority of the vegetation communities in the study area are listed as least concern under the VM Act, however the following three vegetation communities listed as of concern occur in the study area (refer Table 10):

- RE 11.3.2: Poplar Box (*Eucalyptus populnea*) woodland on alluvial plains (Poplar Box alluvial woodland).
- RE 11.3.4: Queensland Blue Gum (*Eucalyptus tereticornis subsp. tereticornis*) and/or *Eucalyptus spp.* on alluvial plains (Queensland Blue Gum alluvial woodland).
- RE 11.9.7a: Poplar Box, False Sandalwood (*Eremophila mitchellii*) shrubby woodland on fine-grained sedimentary rocks (Poplar Box and Dawson River Gum woodland).

No vegetation communities listed as endangered under the VM Act were recorded in the study area (Table 10).

The three of concern communities are discussed in detail below.

#### **RE 11.3.2**

##### **Overview**

The REDD database contains the following description of this community (Queensland Herbarium 2015b):

*Eucalyptus populnea* woodland to open woodland. *E. melanophloia* may be present and locally dominant. There is sometimes a distinct low tree layer

dominated by species such as *Geijera parviflora*, *Eremophila mitchellii*, *Acacia salicina*, *Acacia pendula*, *Lysiphyllum* spp., *Cassia brewsteri*, *Callitris glaucophylla* and *Acacia excelsa*. The ground layer is grassy dominated by a range of species depending on soil and management conditions. Species include *Bothriochloa decipiens*, *Enteropogon acicularis*, *Aristida ramosa* and *Tripogon loliiformis*. Occurs on Cainozoic alluvial plains with variable soil types including texture contrast, deep uniform clays, massive earths and sometimes cracking clays.

### **Presence in the study area**

Approximately 1.2 ha of RE 11.3.2 occurs in the study area. This community was restricted to a small floodplain terrace on the western side of the unnamed tributary of Smoky Creek, in the north-west portion of the study area (Figure 10).

### **Species and Structural Composition**

The canopy layer was found to comprise Poplar Box and associated Sally Wattle (*Acacia salicina*) and Carbeen (*Corymbia tessellaris*). The canopy layer had a median height of 15 m and canopy cover intercept ranging from 5 to 10%. The sub-canopy layer comprised mid-mature Poplar Box and was more representative of the EDL. Sally Wattle was also prevalent in this layer. The sub-canopy had a median height of 10 m and cover intercept ranging from 5 to 20%. The shrub layer comprised Pegunny (*Lysiphyllum hookeri*), Poplar Box and Sally Wattle. The groundcover layer almost exclusively comprised Buffel Grass.

### **Condition**

This community was situated on a narrow terrace between the main channel and the broad clay plains to the east. The community is moderately to markedly fragmented, supporting only scattered mature trees with residual mid-mature regrowth or shrubs. A small, shallow overflow basin was recorded on the eastern edge of the community. Historic clearing and subsequent thinning have affected the community, wherein the community only marginally satisfies the criteria for remnant status (i.e. the 70/50 rule).

## **RE 11.3.4**

### **Overview**

The REDD database contains the following description of this community (Queensland Herbarium 2015b):

*Eucalyptus tereticornis* woodland to open forest. Other tree species that may be present and locally dominant include *E. camaldulensis*, *Corymbia tessellaris*, *E. coolabah*, *C. clarksoniana*, *E. populnea* or *E. brownii*, *E. melanophloia*, *E. platyphylla* or *Angophora floribunda*. *E. crebra* and *Lophostemon suaveolens* may be locally dominant (subregion 14). A shrub layer is usually absent, and a tall grassy ground layer is often prominent, and may include any of *Bothriochloa bladhii* subsp. *bladhii*, *Aristida* spp., *Heteropogon contortus*, *Dichanthium* spp. and *Themeda triandra*. Heavily



grazed areas tend to have shorter or annual grasses such as *Dactyloctenium radulans* or *Bothriochloa spp.* Occurs on Cainozoic alluvial plains and terraces. Occurs on variety of soils, including deep cracking clays, medium to fine textured soils, and deep texture-contrast soils.

### **Presence in the study area**

Approximately 0.5 ha of RE 11.3.4 occurs in the study area. This community was limited to a small patch fringing remnant riparian woodland (RE 11.3.25) in the far northern portion of the study area (Figure 10).

### *Species and Structural Composition*

This community was found to typically support a canopy layer dominated by Poplar Box, Queensland Blue Gum, River Red Gum (*Eucalyptus camaldulensis* var. *obtusa*) and Carbeen. The canopy layer had a median height of 18 m and canopy cover intercept ranging from 25 to 30%. The sub-canopy layer comprised Sally Wattle. Less common species included juvenile canopy species, Pegunny and Ironwood (*Acacia excelsa* subsp. *excelsa*). The sub-canopy layer had a median height of 11 m (range 9 to 15 m) and a cover intercept ranging from 10 to 40%. The very sparse shrub layer comprised Pegunny, juvenile canopy species, Leichhardt Bean (*Cassia brewsteri*) and Whitewood (*Atalaya hemiglauca*). The groundcover variously comprised Buffel Grass, Green Panic (*\*Megathyrsus maximus* var. *pubiglumis*), Indian Blue Grass (*\*Bothriochloa pertusa*) and Golden Beard Grass (*Chrysopogon fallax*).

### *Condition*

This community was moderately intact within its limited distribution but negatively impacted by a large edge to area ratio. The patch is heavily degraded within the groundcover layer and was found to be actively used by cattle due to the proximity of several water points. Some large hollow bearing trees were observed.

## **RE 11.9.7a**

### **Overview**

The REDD database contains the following description of this community (Queensland Herbarium 2015b):

*Eucalyptus populnea* predominates forming a distinct but discontinuous canopy (10-15 m high). Other trees may be scattered throughout the canopy. There is generally a dense, tall shrub layer (4-6 m high) dominated by a range of species including *Eremophila mitchellii*, *Archidendropsis basaltica*, *Acacia excelsa*, *Geijera parviflora*, *Alectryon oleifolius* and *Lysiphyllum carronii*. A low shrub layer is usually present. The ground layer is variable and composed mainly of annual grasses. Occurs on gently undulating to sloping plains. In southern part of bioregion associated with Jurassic Hooray Sandstone. Associated soils are generally moderately deep, hard-setting, solodized solonetz and solodic soils. Brown clays may be present also.

### ***Presence in the study area***

Approximately 8.5 ha of RE 11.9.7a occurs in the study area. This community was limited to two patches in the north-east of the study area either side of Smoky Creek (Figure 10).

#### *Species and Structural Composition*

The canopy layer was found to comprise mostly Poplar Box, with the occasional Dawson River Gum (*Eucalyptus cambageana*) also present. The height of the canopy ranged from 10 to 15 m (median of 13 m) and had a cover intercept of 15 to 30%. The sub-canopy layer comprised Poplar Box, with Ironwood, Sally Wattle, Western Rosewood (*Alectryon oleifolius* subsp. *elongatus*) and Brigalow less frequently encountered. The sub-canopy layer had a median height of 7 m (range 5 to 9 m) and a cover intercept of 5 to 20%. A sparse shrub layer variously comprised Dead Finish (*Archidendropsis basaltica*), Scrub Boonaree (*Alectryon diversifolius*), Pegunny, Leichhardt Bean and Currant Bush. Buffel Grass dominated the groundcover with \**Sida* spp. and Melhania (*Melhania oblongifolia*) also prevalent.

#### *Condition*

The southern patch and north-eastern distribution of this community was moderately intact but tended towards even-age regrowth in the west. Exotic grasses primarily dominated the ground cover. However a variety of native herbs were also prevalent.

### ***Wetland vegetation communities***

A number of REs identified in the study area, i.e. REs 11.3.2, 11.3.4 and 11.3.25, are described by the Queensland Herbarium as potentially supporting wetlands (Queensland Herbarium 2015).

Within the study area neither RE 11.3.2, RE 11.3.4 or 11.3.25 contain palustrine (vegetated non-channel environments of less than 8 ha, e.g. billabongs, swamps, bogs, springs) or lacustrine (large, open, water-dominated systems larger than 8 ha, e.g. lakes) wetlands. These REs are located along the watercourses within the study area, and have the potential to support small, isolated pools that persist for short durations following flow events. For example, several natural depressions were identified in the stream channel of Smoky Creek and these contained water during the wet season survey period. However, all watercourses in the study area are ephemeral, and given the typically long, dry weather conditions in the area, there is a low likelihood of water persisting for extended periods. The vegetation associated with these watercourses is therefore not considered to be adapted to, nor dependent on, living in wet conditions, and consequently these REs do not meet the definition of a wetland under the VM Act.

## **5.3 Flora species**

A total of 332 flora species were recorded during the field surveys representing 70 families and 203 genera. The dominant family group was *Poaceae* (72

species) with *Fabaceae* (31 species), *Malvaceae* (18 species) also prominent. The dominant family groups exemplify the overall composition and condition of the vegetation communities surveyed, with the ground layer being the most diverse. The species inventory included 38 (11%) exotic species, seven of which are listed as declared pests under the Biosecurity Act. A list of the flora species recorded during the field surveys is presented in Appendix L. The relative abundance of each species, in relation to the REs in which they were found, is also presented in Appendix L.

High average species diversity was recorded in the mixed eucalypt riparian woodland vegetation community (RE 11.3.25) (167 species), the Clarkson's Bloodwood woodland community (RE 11.5.12) (111 species), and the Poplar Box woodland community (RE 11.5.3) (101 species). Moderate to high levels of species diversity (i.e. >70 species) were recorded in the Narrow-leaved Red Ironbark woodland (RE 11.5.9), Lancewood woodland (RE 11.7.2) and Mountain Coolabah woodland (RE 11.8.5) communities. The Narrow-leaved Red Ironbark-Queensland Blue Gum woodland on deeply weathered sandplains (RE 11.5.8b) had the lowest species diversity with 41 species recorded. However, this may be an artifact of only one assessment site being located in this community.

### **5.3.1 EPBC Act listed flora**

No flora species, listed under the EPBC Act, were identified during the field surveys or are considered likely to occur within the study area (refer Appendix I).

### **5.3.2 NC Act listed flora**

No threatened flora species were recorded from the study area or are considered likely to occur (refer Appendix I). Small populations of *Bertya pedicellata* (near threatened under the NC Act) were identified during the field surveys in RE 11.7.2 in lateritic jump-ups in the eastern part of the study area (Figure 11). Near threatened species do not have any specific statutory protection. The populations of *Bertya pedicellata* are located in the eastern part of the study area, well beyond the area proposed to be cleared.

## **5.4 Exotic flora species**

### **5.4.1 Nationally declared species**

The ranking criteria for 'Weeds of National Significance' (WoNS) is based on assessments of the weed's invasiveness, economic, social and environmental impacts, the potential for spread and socio-economic (such as impacts on health, fire risk, and recreational values of land) and environmental values. There is no legislated requirement for the control of WoNS – this task is primarily a state and local government responsibility.

Six WoNS, were identified during the field surveys as follows:

- Rubber Vine (\**Cryptostegia grandiflora*)
- Bellyache Bush (\**Jatropha gossypifolia*)

- Tiger Pear (\**Opuntia aurantiaca*)
- Common Prickly Pear (\**Opuntia stricta*)
- Velvety Tree Pear (\**Opuntia tomentosa*)
- Parthenium Weed (\**Parthenium hysterophorus*).

Figure 12 provides locations of infestations of these species recorded during the field surveys. However, it should be noted that these records do not represent an exhaustive audit of their location across the study area.

Velvety Tree Pear and Parthenium Weed were most commonly encountered, although Velvety Tree Pear generally occurred in low densities compared with Parthenium Weed. Parthenium Weed occurred as small isolated patches or individuals and also as moderately sized populations, in the mixed eucalypt riparian woodland.

The Tiger Pear and Common Prickly Pear were rarely encountered, having been recorded at only one location each within the project site.

Bellyache Bush was recorded as scattered juvenile specimens in the western extent of Billy's Gully. Rubber Vine was also recorded at this location.

#### 5.4.2 State declared species

At a State level, the Biosecurity Act provides a framework and powers for improved management of pest plants, under which control of pest plants by land owners is enforceable. Seven State restricted exotic species were recorded during the field surveys and are summarised in Table 13. Six of these are also listed WoNS and discussed in Section 5.4.1. The locations of declared weed species are illustrated in Figure 12.

**Table 13: State declared pests in the project site**

Species	Common Name	WoNS	Biosecurity Act	Regional Ecosystems recorded within
* <i>Cryptostegia grandiflora</i>	Rubber Vine	WoNS	Category 3	11.3.25
* <i>Harrisia martinii</i>	Harrisia Cactus	-	Category 3	11.3.25, 11.5.3, 11.5.12, 11.8.5, 11.9.7a
* <i>Jatropha gossypifolia</i>	Bellyache bush	WoNS	Category 3	11.3.25
* <i>Opuntia aurantiaca</i>	Tiger Pear	WoNS	Category 3	11.9.7a
* <i>Opuntia stricta</i>	Common Prickly Pear	WoNS	Category 3	11.3.25
* <i>Opuntia tomentosa</i>	Velvety Tree Pear	WoNS	Category 3	11.3.25, 11.5.3, 11.5.12, 11.7.2, 11.8.5
* <i>Parthenium hysterophorus</i>	Parthenium Weed	WoNS	Category 3	11.3.25, 11.7.2, 11.8.5

#### 5.4.3 Non-declared species

A total of 38 non-declared exotic species were recorded in the project site. Buffel Grass was common throughout the study area, and present in all vegetation

communities. Shrubby Stylo (*\*Stylosanthes scabra*), Green Panic, Indian Bluegrass, Red Natal Grass (*\*Melinis repens*), Pigweed (*\*Portulaca oleracea*) and Sabi Grass (*\*Urochloa mosambicensis*) were also commonly encountered throughout the study area.

## 6 Field fauna results

### 6.1 Habitat and landscape connectivity

The maintenance of landscape connectivity between patches of habitat is a fundamental aspect of conservation ecology (Endler 1977 Forman 1995). Habitat corridors are often recommended to maintain and/or enhance landscape connectivity (Bennett et al. 1999).

The study area supports a mosaic of remnant vegetation, disturbed vegetation communities and cleared areas. Current and historical disturbance in the form of clearing for agricultural land use, thinning, timber cutting and grazing is evident across the study area.

The watercourses in the study area are mapped as providing connectivity of either state or regional significance (Figure 9). The remainder of remnant communities in the study area, while providing habitat and opportunities for dispersal in the landscape, are less important for connectivity because of the fragmentation between patches and the intervening areas of cleared land, particularly to the south and west.

### 6.2 Habitat assessment

The quality of fauna habitat throughout the study area is typically poor, as the majority of the area has been cleared for cattle grazing. Figure 13 shows the extent of cleared areas. The study area can be divided into the following four broad habitat types (shown in Figure 13):

- remnant vegetation communities comprising:
  - woodlands and open woodlands
  - lancewood with emergent gums
  - riparian vegetation
- areas of non-remnant vegetation comprising regenerating shrubby woodland with emergent gums.

The values of these habitat types are described below.

#### Woodlands and open woodlands

*Eucalyptus* and *Corymbia* dominant woodland communities throughout the study area were considered to be of moderate habitat quality. Mature hollow-bearing trees were moderately abundant and the diversity of ground layer habitat was varied. In some areas there was a moderate abundance of fallen timber (e.g. RE 11.5.12) and native grasses and rocky habitat features (e.g. RE 11.8.5), whereas in many areas fallen timber was sparse and there was a dominance of exotic grasses, particularly Buffel Grass.

All woodland habitats were found to meet remnant status under the VM Act.

### **Lancewood with emergent gums**

Lancewood habitat (RE 11.7.2) was considered to be of high habitat value in the study area due to the moderate to high level of fallen timber, moderate level of leaf litter and generally low weed cover. Substantial surface rocks and boulders were present on scarp edges and slopes, which provide an increased diversity of habitat features. Large hollow-bearing trees were sparse. Emergent gums were present in the form of Clarkson's Bloodwood and Carbeen.

### **Riparian vegetation**

Riparian vegetation within the study area fringing Smoky Creek and its unnamed tributary, as well as Billy's Gully, has moderate habitat value. These communities had a moderate cover of fallen timber and a moderate abundance of hollow bearing trees. However, there was generally a low cover of deep leaf litter and the ground layer was typically dominated by exotic grasses and herbs. Agricultural clearing was evident along some stretches of watercourses up to the high bank of these communities, with a reduced width of vegetation in these areas. This habitat type included a small area of floodplain (RE 11.3.4), which would likely become inundated during high flow events through the unnamed tributary of Smoky Creek.

### **Regenerating shrubby woodland with emergent gums**

This habitat area was considered to be of low to moderate habitat value. It has been historically cleared and now comprises regenerating Quinine Bush, Bitter Bark and Red Ash, which forms a dense shrubland. Emergent Clarkson's Bloodwood and Narrow-leaved Red Ironbark were present. There were only limited tree hollows in this habitat area and the hollows were generally of a small diameter. This area supported a moderate leaf litter and mix of native and exotic grasses.

### ***Cleared and disturbed areas***

Expansive areas of the study area have been cleared or substantially disturbed to the extent that they no longer support remnant vegetation. These areas support open exotic pasture with some patches of low shrubby growth or individual native trees, which does not comprise sufficient height or canopy cover to meet remnant status. These areas are considered to be of low habitat value for fauna as they lack many habitat elements such as fallen timber, deep leaf litter or hollow bearing trees. These areas provide suitable habitat for generalist species that are able to adapt to such highly modified environments, and may occasionally be occupied by other more mobile species.

## **6.3 Fauna diversity**

A total of 152 species of terrestrial vertebrate fauna were recorded during the field surveys, including 5 introduced species. Native species included 89 birds, 27 mammals, 28 reptiles and 8 amphibians. A complete list of species recorded is provided in Appendix M.

Species diversity was similar at most trap sites, with site T3 exhibiting greatest diversity and site T1 with the least number of species recorded. The location of the trap sites is shown on Figure 5. Site T3 was located in Poplar Box and Dawson River Gum woodland (RE 11.9.7a) with 37 species recorded, whereas site T1 was in Lancewood woodland on a lateritic jump-up (RE 11.7.2) with only 19 species recorded. Site T2 was located within Poplar Box woodland (RE 11.5.3) and Trap Site T4 was in mixed eucalypt riparian woodland (RE 11.3.25) with 20 species recorded at each site. Trap site T5 recorded 24 species in Mountain Coolabah woodland (RE 11.8.5), site T6 recorded the second highest number of species, 30, in mixed eucalypt riparian woodland (RE 11.3.25), site T7 recorded 26 species in Clarkson's Bloodwood woodland (RE 11.5.12) and site T8 recorded 29 species in Poplar Box woodland (RE 11.5.3) (Figures 5 and 10).

### **6.3.1 Amphibians**

Field surveys recorded 8 amphibian species, including the introduced Cane Toad (*\*Rhinella marina*). This introduced species was not recorded at any of the eight trap sites, but was recorded at three of the supplementary sites (Appendix M). The majority of species were recorded during the wet season survey at trap sites T5, T6, T7 and T8 and supplementary sites S16, S20 and S21.

The most commonly occurring native amphibians recorded were the Knife-footed Frog (*Cyclorana cultripes*) and Ornate Burrowing Frog (*Platyplectrum ornatum*) (Appendix M).

No threatened or near threatened amphibian species were recorded within the study area, and none are considered likely to occur based on the available habitat present.

### **6.3.2 Reptiles**

Habitat quality for reptiles is strongly influenced by attributes such as leaf litter, fallen logs and debris. The loss of these habitat elements very often occurs in disturbed environments and often leads to reductions in both diversity and abundance of reptiles.

The remnant areas of the study area provide moderate habitat quality for reptiles, with a generally low cover of deep leaf litter and fallen timber and a variable groundcover. However, some areas, for example on land zones 3, 7 and 8 have a diversity of habitats in the ground layer with a high cover of surface rock.

Field surveys recorded 28 reptile species with Bynoe's Gecko (*Heteronotia binoei*), Open-litter Rainbow-skink (*Carlia pectoralis*), South-eastern Morethia Skink (*Morethia boulengeri*), and Ragged Snake-eyed Skink (*Cryptoblepharus pannosus*) most commonly recorded (Appendix M).

The Ornamental Snake, which is listed as vulnerable under both the EPBC Act and NC Act, was recorded in the study area in cleared and disturbed habitat. Further discussion regarding the Ornamental Snake is provided in Section 6.4.1.



No other threatened or near-threatened reptiles are considered likely to occur in the study area.

### **6.3.3 Birds**

A total of 89 birds were identified during field surveys (Appendix M). The most commonly recorded species was the Torresian Crow (*Corvus orru*), Noisy Friarbird (*Philemon corniculatus*), Galah (*Eolophus roseicapillus*), Australian Magpie (*Cracticus tibicen*), Rainbow Bee-eater (*Merops ornatus*) and Pale-headed Rosella (*Platycercus adscitus*). Site T6 provided the greatest diversity of birds, with 21 species recorded in this mixed eucalypt riparian woodland.

The Squatter Pigeon, which is listed as vulnerable under both the EPBC Act and NC Act, was the only threatened bird species recorded in the study area. No other threatened or near-threatened birds are considered to potentially occur within the study area as outlined in Appendix J. Further discussion regarding the Squatter Pigeon is provided in Section 6.4.1.

The Rufous Fantail (*Rhipidura rufifrons*) and Black-faced Monarch (*Monarcha melanopsis*), which are listed as migratory under the EPBC Act, and special least concern (migratory) under the NC Act, were the only other significant bird species recorded in the study area. These species and the likelihood of other migratory birds potentially occurring within study area is discussed in Section 6.4.2.

### **6.3.4 Mammals**

A total of 27 mammal species were recorded during field surveys, including 16 species of microchiropteran bat. The most commonly recorded mammals were the Common Brushtail Possum (*Trichosurus vulpecula*), Little Pied Bat (*Chalinolobus picatus*), Yellow-bellied Sheath-tailed Bat (*Saccolaimus flaviventris*), Eastern Cave Bat (*Vespadelus troughtoni*), Gould's Wattled Bat (*Chalinolobus gouldii*) and a broad-nosed bat (*Scotorepens greyii/sanborni*). The Eastern Grey Kangaroo (*Macropus giganteus*) was the most frequently recorded native ground-dwelling mammal (Appendix M).

The Greater Glider was the only threatened mammal species recorded within the study area and is listed as vulnerable under the EPBC Act. The Greater Glider was recorded at five locations in the project site, in mixed eucalypt riparian woodland along both Smoky Creek and Billy's Gully.

The Short-beaked Echidna, which is listed as special least concern under the NC Act, was recorded in the study area. One individual was recorded from Poplar Box woodland (RE 11.5.3) at supplementary site S7 and scats of this species were recorded at sites S1 and S8 in woodland communities (REs 11.5.8 and ecotone between 11.58b/11.5.12, respectively).

One other threatened mammal species, the Koala (listed as vulnerable under the NC Act and EPBC Act), which was not recorded during field surveys, is considered likely to occur in the study area, particularly in riparian areas, due to its known presence in the broader Moranbah region and suitable habitat being present.

These species are discussed further in Sections 6.4.1 and 6.4.3.

The following four feral mammals were recorded:

- Feral Cat (*\*Felis catus*)
- Domestic Dog (*\*Canis lupus*)
- House Mouse (*\*Mus musculus*)
- European Rabbit (*\*Oryctolagus cuniculus*).

Feral animals are discussed further in Section 6.5.

## **6.4 Threatened and migratory fauna species**

### **6.4.1 EPBC Act listed threatened fauna**

The following three EPBC Act listed threatened fauna species were identified within the study area during field surveys:

- Squatter Pigeon (Southern) (vulnerable)
- Greater Glider (vulnerable)
- Ornamental Snake (vulnerable).

Based on a review of database search results and habitat identified in the study area, an assessment of the likelihood of other EPBC Act listed threatened species occurring in the study area has been undertaken, and is provided in Appendix M. This assessment identified one additional listed threatened species that is considered to likely to occur within the study area, namely:

- Koala (vulnerable).

The four species listed above are discussed in more detail in the following sections.

### ***Species recorded within the study area***

#### **Squatter Pigeon (Southern)**

##### *Species overview*

The Squatter Pigeon (southern subspecies) is listed as vulnerable under the EPBC Act and NC Act. This species is known to inhabit tropical dry, open sclerophyll woodlands and occasionally open savannah. It appears to favour sandy soil dissected with low gravelly ridges and is less common on heavy soils with dense grass cover. It is nearly always found in close association with permanent water (Higgins and Davies 1996). This species is also often recorded from areas that do not support remnant vegetation, but in these areas it seems to be associated with clear, disturbed sites such as tracks and stockyards (DotE 2016d); S. Marston Pers. obs.). These habitat areas are likely to provide breeding, foraging and dispersal habitat.

##### *Presence and habitat within the study area*

PRESENT

Squatter Pigeons were recorded frequently throughout the study area during both survey periods (Figure 14). Recorded locations comprised both remnant vegetation and cleared areas, often along dirt vehicle tracks and usually within approximately 1 km of a dam. Water sources that still contained water at the time of the October 2015 (dry season) survey were considered permanent water points (typically farm dams) for the purpose of mapping Squatter Pigeon habitat.

As detailed in Section 3.3.10, habitat mapping for the Squatter Pigeon (Figure 14) within the study area has been undertaken in accordance with the Red Hill Project EPBC Act approval definition. Habitat is categorised as follows:

- Suitable Habitat – grassy woodland habitat in REs on land zones 3, 5 or 7, which are either: within 1 km of a permanent water body; or within 1 km of a Queensland Government mapped wetland or  $\geq 3^{\text{rd}}$  order stream (DotE 2015a).
- Unsuitable Habitat – The Squatter Pigeon is considered unlikely to breed or forage elsewhere in the study area due to the proximity of water sources, the presence of unsuitable soils or groundcover. The Squatter Pigeon is noted as being less common in dense vegetation and vegetation with dense grass cover (Higgins and Davies 1996). This would largely preclude the cleared and disturbed areas due to the dominance of Buffel Grass in the groundcover layer. Therefore, all other areas of the study area are mapped as being generally unsuitable for this species except for dispersal purposes.

Based on this definition, there are 181.5 ha of suitable habitat for the Squatter Pigeon in the study area.

## **Greater Glider**

### *Species overview*

The Greater Glider is listed as vulnerable under the EPBC Act and least concern under the NC Act. The Greater Glider is a nocturnal species and uses tree hollows during the day to rest (van Dyck and Strahan 2008a). It may glide over distances of up to 100 m, however, it appears to have low dispersal ability and typically small home ranges of 1-4 ha. The species has an almost exclusive diet of eucalypt leaves and occasionally flowers or buds (TSSC 2016a van Dyck and Strahan 2008a). Although it is known to feed on a range of eucalypt species, it is likely to only forage on one or two species (van Dyck and Strahan 2008a).

The Greater Glider occurs in a range of eucalypt-dominated habitats, including low open forests on the coast to tall forests in the ranges and low woodland westwards of the Dividing Range. It does not use rainforest habitats (van Dyck et al. 2013 van Dyck and Strahan 2008a). This species favours taller, montane, moist eucalypt forests with relatively old trees and abundant hollows and a diversity of eucalypt species (TSSC 2016a).

### *Presence and habitat within the study area*

PRESENT

This species was identified at five locations in the study area, along Smoky Creek and Billy's Gully in mixed eucalypt riparian woodland (RE 11.3.25) (Figure 15).

The approved conservation advice for this species (TSSC 2016a) indicates that taller, moist eucalypt forest with relatively old trees and abundant hollows and a diversity of eucalypt species is favoured by this species. Using this description and in consideration of the communities in which the Greater Glider was observed in the study area and in other surveys conducted throughout Central Queensland, the riparian and alluvial communities are considered to provide suitable habitat for this species. These communities are considered to provide the greatest availability of large old hollow-bearing trees and provide the greatest connectivity with larger patches of remnant vegetation in the landscape.

As detailed in Section 3.3.10, habitat mapping for the Greater Glider (Figure 15) within the study area has been undertaken in accordance with information contained in the conservation advice for this species. Habitat is categorised as follows:

- Suitable Habitat – In line with TSSC conservation advice, remnant riparian and alluvial REs 11.3.2, 11.3.4 and 11.3.25 provide habitat.
- Unsuitable Habitat – The Greater Glider is considered unlikely to be present within other vegetation types in the study area as these lack large, old hollow-bearing trees and a diversity of Eucalypt species. Therefore, these areas are mapped as being generally unsuitable for this species.

Based on this definition, there are 49.8 ha of suitable habitat for the Greater Glider in the study area.

## **Ornamental Snake**

### *Species overview*

The Ornamental Snake is listed as vulnerable under the EPBC Act and NC Act. The Ornamental Snake is found in close association with frogs, which form the majority of its prey. It is known to prefer woodlands and open forests associated with moist areas, particularly gilgai (melon-hole) mounds and depressions with clay soils but is also known from lake margins, wetlands and waterways (DotE 2016e).

The SPRAT Profile and Draft Referral Guidelines for the nationally listed Brigalow Belt reptiles specifically describe 'pure grassland associated with gilgais' and 'cleared areas formerly mapped as open-forests to woodlands associated with gilgai formations and wetlands i.e. REs 11.3.3, 11.4.3, 11.4.6, 11.4.8, 11.4.9 and 11.5.16' as suitable habitat for this species (DotE 2016e SEWPaC 2011c).

The Ornamental Snake requires microhabitat features such as cracking clay soils, rotting logs or stumps, coarse woody debris, leaf litter or surface rock. These features are required because they either support the prey food of this

species (i.e. frogs) or provide refuge habitat for the Ornamental Snake (DotE 2016e).

#### *Presence and habitat within the study area*

#### PRESENT

One individual of the Ornamental Snake was detected in the study area during the wet season survey. This individual was recorded on a vehicle track in a cleared area characterised by introduced species (Buffel Grass) and weeds (Parthenium) (Figure 16). No gilgai or wetland habitats were recorded at this location, or indeed anywhere else within in the project site. The area in which the individual was recorded, did not support any suitable microhabitat features such as cracking clay soils, rotting logs or stumps, coarse woody debris, leaf litter or surface rock.

The location where the individual was recorded is approximately 400 m south of Smoky Creek (which has the potential to provide habitat for the Ornamental Snake). The observed record is likely a dispersing individual.

As noted in Section 3.3.10, the Red Hill EPBC Act approval (DotE 2015a) provides a habitat definition for the Ornamental Snake, as follows:

- woodland or open forest habitat, which is included within any Queensland RE on Land Zone 4 and supports gilgai (melon-hole) mounds and depressions; or
- woodland or open forest habitat, which is included within any Queensland RE on Land Zone 3 or 4, or an area of mapped regrowth on Land Zone 3 or 4, which is within 200 m of a mapped wetland or a  $\geq$ fourth order stream (as mapped by the Queensland Government) and supports an abundance of fallen logs ( $>30$  cm in diameter) of  $>10$  per 100 m x 100 m sample plot.

There are no gilgai or wetlands within the project site, nor are there any areas of Land Zone 4. Smoky Creek is, however, mapped as a fourth order stream and so has some potential to provide habitat. The vegetation within 200m of Smoky Creek was therefore assessed against the definition of Ornamental Snake habitat provide by DotE in the Red Hill EPBC Act approval. In general, it was found that along Smoky Creek, the cover of fallen logs  $>30$  cm in diameter was substantially lower than 10 per hectare. The vegetation along Smoky Creek does not therefore meet the definition of Ornamental Snake habitat for the purpose of this assessment.

It should also be noted that the study area would also not meet the definition of Ornamental Snake habitat outlined in SPRAT profile and Draft Referral Guidelines (DotE 2016e SEWPaC 2011c), given that there are no gilgais and no vegetation representing REs 11.3.3, 11.4.3, 11.4.6, 11.4.8, 11.4.9 or 11.5.16.

It is therefore considered that there is no suitable habitat in the study area that could sustain a population of this species, and that the observed record is likely a dispersing individual, moving between preferred habitat areas elsewhere, but nearby the study area.

## ***Species assessed as likely to occur in the study area***

### **Koala**

#### *Species overview*

The Koala is listed as vulnerable under the EPBC Act and NC Act. It is widespread in sclerophyll forest and woodland on foothills and plains on both sides of the Great Dividing Range from about Chillagoe, Queensland to Mt Lofty Ranges in South Australia (Menkhorst and Knight 2011).

Any forest or woodland containing species that are known Koala food trees, or shrubland with emergent food trees provides potential Koala habitat. Koalas are known to occur in modified or regenerating native vegetation communities, and are not restricted to remnant vegetation (DotE 2016f). The EPBC Act referral guidelines for the vulnerable Koala defines Koala food trees as those of the following genus: *Angophora*, *Corymbia*, *Eucalyptus*, *Lophostemon* and *Melaleuca*. The guideline also notes that 'primary' and 'secondary' food trees may be referred to in other state or Commonwealth guidelines or policies, however, all are considered to be food trees for the purposes of the EPBC Act referral guidelines for the vulnerable Koala (DotE 2014).

#### *Likelihood of occurrence with the study area*

HIGH (refer Appendix J)

The Koala was listed as occurring in the region in database searches (Wildlife Online and the Protected Matters Search Tool). This species or evidence of the species has been recorded in recent EIS field surveys undertaken in proximity to the study area, including:

- Integrated Isaac Plains Project EIS – the Integrated Isaac Plains project site was located approximately 8 km to the south of the study area (note this project has been withdrawn since the publication of the EIS)
- Moranbah South Project EIS – the Moranbah South project site is located approximately 4 km to the south of the study area
- Red Hill Project EIS- the Red Hill project site is located approximately 17 km to the north-west of the study area
- Caval Ridge Project EIS – the Caval Ridge ML is located approximately 11 km to the south-west of the study area.

The location of these mines and projects is shown on Figure 3.

The Koala was not identified in the study area during surveys. The EPBC Act referral guidelines for the vulnerable Koala (DotE 2014) explain, however, that "*Koalas do not necessarily have to be present*" for Koala habitat to be present. The definition of Koala habitat is based on the vegetation community present and the vegetation structure. Based on the habitat definitions contained in these guidelines and the records of the species from the region, the Koala has been assessed as having a high probability of occurrence. This rating is based on:

- The presence of suitable habitat within the study area in the form of woodland vegetation that contains Koala food trees, as defined in the EPBC Act referral guidelines for the vulnerable Koala (DotE 2014).
- A connection between this habitat and habitat in the region where the Koala has been recorded. The Koala has been recorded during field surveys undertaken for a number of other mining projects located within 10 km of the study area (i.e. Grosvenor Project, Integrated Isaac Plains Project, Moranbah South Project, Red Hill Project). The riparian vegetation within the study area provides a connection between these project sites and the Isaac Plains East Project.
- The Koala's ability to move between habitat areas, including its willingness to traverse rural landscapes, modified and disturbed areas in search of habitat (DotE 2016f).

#### *Potential habitat within the study area*

As detailed in Section 3.3.10, habitat mapping for the Koala (Figure 17) within the study area has been undertaken in accordance with the Red Hill Project EPBC Act approval definition (DotE 2015a). Habitat is categorised as follows:

- Suitable Habitat – any forest or woodland containing species that are Koala food trees, or any shrubland with emergent Koala food trees (i.e., trees of any of the following genera: *Angophora*, *Corymbia*, *Eucalyptus*, *Lophostemon*, *Melaleuca*).
- Unsuitable Habitat – Cleared areas, Brigalow and SEVT vegetation types are considered to be generally unsuitable habitat for the Koala.

All of the areas of remnant vegetation within the study area, and particularly the riparian corridors of Billy's Gully and Smoky Creek, are considered to provide habitat for the Koala due to the presence of the Koala feed trees, namely:

- RE 11.3.2 – Carbeen (*Corymbia tessellaris*), Poplar Box (*Eucalyptus populnea*)
- RE 11.3.4 – Carbeen, Poplar Box, River Red Gum (*Eucalyptus camaldulensis* var. *obtusata*) and Queensland Blue Gum (*Eucalyptus tereticornis* subsp. *tereticornis*)
- RE 11.3.25 – Carbeen, Poplar Box, River Red Gum, Queensland Blue Gum, Long-fruited Bloodwood (*Corymbia clarksoniana*), Dallachy's Gum (*Corymbia dallachiana*), Narrow-leaved Red Ironbark (*Eucalyptus crebra*) and Black Tea Tree (*Melaleuca bracteata*)
- RE 11.5.3 – Poplar Box and Narrow-leaved Red Ironbark
- RE 11.5.8b – Poplar Box, Queensland Blue Gum, Long-fruited Bloodwood, Dallachy's Gum, Narrow-leaved Red Ironbark, Poplar Gum (*Eucalyptus platyphylla*) and Yellow-barked Paperbark (*Melaleuca nervosa*)
- RE 11.5.9 – Long-fruited Bloodwood, Dallachy's Gum and Narrow-leaved Red Ironbark
- RE 11.5.12 - Carbeen, Poplar Box, Long-fruited Bloodwood and Yellow-barked Paperbark

- RE 11.7.2 – Carbeen, Long-fruited Bloodwood and Narrow-leaved Red Ironbark
- RE 11.8.5 - Mountain Coolabah (*Eucalyptus orgadophila*) and Variable-barked Bloodwood (*Corymbia erythrophloia*)
- RE 11.9.7a – Poplar Box.

In addition, some areas of non-remnant habitat with emergent gums (such as Narrow-leaved Red Ironbark) are considered potential habitat for this species.

Figure 17 shows areas that have been mapped as suitable habitat. There are 380.1 ha of suitable habitat for the Koala in the study area.

The habitat within the study area has been assessed using the Koala Habitat Assessment Tool in the EPBC Act referral guidelines for the vulnerable Koala (DotE 2014). As outlined in Appendix N, it has been determined that the study area is considered to support habitat critical to the survival of the Koala, with the main factors contributing to this assessment being:

- The habitat in the study area supports 12 potential feed tree species for the Koala
- The habitat in the study area is contiguous with more than 1,000 ha of habitat in the surrounding area
- The remnant vegetation along watercourses in the study area is likely to provide refuge habitat for the Koala, meaning that it may be important for achieving the interim recovery objectives for the Koala.

#### **6.4.2 EPBC Act listed migratory fauna**

Two species listed as migratory under the EPBC Act were identified in the study area during the field survey, namely:

- Black-faced Monarch
- Rufous Fantail.

Based on a review of database search results and habitat identified in the study area, an assessment of the likelihood of other EPBC Act listed migratory species occurring in the study area has been undertaken, and is provided in Appendix J. This assessment identified an additional two listed migratory bird species that are considered to have a moderate potential to occur within the study area. These species are:

- Fork-tailed Swift (*Apus pacificus*)
- White-throated Needletail (*Hirundapus caudacutus*).

The four species listed above are discussed in more detail in the following sections. All remnant vegetation in the study area potentially provide habitat, to some extent, for these species and are preferred over cleared or heavily disturbed areas due to the structural diversity of habitats in remnant areas. However, cleared areas may provide foraging habitat for the White-throated Needle-tail and Fork-tailed Swift as these are predominantly aerial species.



## ***Species recorded within the study area***

### **Black-faced Monarch**

#### *Species overview*

This species occurs in rainforest, eucalypt woodlands and forest (mainly wet sclerophyll), coastal scrubs and rainforest gullies with a dense understorey of ferns and/or shrubs (DotE 2016g, 2015b Pizzey et al. 2012). These habitat communities are described as important habitat under the EPBC Act (DotE 2015b). In Queensland this species occurs generally on the eastern slopes of the Great Divide and occasionally further inland (DotE 2016g).

#### *Presence within the study area*

#### PRESENT

This species was recorded at one location in the study area, in mixed eucalypt riparian woodland along Smoky Creek (RE 11.3.25) during a bird survey. This bird species is likely to use the riparian and alluvial habitat of the study area and may forage in adjacent woodland areas at times. However, this species is only occasionally recorded on the western side of the Great Divide and is considered likely to be an occasional visitor to the Moranbah region. It is considered unlikely that the study area provides important habitat for this species as the habitat is homogenous in the surrounding landscape and would be unlikely to form important breeding habitat for this species.

### **Rufous Fantail**

#### *Species overview*

The Rufous Fantail is typically found in rainforest, wet eucalypt forests, monsoon forests, paperbarks, sub-inland and coastal scrubs, mangroves, watercourses, and parks (Pizzey et al. 2012). Important habitat under the EPBC Act is described as moist, dense habitats, including mangroves, rainforest, riparian forests and thickets, and wet eucalypt forests with a dense understorey. A wider range of habitats are used when migrating, including dry eucalypt forests and woodlands and Brigalow shrublands (DotE 2015b).

#### *Presence within the study area*

#### PRESENT

The Rufous Fantail was recorded at one location in the study area during field surveys, in Lancewood woodland (RE 11.7.2), while undertaking a bird survey. It is considered unusual that this species was recorded during the field surveys given the drier habitat types present in the study area. It is likely that the individual recorded was using the study area while in migration. The study area is unlikely to provide important habitat for this species due to the lack of dense, wet and rainforest environments.

## ***Species assessed as having a moderate potential to occur in the study area***

### **White-throated Needletail**

#### *Species overview*

This species is almost exclusively aerial and occurs over forests, woodlands, farmlands, plains, lakes and towns (Pizzey et al. 2012). It is known from above mainly wooded areas, and larger tracts of vegetation, particularly forest. The species roosts in tree hollows in tall trees on ridge-tops, on bark or rock faces and it is thought to have traditional roost sites (DotE 2015b). Large tracts of forest vegetation and breeding habitat is considered important in Australia (DotE 2015b).

The nearest record of this species is approximately 22 km east of the north-eastern corner of the study area (BirdLife Australia 2015a).

#### *Likelihood of occurrence in the study area*

MODERATE (refer Appendix J)

This species was not recorded during the field surveys. There is a moderate likelihood that the White-throated Needletail could overfly the study area as part of a wider foraging range. There is no evidence of traditional roost sites within the study area.

The study area is unlikely to provide important habitat for this species because of the fragmented nature of habitats in the local landscape and the more intact remnant areas present to the north and south, associated with the Denham, Peak Ranges, Carborough and Kerlong Ranges.

### **Fork-tailed Swift**

#### *Species overview*

The Fork-tailed Swift is a non-breeding visitor to Australia and is almost exclusively aerial (DotE 2016h). The species is an aerial forager typically over open habitats however, sometimes occurs above rainforests, wet sclerophyll forest or pine plantations and cities (DotE 2016h Pizzey et al. 2012).

The closest record of this species, is approximately 20 km to the north-west of the study area (BirdLife Australia 2015a).

#### *Likelihood of occurrence within the study area*

MODERATE (refer Appendix J)

This species was not recorded during the field surveys. There is a moderate likelihood that the Fork-tailed Swift could overfly the study area as part of a wider foraging range. However, it is considered unlikely that the study area provides important habitat for this species as the habitat is homogenous in the surrounding landscape and would be unlikely to form important breeding habitat for this species.

### **6.4.3 NC Act listed fauna**

Two vulnerable and one special least concern fauna species listed under the NC Act have been recorded in the study area, namely the Squatter Pigeon (Southern), Ornamental Snake, and the Short-beaked Echidna. Another vulnerable species under the NC Act, the Koala, is considered likely to occur in the study area. The Squatter Pigeon, Ornamental Snake and Koala are also listed under the EPBC Act, and an overview of these species and suitable habitat within the study area is discussed in Section 6.4.1. The Short-beaked Echidna and other special least concern species are discussed below.

The likelihood of NC Act listed significant fauna species identified in database searches to occur in the study area is presented in Appendix J.

#### ***Special least concern fauna species***

One special least concern fauna species listed under the NC Act was recorded during the field surveys, namely the Short-beaked Echidna.

Four special least concern migratory species were recorded or assessed as having a moderate likelihood of occurring in the study area, namely the Black-faced Monarch, Rufous Fantail, White-throated Needletail, and Fork-tailed Swift. These species are also listed as migratory under the EPBC Act, and an overview of these species and suitable habitat within the study area are discussed in Section 6.4.2. Special least concern migratory bird species that are not listed under the migratory provisions of the EPBC Act, are not MSES or MNES as defined under the EO Act and will therefore not be discussed further.

An overview of the Short-beaked Echidna and presence of suitable habitat within the study area is provided below.

#### **Short-beaked Echidna**

##### *Species overview*

The Short-beaked Echidna occurs in almost all terrestrial habitats except intensively managed farmland. It shelters in logs, crevices, burrows or piles of litter and feeds on ants, termites and other soil invertebrates, particularly beetle larvae (Menkhorst and Knight 2011).

##### *Presence and habitat in the study area*

PRESENT

This species or evidence of this species was recorded at three locations in cleared and vegetated areas in the study area. While this species is likely to use all areas of the study area for dispersal, remnant vegetation communities are considered to provide more favourable habitat due to the presence of foraging resources such as hollow logs and leaf litter. Approximately 345.2 ha of foraging habitat is present in the study area for this species.

## 6.5 Feral animals

Five feral animals were recorded during the field surveys (Appendix M). These species are listed under the Queensland Biosecurity Act (refer Section 2.4). Table 14 provides a description of the presence of feral animals in the study area.

**Table 14: Feral animals in the study area**

Species	Biosecurity Act	Abundance and occurrence in the study area
Cane Toad ( <i>*Rhinella marina</i> )	GBO	The Cane Toad was recorded at 3 of the 25 supplementary sites, and opportunistically throughout the project site.
Feral Cat ( <i>*Felis catus</i> )	Categories 3, 4 and 6	This species was recorded incidentally during drive spotlighting, as well as on an infrared camera at trap site T3. It was also recorded at infrared camera site 2.
Dog ( <i>*Canis lupus</i> )	Categories 3, 4 and 6	Evidence of this species was recorded at trap site T4 and also supplementary site 19.
House Mouse ( <i>*Mus musculus</i> )	GBO	One individual was recorded in a pitfall trap at Trap Site T1.
European Rabbit ( <i>*Oryctolagus cuniculus</i> )	Categories 3, 4, 5 and 6	The European Rabbit was recorded incidentally throughout the project sites as well as at 3 of the 8 trap sites and 4 of the 25 supplementary sites.

## 7 Impact assessment

### 7.1 Introduction

This section presents an assessment of the likely impacts of the project on terrestrial ecology with a focus on threatened vegetation communities and flora and fauna species listed under the EPBC Act and NC Act.

The following impacts were considered in the assessment:

- direct impacts from vegetation clearing (Section 7.2)
- indirect impacts such as the effects of noise and vibration, vehicle strike, lighting, dust, erosion and sedimentation, and the introduction or spread of invasive species (Section 7.3).

Assessments of significance have been conducted for each species as per the criteria presented in Table 7, and these are provided in Appendices O and P. The assessments consider both the direct and indirect impacts of the project, and were undertaken in accordance with the EPBC Act Policy Statement 1.1 Significant Impact Guidelines (DotE 2013) and the SRI Guideline (EHP 2014a), where relevant to Commonwealth or State listed matters.

### 7.2 Direct impacts

The project layout and disturbance footprint is shown in Figure 2. The project involves clearing of areas of remnant and non-remnant vegetation for open cut mining activities, including for the construction of five open cut pits, overburden emplacement areas, and ROM stockpile areas. Haul roads connecting each of the proposed pits to the existing Isaac Plains Mine road network are also required to be constructed. Clearing along the haul road connections will typically be up to 80 m wide, to allow for construction of the haul road and associated activities. Two haul road crossings are required to be constructed over Billy's Gully and Smoky Creek Northern Tributary.

The proposed disturbance footprint, which covers an area of 611.5 ha, has been configured in a manner that avoids impacts to remnant vegetation, and significant fauna habitat as far as practical. For example, the width of clearing for haul roads will be reduced to approximately 40 m in the vicinity of watercourses and associated riparian vegetation, to minimise the extent of clearing remnant vegetation and associated fauna habitat through these areas. In areas where impacts to vegetation communities, flora species and fauna habitat cannot be avoided, control measures have been designed to minimise impacts on vegetation and habitat as far as practical. These measures are discussed further in Section 8. Clearing will be undertaken gradually over a period of approximately seven years as each open cut pit is progressed and disturbed areas will be rehabilitated once mining has been completed.

Clearing for mining activities will be undertaken gradually over a period of approximately seven years as each open cut pit is progressed. Clearing will cause a direct impact by removing areas of vegetation that may also support habitat features for threatened species.

The vegetation communities within the study area support a range of habitat features, including features which create foraging, shelter and breeding opportunities. However, despite the project resulting in the removal of areas of habitat, extensive areas of land containing similar habitat occurs both within the remainder of the study area and in areas adjacent to the study area. It is anticipated that the types of species utilising the habitat within the disturbance footprint will continue to persist in these adjacent areas where suitable habitat is present. It is also worth noting that vegetation clearing will be undertaken gradually over the seven year life of the project, which will minimise the overall disturbance to habitat areas.

In addition, rehabilitation of mined areas will occur progressively following mining, which will reinstate habitat resources for fauna species (discussed further in Section 8.2.3). The objective of the rehabilitation is to create a stable landform with a self-sustaining vegetation cover for either bushland or grazing land uses, which is similar to current land uses within the study area.

### **7.2.1 Impacts to vegetation communities**

This section provides an assessment of the impacts to vegetation communities that will result from the project.

Approximately 122.3 ha of remnant vegetation will be required to be cleared for the project, with further clearing in areas of non-remnant vegetation, some of which provides suitable habitat for various threatened species. Figure 18 shows the distribution of remnant vegetation communities relative to the disturbance footprint.

Appendix O provides a summary of the remnant REs within the study area, and identifies those that will be cleared for construction of the project. Table 15 provides a summary of the areas of each vegetation community that will be cleared.

**Table 15: Remnant vegetation communities within the disturbance footprint**

Vegetation Community	Conservation Status		Total area within ecology study area (ha)	Total area to be cleared (ha)
	VM Act <sup>1</sup>	EPBC Act <sup>2</sup>		
RE 11.3.25 Mixed eucalypt riparian woodland	Least concern	-	48.1	<b>1.4</b>
RE 11.5.3 Poplar Box woodland	Least concern	-	105.2	<b>80.1</b>
RE 11.5.12 Clarkson's Bloodwood woodland	Least concern	-	142.2	<b>36.2</b>
RE 11.8.5 Poplar Box alluvial woodland	Least concern	-	11.8	<b>0.9</b>

Vegetation Community	Conservation Status		Total area within ecology study area (ha)	Total area to be cleared (ha)
	VM Act <sup>1</sup>	EPBC Act <sup>2</sup>		
RE 11.9.7a Poplar Box - Dawson River Gum woodland	Of concern	-	8.5	3.7
<b>TOTAL (ha)</b>				<b>122.3</b>

1 VM Act status defined under the Regional Ecosystem Description Database (REDD) (Queensland Herbarium 2015b)

### ***EPBC Act Vegetation Communities***

There are no EPBC Act listed TECs within the study area, and none are predicted to occur. As such, no impacts to EPBC Act listed communities are anticipated.

### ***VM Act vegetation communities***

#### **Threatened communities**

Clearing for the project will involve the removal of approximately 122.3 ha of remnant vegetation within the study area (Figure 18). The majority of this vegetation (120.0 ha) supports REs with a least concern status under the VM Act (Table 15). The remaining vegetation that will be cleared comprises 3.7 ha of of concern RE 11.9.7a. This RE is classified by the Queensland Herbarium as having a sparse structure. There are no endangered REs within the disturbance footprint.

Offsets are required under the EO Act for significant residual impacts on remnant of concern REs. The SRI Guideline (EHP 2014a), provides thresholds for clearing in remnant endangered and of concern vegetation that constitute a significant residual impact and trigger the provision of an environmental offset. With reference to the significant residual impact criteria for regulated vegetation contained in Table 1 of the SRI Guideline, a significant residual impact will result from clearing more than 2.0 ha of remnant of concern REs with a sparse structure. The proposed clearing area of 3.7 ha of RE 11.9.7a exceeds this criterion and offsets are therefore required. Environmental offsets are detailed in Section 9.3 and Appendix Q.

#### **REs within a defined distance of a watercourse**

In accordance with the Queensland Offsets Regulation 2014, remnant REs that occur within certain distances of watercourses are classified as MSES. Clearing in these watercourse REs can trigger an environmental offsets under the EO Act.

There are three watercourses within the study area, Smoky Creek (4<sup>th</sup> order stream), Billy's Gully (3<sup>rd</sup> order stream), and an unnamed tributary of Smoky Creek (3<sup>th</sup> order stream). These drainage features are associated with remnant vegetation, namely least concern RE 11.3.25 (Mixed eucalypt riparian woodland). This RE is classified by the Queensland Herbarium as having a mid-dense structure.

Areas of RE 11.3.25 associated with both the unnamed tributary of Smoky Creek and Billy's Gully will be required to be cleared for the construction of linear infrastructure associated with the haul road connections (Figure 18). The haul road connections are approximately 80 m wide, to allow for construction of the haul road and associated infrastructure. However, in the vicinity of watercourses and associated riparian vegetation, the width of the haul roads will be reduced to approximately 40 m to ensure clearing of remnant vegetation through these areas is minimised. It is therefore expected that the proposed clearing will not give rise to significant impacts on riparian vegetation.

Appendix 3 of QEOP, lists the defined distance of REs for 3<sup>rd</sup> or 4<sup>th</sup> order streams as 50 m from the defining banks. Approximately 0.7 ha of RE 11.3.25 is located within this defined distance, and will be cleared for the construction of haul roads (refer Figure 18).

With reference to the significant residual impact criteria for regulated vegetation contained in Table 1 of the SRI Guideline, a significant residual impact will result from clearing for linear infrastructure of greater than 10m wide in an RE of mid-dense structure. The proposed clearing area of 0.7 ha of RE 11.3.25 exceeds this criterion and offsets are therefore required. Environmental offsets are detailed in Section 9.3 and Appendix Q.

## ***7.2.2 Impacts to threatened flora species***

### ***EPBC Act flora species***

No threatened flora species listed under the EPBC Act were found within the study area, and none are predicted to occur. As such, no impacts to EPBC Act listed flora are anticipated.

### ***NC Act flora species***

No threatened flora species under the NC Act were recorded in the study area, and none are predicted to occur. As such, no impacts to NC Act listed threatened flora are anticipated.

## ***7.2.3 Impacts to significant fauna species***

This section provides an assessment of the impacts to significant fauna species that will result from the project.

Approximately 122.3 ha of remnant woodland and open woodlands and riparian vegetation is proposed to be cleared over the life of the project, along with 2.5 ha of non-remnant, emergent woodland that provides habitat for a range of fauna species, including species of conservation significance listed under the EPBC Act and NC Act.

Appendix O provides a detailed breakdown of all areas of habitat within the study area. Table 16 provides a summary of the areas of fauna habitat that will be cleared. Note the clearing areas provided in this table overlap in some instances, and therefore cannot be added.



**Table 16: Suitable fauna habitat within the disturbance footprint**

Species	Likelihood of occurrence within the ecology study area	Conservation Status		Total area of suitable habitat within ecology study area (ha)	Total area of suitable habitat to be cleared (ha)
		NC Act	EPBC Act		
Squatter Pigeon (southern)	Present	Vulnerable	Vulnerable	181.5	<b>73.7</b>
Greater Glider	Present	Least concern	Vulnerable	49.8	<b>1.4</b>
Koala	High	Vulnerable	Vulnerable	380.1	<b>124.8</b>
Short-beaked Echidna	Present	Special least concern	Not listed	345.2	<b>122.3</b>
Black-faced Monarch	Present	Special least concern	Migratory	345.2	<b>122.3</b>
Rufous Fantail	Present	Special least concern	Migratory	345.2	<b>122.3</b>
White-throated Needle-tail	Moderate	Special least concern	Migratory	345.2	<b>122.3</b>
Fork-tailed Swift	Moderate	Special least concern	Migratory	345.2	<b>122.3</b>

Note the clearing areas provided in this table overlap in some instances, and therefore cannot be added

### ***EPBC Act listed fauna species***

#### **Threatened fauna**

Three EPBC Act listed threatened fauna species are considered to have suitable habitat within the study area that will be impacted by the project, namely the Squatter Pigeon (southern subspecies), Greater Glider and Koala. Figures 19 to 21 present the extent of habitat for these species in relation to the proposed disturbance footprint. A range of mitigation measures will be implemented for the project to reduce impacts to fauna during the clearing phase of the project. These are presented in Section 8.

#### ***Squatter Pigeon***

EPBC Act Status: Vulnerable

NC Act Status: Vulnerable

The Squatter Pigeon was recorded frequently during both survey periods throughout the study area (Figure 14). Recorded locations comprised both remnant vegetation and cleared areas, often along dirt vehicle tracks and usually within approximately 1 km of a dam. Approximately, 181.5 ha of Squatter Pigeon (southern subspecies) habitat has been identified within the study area (Table 16; Figure 14). There are a considerable number of records for this species in the locality and large areas of similar habitat occur to the north, east, south and west of the study area.

The project would result in the clearing of approximately 73.7 ha of habitat for the Squatter Pigeon (southern subspecies) (Figure 19). However, this is a highly mobile species and is known to disperse across cleared and degraded landscapes between preferred habitat areas. The removal of this habitat is unlikely to isolate any populations of this species due to their mobility.

An assessment of significance has been conducted for the Squatter Pigeon (southern subspecies) according to the EPBC Act Policy Statement 1.1 Significant Impact Guidelines (DotE 2013) for vulnerable species (Appendix P). The assessment concluded that the project is considered unlikely to result in a significant impact to the Squatter Pigeon as the species remains common in its northern distribution, the study area is unlikely to support an important population (as defined in the EPBC Act Significant Impact Guidelines, (DotE 2013), and extensive habitat occurs elsewhere in the region.

Offsets are therefore not required for impacts on the Squatter Pigeon, given that the project is not predicted to give rise to a significant, residual impact on this species.

### ***Greater Glider***

EPBC Act Status: Vulnerable

NC Act Status: Least concern

The Greater Glider was identified at five locations in the study area, along Smoky Creek and Billy's Gully in mixed eucalypt riparian woodland (RE 11.3.25) (Figure 15). A total of 49.8 ha of habitat has been mapped for this species in the ecology study area, primarily in association with riparian communities (Section 6.4.1 and Figure 15). These areas support a greater diversity of Eucalypt species and larger older trees that are more likely to provide hollow habitat for this species.

A total of 1.4 ha of suitable Greater Glider habitat is proposed to be cleared for the project. This clearing is primarily associated with the proposed haul road crossings of Billy's Gully and the unnamed tributary of Smoky Creek (Figure 20). This clearing may cause some fragmentation of riparian habitat and may affect dispersal opportunities for this species to some extent. However, the haul road corridors are only 40 m wide in riparian vegetation, and Greater Gliders are known to glide distances of up to 100 m (van Dyck and Strahan 2008b).

An assessment of significance has been conducted for the Greater Glider (according to the EPBC Act Policy Statement 1.1 Significant Impact Guidelines (DotE 2013) for vulnerable species (Appendix P). The assessment concluded that the project is considered unlikely to result in a significant impact to the Greater Glider, given that only a small area of habitat is proposed to be cleared, and habitat will remain in the broader landscape.

Offsets are therefore not required for impacts on the Greater Glider, given that the project is not predicted to give rise to a significant, residual impact on this species.

## **Koala**

EPBC Act Status: Vulnerable

NC Act Status: Vulnerable

The Koala was not identified in the study area during the field surveys, undertaken over two seasons. However, it is considered to have a high likelihood of occurrence as it is known from the local area, and the study area supports a number of potential Koala feed tree species (Figure 18). Approximately 380.1 ha of Koala habitat has been mapped within the study area, including areas of remnant riparian vegetation which provides the highest value habitat for the Koala in the study area (Section 6.4.1 and Figure 21). With reference to the Koala Habitat Assessment Tool in the EPBC Act referral guidelines for the vulnerable Koala (DotE 2014), the habitat has a score of 6 and is considered critical habitat for the species (refer to Appendix N).

The project would result in the removal of 124.8 ha of habitat. EPBC Act Policy Statement 1.1 Significant Impact Guidelines (DotE 2013) for vulnerable species provides guidance on the factors to be considered in determining whether an impact is significant. An Assessment of Significance has been prepared for this species in accordance with this guideline and is provided in Appendix P. The EPBC Act referral guidelines for the vulnerable Koala (DotE 2014) were consulted in preparing this assessment to assist with determining whether the impact is considered to be significant.

The EPBC Act referral guidelines for the vulnerable Koala (DotE 2014) provide advice on the various factors that should be considered in determining whether an impact is significant. One of these factors is the potential of a project to adversely affect habitat critical to the survival of the Koala. Figure 2 in the referral guidelines (DotE 2014) provides various thresholds, in terms of areas of impacted habitat that could be anticipated to give rise to adverse effects on habitat critical to the survival of the Koala. For example, clearing <2 ha of habitat with a score of 5 is not anticipated to give rise to adverse effects on habitat critical to the survival of the Koala, whereas clearing >20 ha of habitat with a score of >8 is anticipated to give rise to adverse effects on habitat critical to the survival of the Koala.

The project involves clearing 124.8 ha of habitat with a score of 6. According to Figure 2 in the referral guidelines (DotE 2014), the impacts of this clearing are “uncertain” and the impacts should be considered on a case by case basis, and the guideline provides various factors that should be considered in this instance. These factors have been considered in the Assessment of Significance for the Koala (provided in Appendix P). The Assessment of Significance concluded that the project is not anticipated to give rise to significant impacts on the species.

Key considerations in this assessment are the likely low density of Koalas in the study area (Koalas were not recorded during two field surveys, and no scats or scratches were observed) and the fragmented, disturbed nature of the vegetation within the study area. The study area is currently used for cattle grazing, with much of the vegetation having been subject to historic clearing

activities. In addition, the project has been designed to avoid clearing of remnant vegetation where possible, and only involves very limited clearing of riparian vegetation which provides the highest value habitat for the Koala in the study area. The riparian vegetation in the study area will therefore continue to provide connectivity to other areas of habitat beyond the study area.

Offsets are therefore not required for impacts on the Koala, given that the project is not predicted to give rise to a significant, residual impact on this species.

### **Migratory fauna**

Two migratory fauna species were recorded in the study area during field surveys, namely the Black-faced Monarch and Rufous Fantail. An additional two migratory species have a moderate likelihood of occurring within the study area, namely the White-throated Needletail and Fork-tailed Swift.

The study area supports a range of habitat types that are likely to be used by the above migratory species as they move throughout the locality. It has been assumed for the purposes of this report, that areas of remnant vegetation could provide potential habitat for migratory species. The project will therefore result in the clearing of approximately 122.3 ha of habitat for migratory birds (Table 16).

Despite this clearing, areas of potential habitat will remain within the study area, particularly within riparian areas. Large areas of habitat also occur in the broader region.

An assessment of significance for the migratory species listed above has been conducted in accordance with the EPBC Act Significant Impact Guidelines (DotE 2013) for listed migratory species (Appendix P). This assessment concluded that the habitat within the study area is not considered to be "important habitat" (as defined in the EPBC Act Significant Impact Guidelines, (DotE 2013) for these species. Further, there is no evidence that the study area supports an ecologically significant proportion of the population of these migratory species. Offsets are therefore not required for impacts on migratory species, given that the project is not predicted to give rise to a significant, residual impact on these species.

### ***NC Act listed fauna species***

#### **Threatened fauna**

Two NC Act listed threatened fauna species are considered to have suitable habitat within the study area, namely the Squatter Pigeon (southern subspecies), and Koala. These species are also listed under the EPBC Act, and have been addressed in the previous sections.

#### **Special least concern fauna**

The Short-beaked Echidna was the only special least concern fauna species (non-migratory) recorded in the study area.

The Short-beaked Echidna has broad habitat preferences, and for the purposes of this report all areas of remnant vegetation are considered to provide suitable habitat for this species (Section 6.4.3). The project will therefore result in the clearing of approximately 122.3 ha of suitable habitat for the Short-beaked Echidna (Table 16). Despite this reduction of habitat available in the study area, a large area of suitable habitat remains within the study area and connectivity to retained habitat and adjoining vegetation communities will not be substantially interrupted.

An assessment of significance was undertaken for the Short-beaked Echidna in accordance with SRI Guideline (EHP 2014a) (Appendix R). Based on this assessment, the project is unlikely to have a significant residual impact on this species, due to the broad habitat preferences and mobility of this species.

Offsets are therefore not required for impacts on the Short-beaked Echidna, given that the project is not predicted to give rise to a significant, residual impact on these species.

### 7.2.4 Summary of impacts

Table 17 provides a summary of the impacts to each of the Commonwealth and State matters discussed above. Please note, the total areas of impact presented in this table cannot be added together, as in some instances, these areas overlap.

**Table 17: Summary of impacts**

Protected Matter	NC Act Status	EPBC Act Status	Likelihood of occurrence	Total area in ecology study area (ha)	Total area to be cleared (ha)	Significant impact likely? <sup>1</sup>
Regulated Vegetation – RE 11.9.7a	Of concern	Not listed	Present	8.5	3.7	Yes
Watercourse RE - RE 11.3.25	Least concern	Not listed	Present	38.9	0.7	Yes
Squatter Pigeon (southern)	Vulnerable	Vulnerable	Present	181.5	73.7	No
Greater Glider	Least concern	Vulnerable	Present	49.8	1.4	No
Koala	Vulnerable	Vulnerable	High	380.1	124.8	No
Black-faced Monarch	Special least concern (Migratory)	Migratory	Present	345.2	122.3	No
Rufous Fantail	Special least concern (Migratory)	Migratory	Present	345.2	122.3	No
White-throated Needletail	Special least concern (Migratory)	Migratory	Moderate	345.2	122.3	No
Fork-tailed Swift	Special least concern (Migratory)	Migratory	Moderate	345.2	122.3	No

Protected Matter	NC Act Status	EPBC Act Status	Likelihood of occurrence	Total area in ecology study area (ha)	Total area to be cleared (ha)	Significant impact likely? <sup>1</sup>
Short-beaked Echidna	Special least concern	Not listed	Present	345.2	122.3	No

<sup>1</sup> assessment of impacts in accordance with the EPBC Act Significant Impact Guidelines (DotE 2013) and the EO Act QEOP and SRI Guidelines (EHP 2016a, 2014a)

### 7.3 Indirect impacts

The project will have a range of indirect impacts on the ecological values of the remaining vegetation and habitat within the study area. The potential for indirect impacts to occur as a result of the project is predominantly related to:

- habitat fragmentation and edge effects due to vegetation clearing
- the potential spread of weeds and pest animals
- creation of noise and dust as a result of mining activities
- potential vehicle strike due to haul truck movements
- erosion of disturbed areas and sedimentation of watercourses.

#### ***7.3.1 Habitat fragmentation and edge effects***

Vegetation clearing can result in the fragmentation of habitat which can impact flora and fauna species. The clearing for the project has the potential to fragment fauna habitat and create barriers (i.e. cleared corridors) which may impair movement of some fauna species, and impact connectivity of habitat. In some areas fragmentation may isolate some smaller vegetation polygons. However, many areas within the study area are already fragmented due to historic land management practices. Given the open structure of the woodland and open forest habitat in the study area, coupled with the already heavily fragmented vegetation, it is considered unlikely that the project will significantly impact flora and fauna species due to fragmentation of habitat.

The riparian vegetation provides the most significant habitat corridors in the study area. Some clearing in riparian areas is required for the project for the construction of linear infrastructure associated with haul roads (Figure 18). However the width of clearing for the haul roads in the vicinity of watercourses and associated riparian vegetation will be minimised to reduce impacts to riparian vegetation. In addition, the project mine plan does not include mining within the floodplains of the watercourses that traverse the study area. In particular, the mine has been designed to ensure that there will be no mining within the 0.1% Annual Exceedance Probability (AEP) (1 in 1,000 year) flood extents of Smoky Creek and Billy's Gully. This will allow the riparian vegetation habitat corridors to essentially remain intact, but for the limited clearing for the haul road crossings. In accordance with the EHP's 2014 Significant Residual Impacts Guideline, EHP's Landscape Fragmentation and Connectivity (LFC) Tool was used to assist in identifying and quantifying any significant impact as a result of the project on habitat connectivity. EHP's LFC Tool determined that the project would not result in a significant residual impact on local or regional

connectivity and, therefore, offsets for connectivity are not required for the project. The output of the LFC Tool is presented in Appendix S.

### **7.3.2 Pest animals and plants**

The study area is located within a highly modified landscape of historic grazing activities, where weeds, introduced plants and some feral predators are present.

At the time of the field survey, seven Queensland declared pest plants were detected within the project site with Parthenium Weed, Velvety Tree Pear and Harrisia Cactus being relatively common or widespread (refer Section 5.4). The exotic Buffel Grass, not a declared weed, but a significant environmental weed was also common throughout the study area. Given that the study area is already highly disturbed, project activities are unlikely to increase weed populations any more than existing activities on the site (including grazing activities).

Pest animals that were identified in the project site during field surveys included the Cane Toad, Dog, Feral Cat and European Rabbit (refer Section 6.5). It is likely that other species such as Foxes are also present. The project itself is unlikely to introduce new pest animals to the area as these types of animals are able to move freely throughout the landscape and/or readily colonise new areas. Vegetation clearing activities may temporarily attract some predatory feral animals.

Although the project is unlikely to result in the increase of weed species in the study area, and will not facilitate the expansion of existing populations of pest animals, Isaac Plains Mine has existing procedures in place for weed and feral animal control, and these will be applied to the project (refer to Section 8.2.4).

### **7.3.3 Dust**

Construction and mining activities have the ability to generate dust, which has the potential to impact vegetation and fauna. Increased levels of dust could reduce the health of vegetation along the edge of mined areas and haul roads, impact potential foraging resources for wildlife, and influence faunal abundance. However, recent studies on the impacts of dust from unsealed roads, including haul roads, on vegetation and fauna, have found no evidence that dust has any detrimental impacts on vegetation or fauna abundance (Cumberland Ecology 2015 Jones et al. 2016).

Isaac Plains Mine has standard dust minimisation and suppression strategies, such as watering haul roads, and these strategies will also be implemented for the project to minimise the creation of dust (dust mitigation measures are discussed further in the EAR Air Quality Section). In addition, mining for the project will be undertaken progressively over a seven year period, and therefore dust will only be generated from active mining areas. Mined areas will also be progressively rehabilitated and vegetated following mining, which will also reduce the potential for dust generation. Dust is therefore not likely to cause a significant impact on the ecological values of the study area.

### **7.3.4 Noise and vibration**

Noise and vibration emissions associated with the project will be generated from various sources, such as mining equipment, excavators, and blasting activities.

Most fauna species exhibit a high degree of adaptability to noise impacts. Noise from mining activities may cause some behavioural modification by birds, such as altering feeding activity, and sudden loud noises may also startle bird and mammal species. Consequently, depending on the magnitude of construction and operational noise, some species are likely to move in response to noise, and therefore the habitat value of the woodlands remaining in the immediate vicinity of open cut mining and mine infrastructure areas may decrease. The size of the disturbance zone is likely to be different for individual species and will depend upon the intensity and nature of the noise sources. It is not possible to quantify the proportion of the local fauna community that will be adversely affected by noise impacts, but it is expected to be a minority of species, and noise impacts on fauna are unlikely to occur over a significant distance from the noise source. In the case of temporary noise associated with project construction or clearing activities, native fauna are likely to return to affected habitat areas within a short period of the noise emissions ceasing.

The area is already affected, to an extent, by noise impacts due to the proximity of the existing Isaac Plains Mine immediately to the west of the project, the Peak Downs Highway to the south, and the Goonyella Rail Line to the north. It is not possible to quantify the proportion of the local fauna community that will be adversely affected by noise impacts from the project, but it is expected to be a minority of species, and noise impacts on fauna are unlikely to occur over a significant distance from the noise source. Noise impacts will only occur during the active life of the project (anticipated to be seven years), and native fauna are likely to return to affected habitat areas within a short period of the noise emissions ceasing. Noise from the project is therefore not likely to cause a significant impact on the ecological values of the study area.

Impacts on fauna from ground vibration (e.g. from blasting) will be similar to noise disturbance. It is possible that some species would move away from areas close to the vibration source, where the intensity of the vibration exceeds the tolerance of the species. This is likely to be greatest in the vicinity of the open cut pit but is also considered a temporary impact. The ecological values of the study area are therefore not likely to be impacted, in the long term, by ground vibration from the project.

Specific noise and vibration mitigation measures are in place for the Isaac Plains Mine, and these will be implemented for the project. These mitigation measures are discussed in the EAR Noise Report.

### **7.3.5 Light**

The project has the potential to increase the level of artificial light in the study area. Light spill may disturb some species of fauna. Impacts of light may include some animals being attracted to the artificial light source and other species avoiding the light source due to increased risk of visibility and predation. Some



interactions between fauna can be masked or interrupted as a result of the increased light source. It is likely however, that most fauna species would habituate to the levels of artificial light or temporarily move away from areas of night lighting and return once the night lighting has ceased. The extent of impact of lighting will vary between species and habitat types as light shed will be greater in more open habitat types.

Some intermittent lighting impacts are likely to already be experienced in the study area from the adjacent Peak Downs Highway and Goonyella Rail Line. Night lighting from the adjacent Isaac Plains Mine may also contribute to existing night lighting impacts within the study area.

There are relatively limited sources of light proposed within the project site. The key light sources will be limited to the operating dragline within the pits, mobile lighting plants for operating pit and overburden emplacement work areas, and lighting of crib huts, and vehicle headlights. At any one time, only a small proportion of the project site would experience any impacts from lighting of mining areas, given lights will only be used in the operating areas of the mine at night. The impacts from lighting are likely to remain close to the light source, with only limited glare into the surrounding natural vegetation. Lighting impacts on fauna from vehicles travelling along the haul roads will be brief and intermittent.

Lighting is therefore not likely to significantly impact fauna species.

### **7.3.6 Vehicle Strike**

The construction and operation of haul roads as part of mining projects may impact fauna through increased risk of vehicle strike, leading to injury and mortality. Ground-dwelling fauna are the most susceptible to vehicle strike, although birds and micro-bats may also be impacted. Haul roads for this project are proposed to be located largely within cleared areas (Figure 18), which would reduce the incidence of vehicle strike. Nevertheless, some mortality of animals as a result of vehicle strike is likely, particularly in areas where haul roads cross through remnant vegetation. This impact is, however, not expected to be significant and the impact would only occur for the duration of mining activities (approximately seven years).

The project will be subject to the same internal procedures that are in place at the Isaac Plains Mine in relation to speed limits and safe driving practices.

### **7.3.7 Erosion and sedimentation**

The project has the potential to result in erosion of disturbed areas and sedimentation of waterways within the project site through the clearing of vegetation for the development of open cut pits, and construction of haul roads and other infrastructure. Erosion may result in elevated levels of suspended sediment in site drainage water and sedimentation of downstream waterways.

A drainage plan will be implemented for the project site, and it is described in detail in the EAR Surface Water and Mine Water Management Section. The drainage plan includes diverting runoff from undisturbed areas away from areas

disturbed by mining activities, collecting drainage from disturbed areas and directing it to sediment control structures for the control of suspended sediment prior to overflow from site.

An Erosion and Sediment Control Plan is in place for the Isaac Plains Mine, and this will be implemented for the project (discussed further in Section 8.2.5). The plan outlines methods and strategies to control soil erosion and minimise sediment transport.

#### **7.4 Duration and timing of impacts**

The duration and timing of the project's impacts has important effects on the magnitude of the overall impacts of the project.

Vegetation clearing for pit and infrastructure development is the principal direct impact from this project to vegetation communities and fauna habitat. The project is proposed to have a relatively short mine life of approximately 7 years. Clearing will take place progressively as pit development progresses. At completion of mining activities disturbed areas will be rehabilitated to a stable land form with a self-sustaining vegetation cover. Rehabilitation is discussed further in Section 8.2.3.

## 8 Mitigation

### 8.1 Measures to avoid impacts

The project has been designed to avoid impacts on terrestrial ecology as far as possible. The project mine plan does not include mining within the floodplains of the watercourses that traverse the project site. In particular, the mine has been designed to ensure that there will be no mining within the 0.1% Annual Exceedance Probability (AEP) (1 in 1,000 year) flood extents of Smoky Creek and Billy's Gully. This will avoid direct impacts on watercourses due to mining, and also allow the riparian vegetation habitat corridors to essentially remain intact.

The project will make use of the existing Isaac Plains Mine infrastructure, and only very limited new infrastructure is required to be constructed for the project. The proposed new infrastructure has been sited to avoid or minimise the clearing of remnant vegetation, where possible. In particular:

- The substation and reload pad on the project site have been sited to avoid the need for clearing of remnant vegetation.
- The haul road connections through the existing Isaac Plains ML have been sited to minimise the amount of remnant vegetation required to be cleared.

### 8.2 Measures to mitigate impacts

A range of plans and procedures are in place at the Isaac Plains Mine that are relevant to the management of terrestrial ecology. In particular, the Isaac Plains Mine has:

- a Permit to Disturb process, which is a process that is designed to ensure that environmental aspects (including potential impacts on terrestrial ecology) are considered as part of the vegetation clearing process
- procedures in relation to the rehabilitation of disturbed areas
- a Weed and Feral Animal Management Plan
- an Erosion and Sediment Control Plan.

The following sections outline key management measures relevant to the project, as detailed in the Isaac Plains Mine's existing plans and processes. These plans and procedures will be reviewed and revised, as necessary, prior to the commencement of the project to ensure that they address all project activities.

#### **8.2.1 Permit to Disturb Process**

Prior to the commencement of clearing activities, the area to be cleared will be assessed as part of the proponent's Permit to Disturb process. The assessment will include a description of the vegetation in the proposed clearance area (e.g. remnant vegetation, grazing pasture, riparian, etc.) based on existing mapping and an inspection of the area. The assessment will also include inspection of the area to be cleared to confirm whether any animal breeding places are present or

likely to be present. If breeding places are present or likely to be present, the proponent will engage a spotter catcher. The spotter catcher will:

- be appropriately qualified and experienced in wildlife management and will hold the necessary Rehabilitation Permit (under the *Nature Conservation (Administration) Regulation 2006*) to allow the removal of fauna from the area to be cleared, if necessary
- undertake a pre-clearing inspection of the area proposed to be cleared and relocate fauna, as necessary, during the pre-clearance inspection
- be present during clearing activities to provide advice in the event of native fauna being injured during clearing
- provide advice in relation to the direction in which trees should be felled and how trees with hollows are to be handled (e.g. whether there is a need for any felled trees to be left in situ to allow fauna to relocate).

The existing Permit to Disturb process also involves delineating the approved clearing area with survey pegs or flagging tape. This will ensure that any areas of remnant vegetation to be cleared are restricted to the minimum area necessary for mining operations and prevent unnecessary encroachment of disturbance into adjoining remnant vegetation.

### **8.2.2 Construction in watercourses**

As noted in Section 8.1, there will be no mining within the 1 in 1,000 year flood extents of the watercourses traversing the project site. The only construction required in watercourses is the construction of two haul road crossings. The following management measures will be applied, in addition to the Permit to Disturb process, to minimise the impacts associated with the construction of the haul road crossings:

- undertaking construction of crossings during periods when the watercourses are dry
- implementing appropriate erosion and sediment control works, as necessary to prevent downstream sedimentation. This will be conducted in accordance with the requirements of the existing Isaac Plains Mine Erosion and Sediment Control Plan (which will be updated to include project activities), and the DNRM guideline *Activities in a Watercourse, Lake or Spring Associated with a Resource Activity or Mining Operations* (as per the Isaac Plains Mine EA)
- stabilisation and/or revegetation of the final construction batters and embankments to minimise erosion
- any necessary revegetation of riparian areas or construction batters will be undertaken using native flora species.

### **8.2.3 Mine rehabilitation**

In accordance with the Isaac Plains Mine EA, all areas disturbed by mining activities will be rehabilitated to a stable landform with a self-sustaining vegetation cover. Rehabilitation will be completed progressively. Rehabilitation design is based on achieving either bushland or grazing land uses. The Isaac Plains Mine EA includes requirements in relation to acceptance criteria for

rehabilitation. It requires that rehabilitation monitoring is undertaken on a yearly basis, including monitoring of reference sites (i.e. monitoring sites located in areas not subject to disturbance and which form a benchmark against which the success of rehabilitation can be measured).

#### **8.2.4 Weed and feral animal management**

The Isaac Plains Mine has a Weed and Feral Animal Management Plan in place, which describes the measures undertaken at the Isaac Plains Mine to manage weeds and feral animals as per the requirements of the Isaac Plains Mine EA and in accordance with the *Biosecurity Act*. This management plan will be updated to include the project.

The existing weed and pest control measures include the following measures that will also be applied to the project site:

- delivering education and awareness training about weeds and pest animals to all staff and contractors via site inductions
- implementing the following prevention measures:
  - use of wash down facilities by all vehicles and plant prior to entering the site and prior to exiting the mining area if they have been operating off graded site roads
  - maintenance of roads and tracks to minimise weeds on tracks and to reduce the spread of weeds by vehicle movements
  - monitoring topsoil stockpiles to ensure that they do not become infested with weeds.
- designing and implementing appropriate treatment control programs for priority weed species identified at the project site. The control programs will aim to contain and reduce the extent of weed species and prevent the introduction of additional species. Control programs may involve chemical and mechanical methods, depending on the sensitivity of the receiving environment
- undertaking weed audits and mapping throughout the project site for restricted pest species listed under the *Biosecurity Act* and those considered WONS. This mapping will identify any areas of severe weed infestation to allow prioritisation of weed management actions
- monitoring weed infestations, using photo point monitoring where necessary
- developing pest management strategies in consultation with relevant key stakeholders, such as local government
- passive monitoring of pest animals on the project site and implementing control options when population sizes are considered to require management.

#### **8.2.5 Soil erosion and sedimentation**

The conceptual drainage plan for the project site is described in detail in the EAR Surface Water and Mine Water Management Section. The drainage plan includes diverting runoff from undisturbed areas away from areas disturbed by mining activities, collecting drainage from disturbed areas and directing it to sediment

control structures for the control of suspended sediment prior to overflow from site.

The Isaac Plains Mine has an Erosion and Sediment Control Plan in place, which will be updated to include project activities. The plan outlines methods and strategies to control soil erosion and minimise sediment transport. Further detail on the plan is provided in the EAR Surface Water and Mine Water Management Section.

## **9 Residual impacts and offset liability**

### **9.1 Introduction**

Biodiversity offsets are required to compensate for significant residual impacts on MNES and MSES.

Offsets are required under the EPBC Act if an action is likely to give rise to a significant residual impact on MNES. The EPBC Act Environmental Offsets Policy (SEWPaC 2012) details requirements under the EPBC Act in relation to biodiversity offsets. The Significant Impact Guidelines 1.1: Matters of National Environmental Significance (DotE 2013) provides guidance to assist with determining whether an impact is considered significant. For some species, there are also species-specific guidelines available to assist with determining whether an impact is considered to be significant (e.g. EPBC Act referral guidelines for the vulnerable Koala (DotE 2014)).

In Queensland, offsets are required under the EO Act for activities likely to cause a significant residual impact on MSES, as defined in Schedule 2 of the EO Regulation. The SRI Guideline (EHP 2014a) is used to assess the potential for significant residual impacts to occur.

In the case of matters that are prescribed as being both MNES and MSES, offsets are not required under the Queensland EO Act if the same, or substantially the same, impact to the prescribed matter has been assessed under the EPBC Act.

Sections 9.2 and 9.3 outline potential significant residual impacts to MNES and MSES, respectively. These sections provide areas of impact from which offset liability may be determined. It should be noted that in many cases area calculations may overlap where an area supports more than one MNES or MSES. The areas quoted in the following sections cannot, therefore, be added.

Matters which are dual listed as both MNES and MSES are only discussed in Section 9.2, given that offsets under the EPBC Act take precedence.

### **9.2 Matters of national environmental significance**

The Assessments of Significance provided in Appendix P describe and assess the project's potential impacts on MNES. As detailed in Appendix P, for the Squatter Pigeon, Greater Glider and Koala, the assessment concluded that there will be no residual impact to these MNES, given that impacts could be avoided or minimised sufficiently to reduce the likelihood of the project giving rise to significant residual impacts. Similarly, the project is unlikely to have a significant residual impact on migratory species listed under the EPBC Act, given that the study area is unlikely to support important habitat for migratory species, and does not support an ecologically significant proportion of the population of these migratory species. Further detail is provided in Appendix P.

### 9.3 Matters of state environmental significance

Appendix Q assesses the MSES relevant to terrestrial ecology. This appendix:

- contains a list of MSES that occur within the project site that are likely to require offsets
- indicates whether the matters are also listed under the EPBC Act, given that matters also classified as MNES do not require offsets under the EO Act
- summarises potential impacts on the MSES
- provides cross references to sections of this report that discuss the impacts
- concludes whether offsets are required under the EO Act. Reference has been made to the SRI Guideline in determining whether offsets are required.

As per the findings in Appendix Q, offsets are required for the following MSES:

- Regulated vegetation – of concern REs. Offsets are required for clearing:
  - 3.7 ha of RE 11.9.7a
- Watercourse REs. Offsets are required for clearing:
  - 0.7 ha of RE 11.3.25

As detailed in Section 9.1, these areas cannot be added, given that an area of land may support multiple MSES. Offsets are proposed to be provided for these impacts.

The proponent is still considering options for the provision of offsets. They may be provided as land-based offsets, or alternatively as a financial settlement offset.



## 10 References

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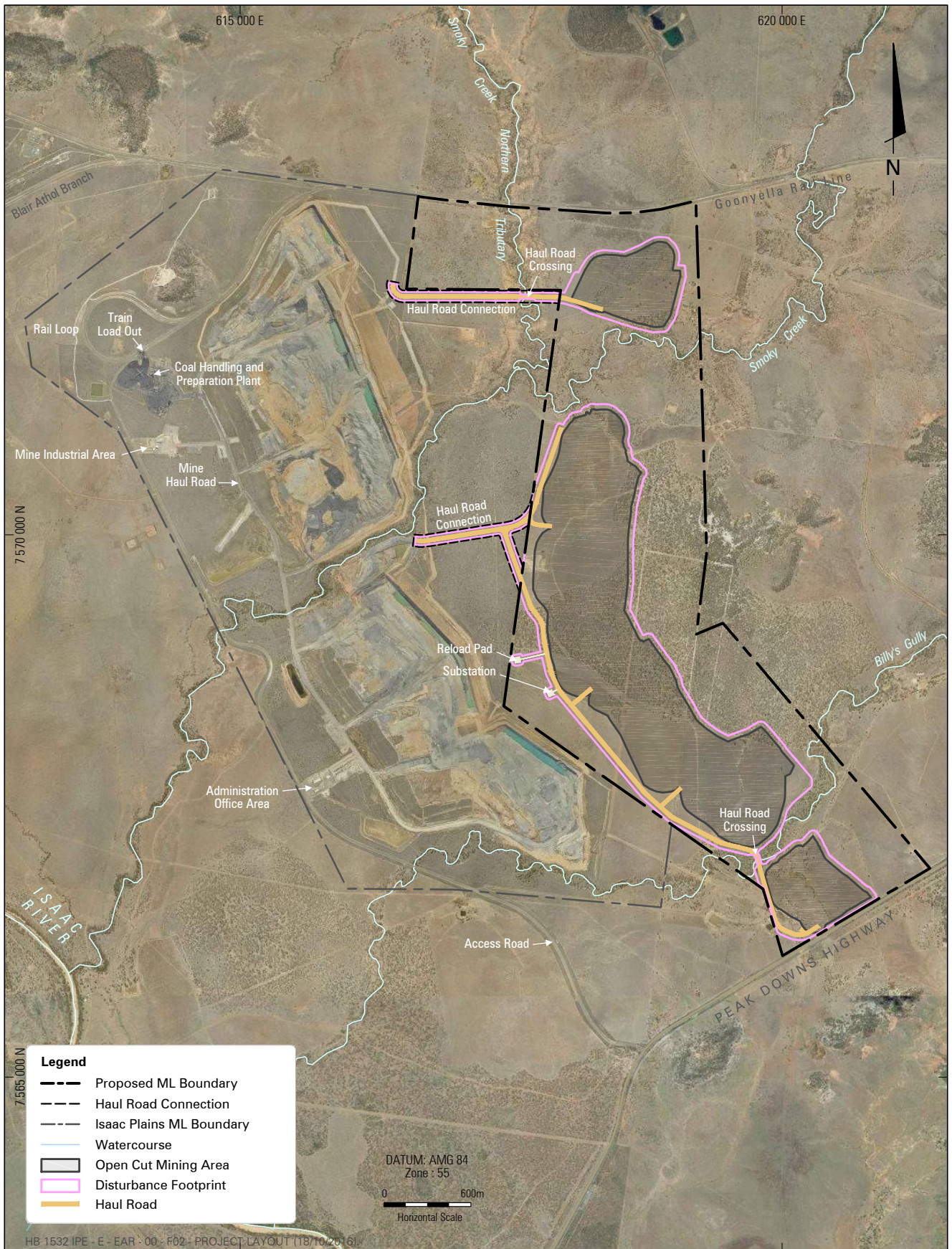
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## Figures



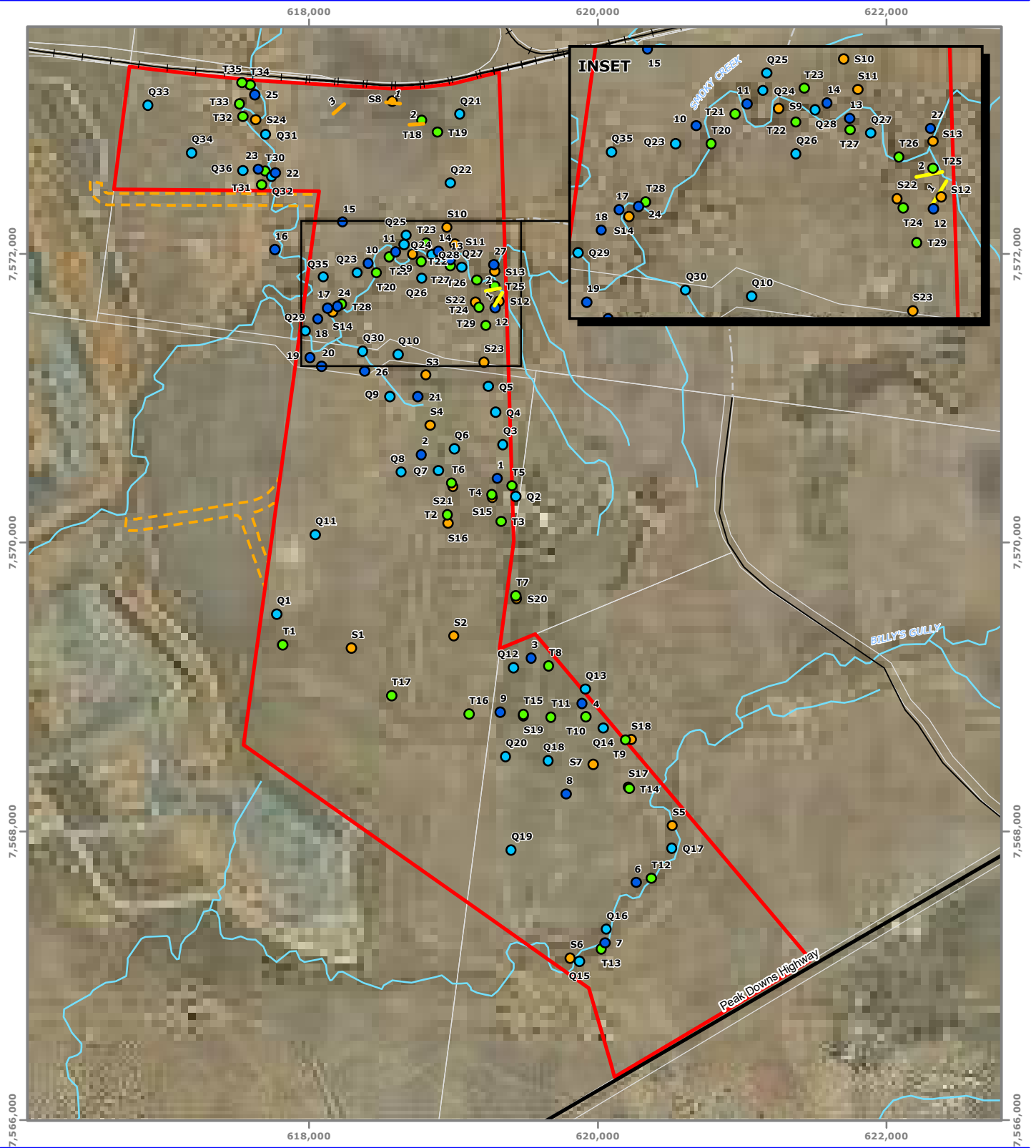
ISAAC PLAINS EAST PROJECT



ISAAC PLAINS EAST PROJECT



ISAAC PLAINS EAST PROJECT

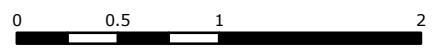


- Legend**
- Project Site
  - Proposed Haul Road Connections
  - Highway
  - Local Road
  - Vehicular Track
  - Railway
  - Vegetation Management Act Watercourse
  - Cadastral Boundary
- Vegetation Assessment Sites**
- Secondary Assessment Site
  - Tertiary Assessment Site
  - Quaternary Assessment Site
  - Quaternary Assessment Site (Photo Point)
  - Brigalow survey transects
  - Natural Grassland survey transects

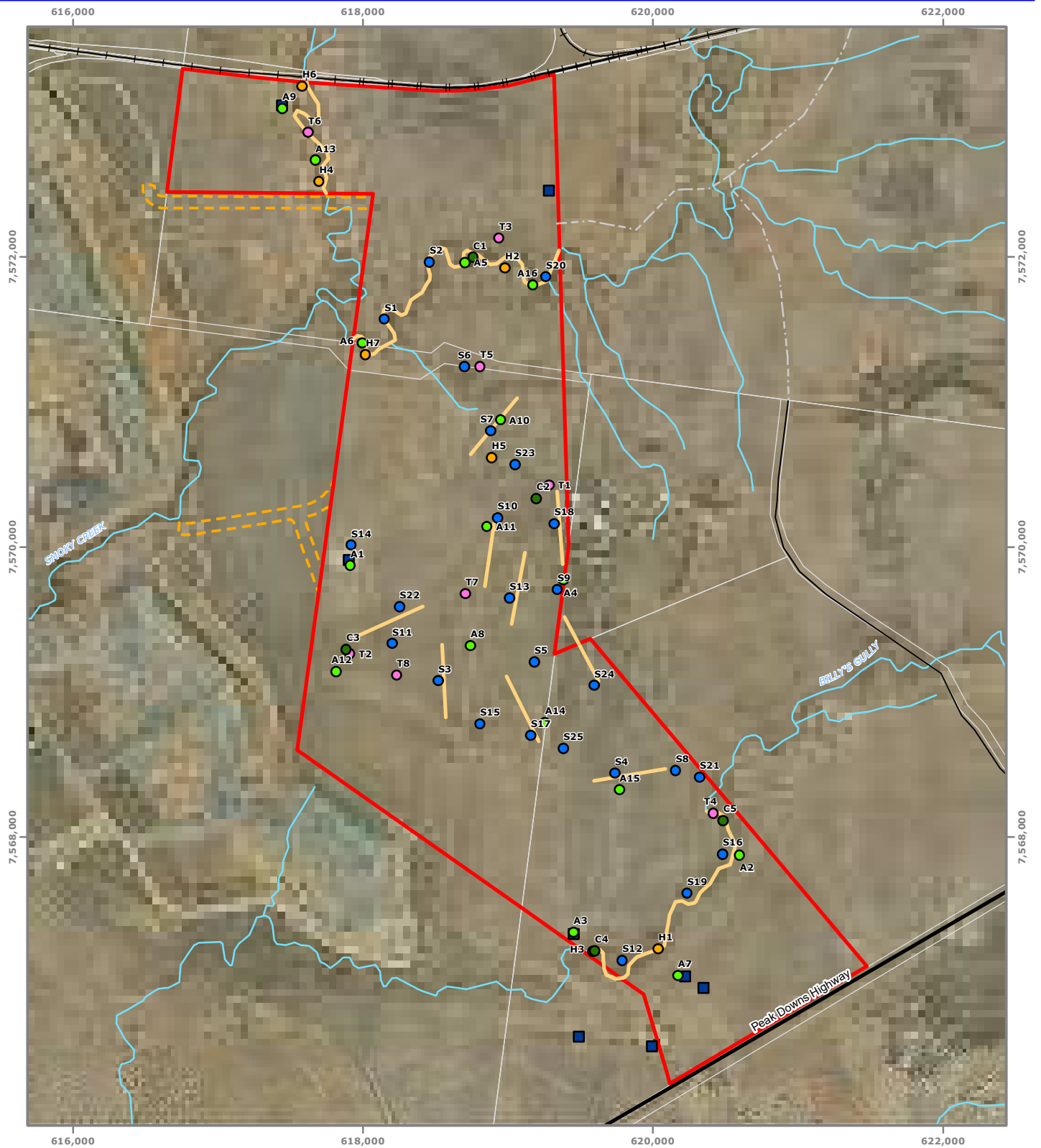
**Figure 4 : Flora survey sites in the ecology study area**

Isaac Plains East Project  
Terrestrial Ecology Assessment

Map Number: 15046\_EAR\_04\_D  
Date: 29 August 2016  
Map Projection: GDA 1994 MGA Zone 55  
Imagery: Stanmore Coal - Sept 2015  
Data: DCDB, Roads, Railway, Watercourse - (c)DNRM 2016







**Legend**

- Project Site
- Proposed Haul Road Connections
- Highway
- Local Road
- Vehicular Track
- Railway
- Vegetation Management Act Watercourse
- Cadastral Boundary

**Water Source**

- Water Point

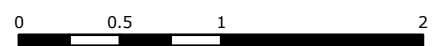
**Fauna Survey Sites**

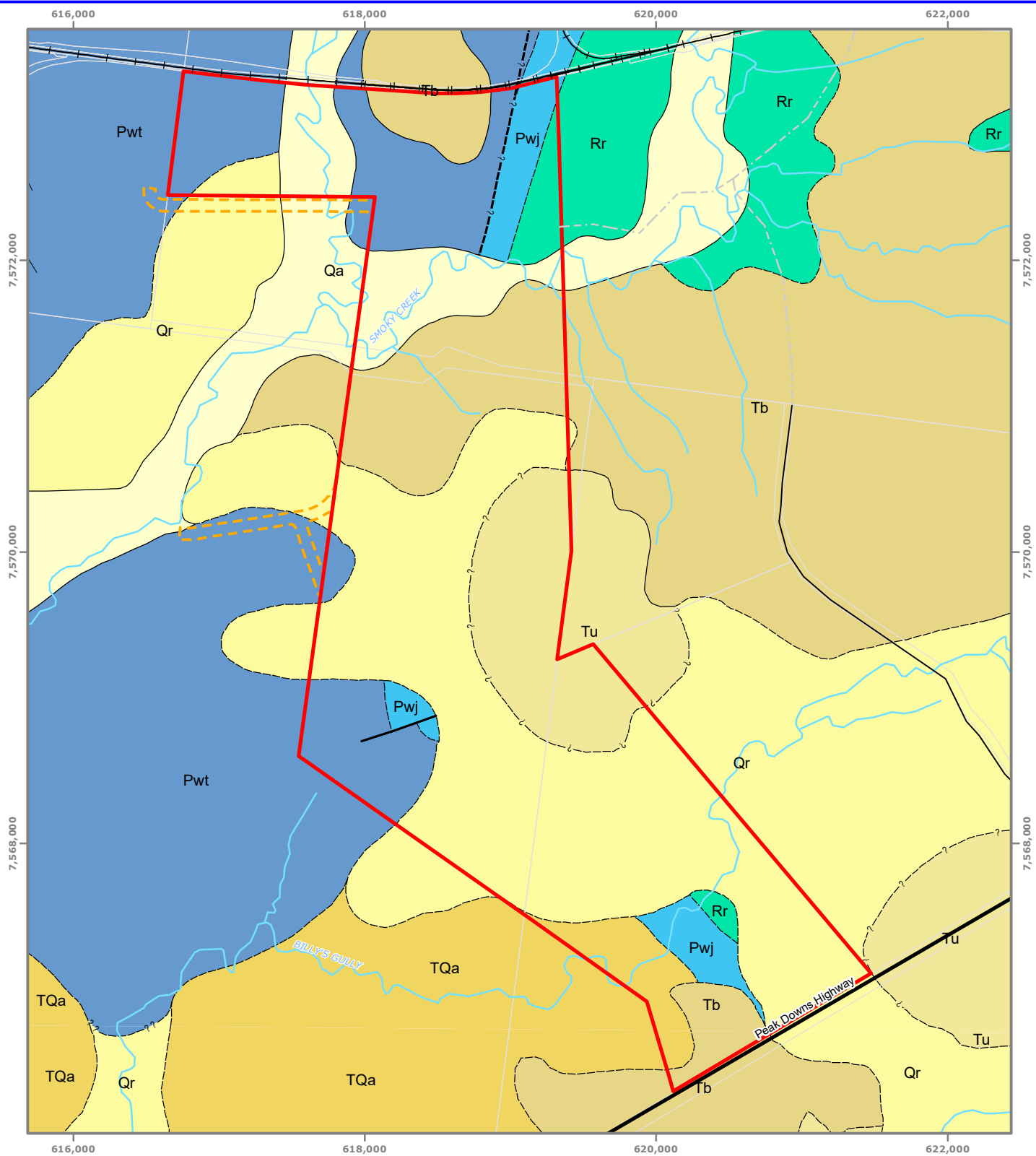
- Anabat Site
- Harp Trap Site
- Supplementary Survey Site
- Trap Site
- Camera Trap Site
- Koala Transect

**Figure 5 : Fauna survey sites in the ecology study area**

Isaac Plains East Project  
Terrestrial Ecology Assessment

Map Number: 15046\_EAR\_05\_C  
Date: 29 August 2016  
Map Projection: GDA 1994 MGA Zone 55  
Imagery: Stanmore Coal - Sept 2015  
Data: DCDB, Roads, Railway, Watercourse - (c)DNRM 2016





**Legend**

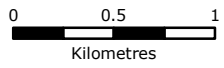
- Project Site
- Proposed Haul Road Connections
- Highway
- Local Road
- Vehicular Track
- Railway
- Vegetation Management Act Watercourse

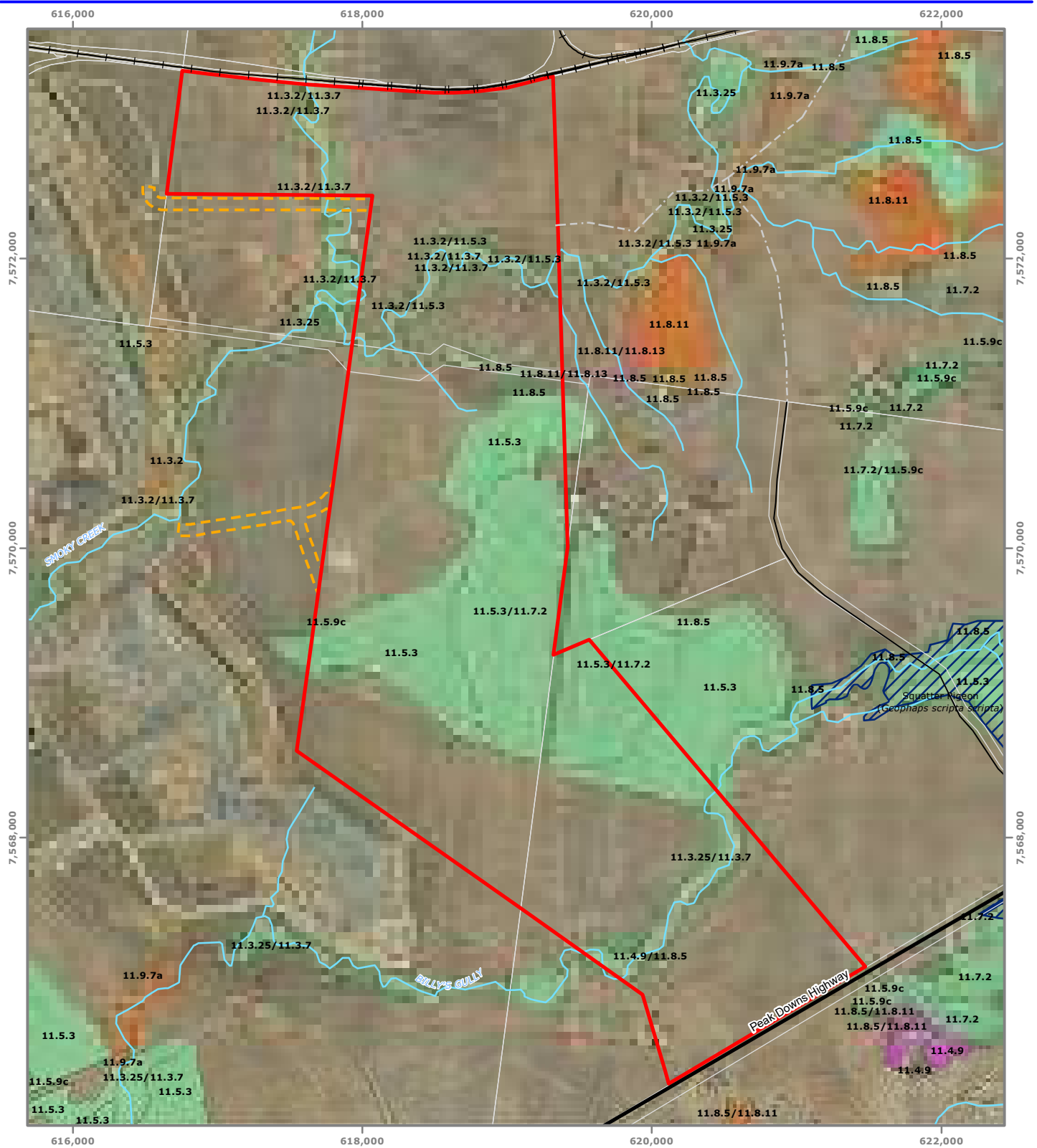
**Figure 6 : Geology mapping for the ecology study area**

Isaac Plains East Project  
Terrestrial Ecology Assessment

Rock Unit Name (Map Symbol)	Lithology	Dominant Rock	Age
Qa-QLD (Qa)	Clay, silt, sand, gravel; flood-plain alluvium	ALLV	QUATERNARY
Qr-QLD (Qr)	Clay, silt, sand, gravel and soil; colluvial and residual deposits	COLLUVIUM	QUATERNARY
TQa-QLD (TQa)	Locally red-brown mottled, poorly consolidated sand, silt, clay, minor gravel; high-level alluvial deposits, generally dissected, and related to present stream valleys	PCON	LATE TERTIARY - QUATERNARY
Suttor Formation (Tu)	Quartz sandstone, clayey sandstone, mudstone and conglomerate; fluvial and lacustrine sediments; minor interbedded basalt	SEDS	TERTIARY
Tb-QLD (Tb)	Mostly olivine basalt flows and some plugs; some areas of nephelinite, basanite etc	BSLT	TERTIARY
Rewan Group (Rr)	Lithic sandstone, pebbly lithic sandstone, green to reddish brown mudstone and minor volcanolithic pebble conglomerate (at base)	ARMU	EARLY TRIASSIC
Fort Cooper Coal Measures (Pwt)	Lithic sandstone, conglomerate, mudstone, carbonaceous shale, coal, tuff, tuffaceous (cherty) mudstone	SEDS	LATE PERMIAN
Rangal Coal Measures (Pwj)	Calcareous sandstone, calcareous shale, mudstone, coal, concretionary limestone	ARMU	LATE PERMIAN

Map Number: 15046\_EAR\_06\_F  
Date: 29 August 2016  
Map Projection: GDA 1994 MGA Zone 55  
Data: DCDB, Roads, Railway, Watercourse, Geology - (c)DNRM 2016





**Legend**

- Project Site
- Proposed Haul Road Connections
- Highway
- Local Road
- Vehicular Track
- Railway
- Vegetation Management Act Watercourse
- Cadastral Boundary
- VMA Essential Habitat V4.27

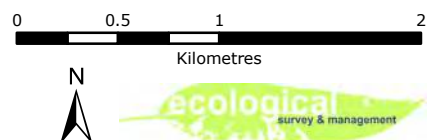
**Vegetation Management Act Status**

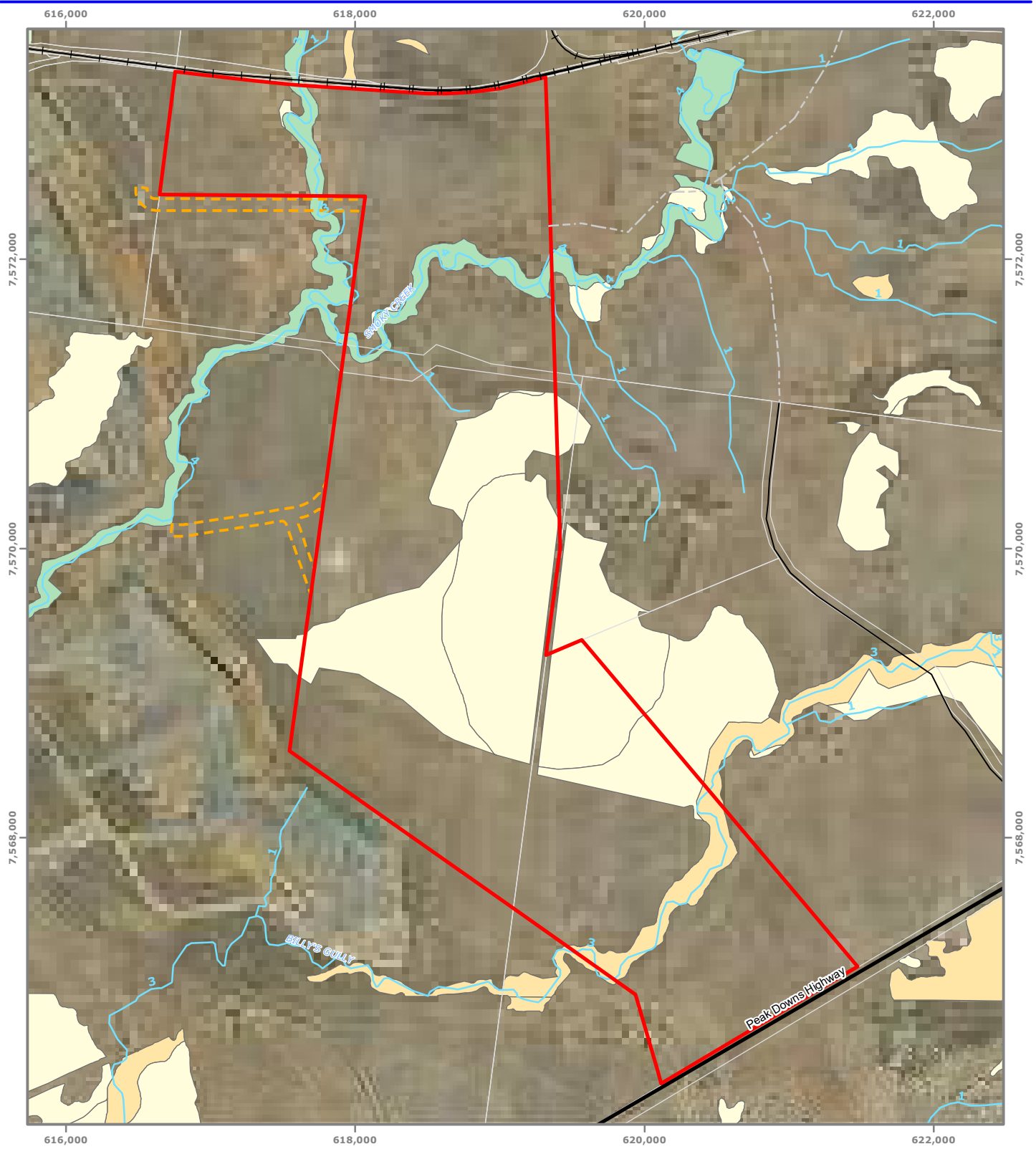
- Category A or B area containing endangered regional ecosystems
- Category A or B area containing of concern regional ecosystems
- Category A or B area that is a least concern regional ecosystems

**Figure 7 : Queensland Government regional ecosystem mapping for the ecology study area**

Isaac Plains East Project  
Terrestrial Ecology Assessment

Map Number: 15046\_EAR\_07\_F  
Date: 29 August 2016  
Map Projection: GDA 1994 MGA Zone 55  
Imagery: Stanmore Coal - Sept 2015  
Data: DCDB, Roads, Railway, Watercourse, Regional Ecosystems - (c)DNRM 2016





**Legend**

- Project Site
- Proposed Haul Road Connections
- Highway
- Local Road
- Vehicular Track
- Railway
- Vegetation Management Act Watercourse
- Cadastral Boundary

**GDE, Reliant on surface expression of groundwater (rivers, springs, wetlands)**

- High potential for groundwater interaction
- Moderate potential for groundwater interaction

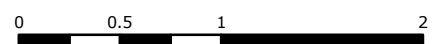
**GDE, Reliant on subsurface groundwater (vegetation)**

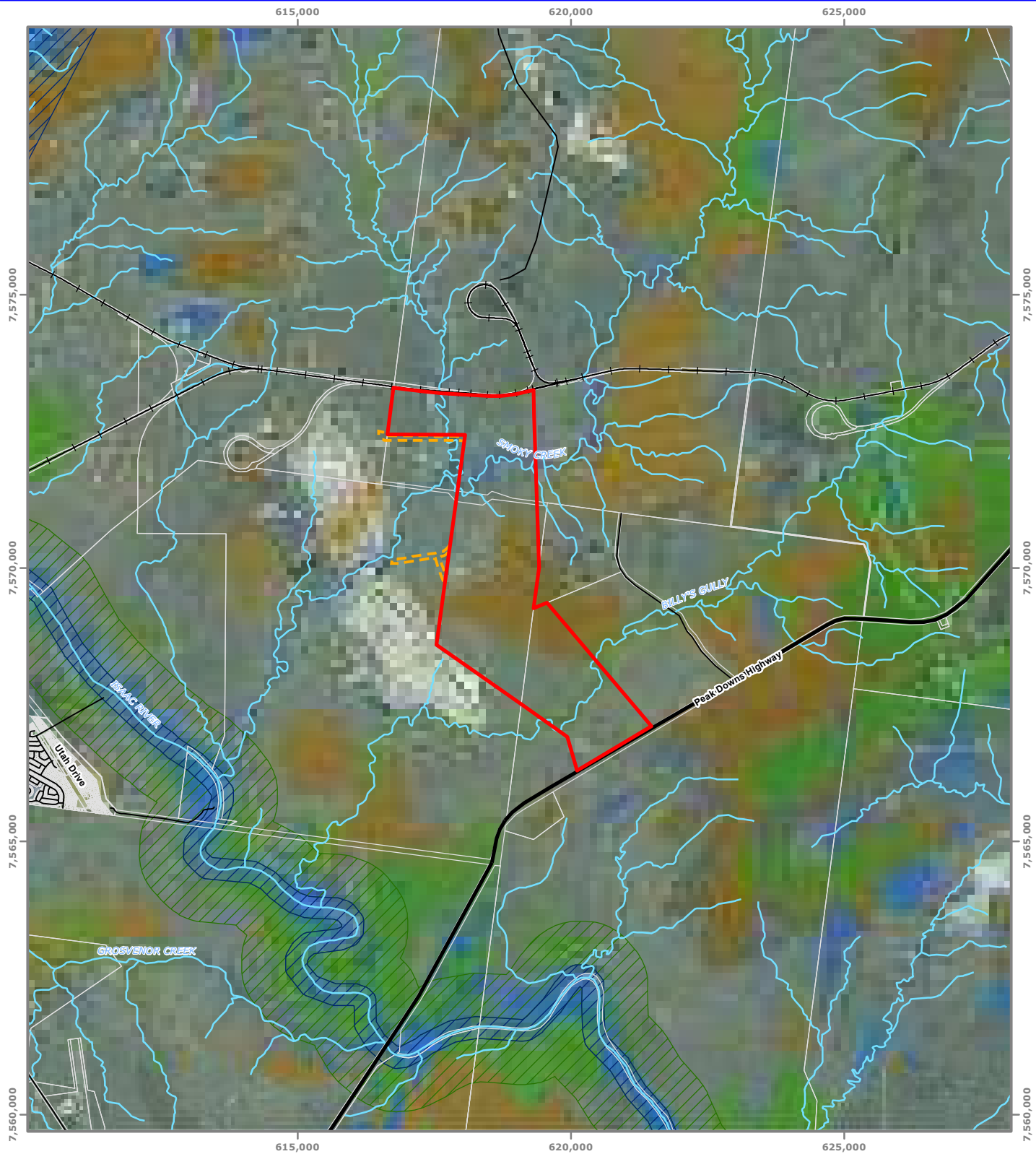
- Moderate potential for groundwater interaction
- Low potential for groundwater interaction

**Figure 8 : Bureau of Meteorology Groundwater Dependent Ecosystem mapping for the ecology study area**

Isaac Plains East Project  
Terrestrial Ecology Assessment

Map Number: 15046\_EAR\_08\_F  
Date: 29 August 2016  
Map Projection: GDA 1994 MGA Zone 55  
Imagery: Stanmore Coal - Sept 2015  
Data: DCDB, Roads, Railway, Watercourse - (c)DNRM 2016  
GDE Atlas - (c)BOM 2016





**Legend**

- Project Site
- Proposed Haul Road Connections
- Highway
- Local Road
- Railway
- Vegetation Management Act Watercourse
- Cadastral Boundary

**Biodiversity Planning Assessment Mapping**

**Ecological Corridors**

- State
- Regional

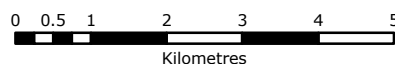
**Biodiversity Significance**

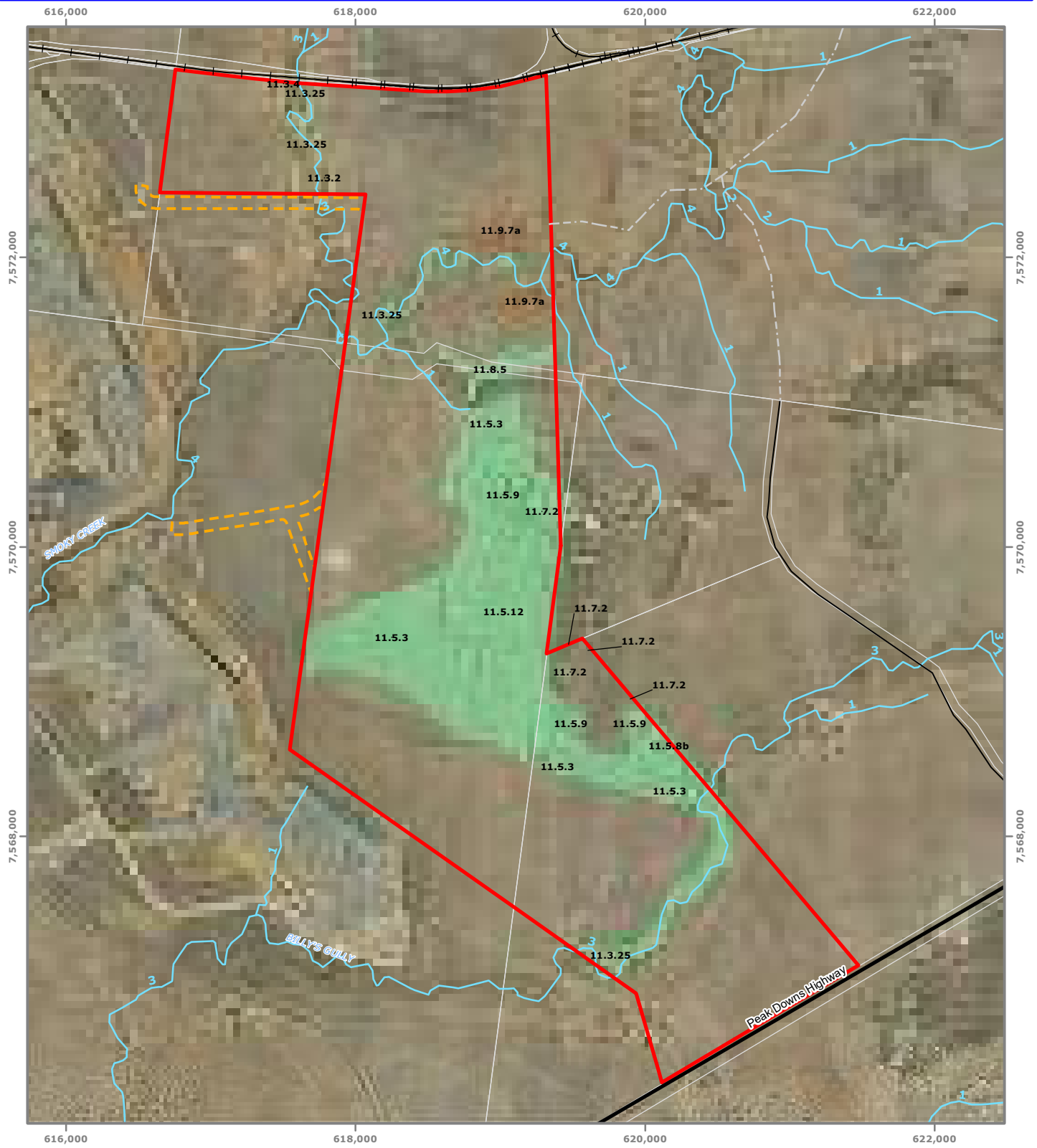
- State
- Regional
- Local or Other Values

**Figure 9 : Biodiversity Planning Assessment mapping for the ecology study area**

Isaac Plains East Project  
Terrestrial Ecology Assessment

Map Number: 15046\_EAR\_09\_F  
Date: 29 August 2016  
Map Projection: GDA 1994 MGA Zone 55  
Imagery: Digital Globe - August 2010  
Data: DCDB, Roads, Railway, Watercourse, BPA - (c)DNRM 2016





**Legend**

- Project Site
- Proposed Haul Road Connections
- Highway
- Local Road
- Vehicular Track
- + Railway
- Vegetation Management Act Watercourse
- Cadastral Boundary

**Remnant Vegetation**

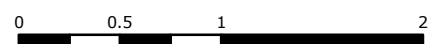
**Vegetation Management Act Status**

- Of concern
- Least concern

**Figure 10 : Field-validated regional ecosystem mapping for the ecology study area**

Isaac Plains East Project  
Terrestrial Ecology Assessment

Map Number: 15046\_EAR\_10\_G  
Date: 29 August 2016  
Map Projection: GDA 1994 MGA Zone 55  
Imagery: Stanmore Coal - Sept 2015  
Data: DCDB, Roads, Railway, Watercourse - (c)DNRM 2016





**Legend**

- Project Site
- Proposed Haul Road Connections
- Highway
- Local Road
- Vehicular Track
- + Railway
- Vegetation Management Act Watercourse
- Cadastral Boundary

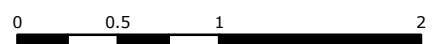
**Recorded Locations**

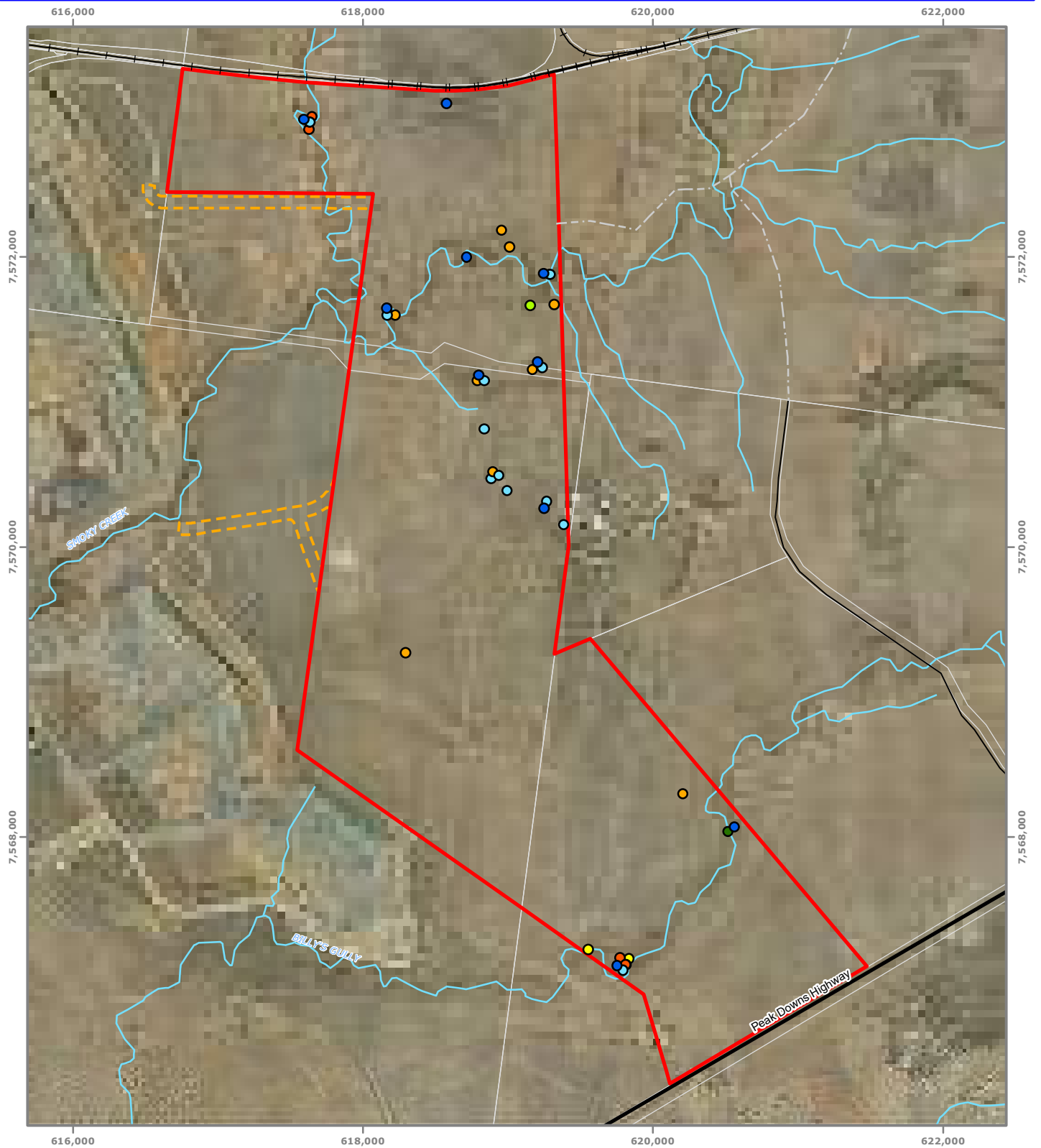
- *Bertya pedicellata* (no common name) – Near threatened (NC Act)

**Figure 11 : *Bertya pedicellata* records for the ecology study area**

Isaac Plains East Project  
Terrestrial Ecology Assessment

Map Number: 15046\_EAR\_11\_G  
Date: 29 August 2016  
Map Projection: GDA 1994 MGA Zone 55  
Imagery: Stanmore Coal - Sept 2015  
Data: DCDB, Roads, Railway, Watercourse - (c)DNRM 2016





**Legend**

- Project Site
- Proposed Haul Road Connections
- Highway
- Local Road
- Vehicular Track
- Railway
- Vegetation Management Act Watercourse
- Cadastral Boundary

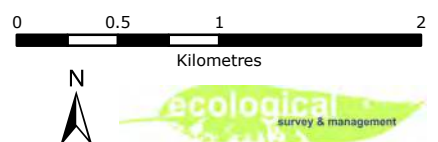
**Individual and plot based records of weeds**

- Rubber Vine (*Cryptostegia grandiflora*) – Category 3 (Biosecurity Act), WoNS
- Harrisia Cactus (*Harrisia martinii*) – Category 3 (Biosecurity Act)
- Bellyache Bush (*Jatropha gossypifolia*) – Category 3 (Biosecurity Act), WoNS
- Tiger Pear (*Opuntia aurantiaca*) – Category 3 (Biosecurity Act), WoNS
- Common Prickly Pear (*Opuntia stricta*) – Category 3 (Biosecurity Act), WoNS
- Velvety Tree Pear (*Opuntia tomentosa*) – Category 3 (Biosecurity Act), WoNS
- Parthenium Weed (*Parthenium hysterophorus*) – Category 3 (Biosecurity Act), WoNS

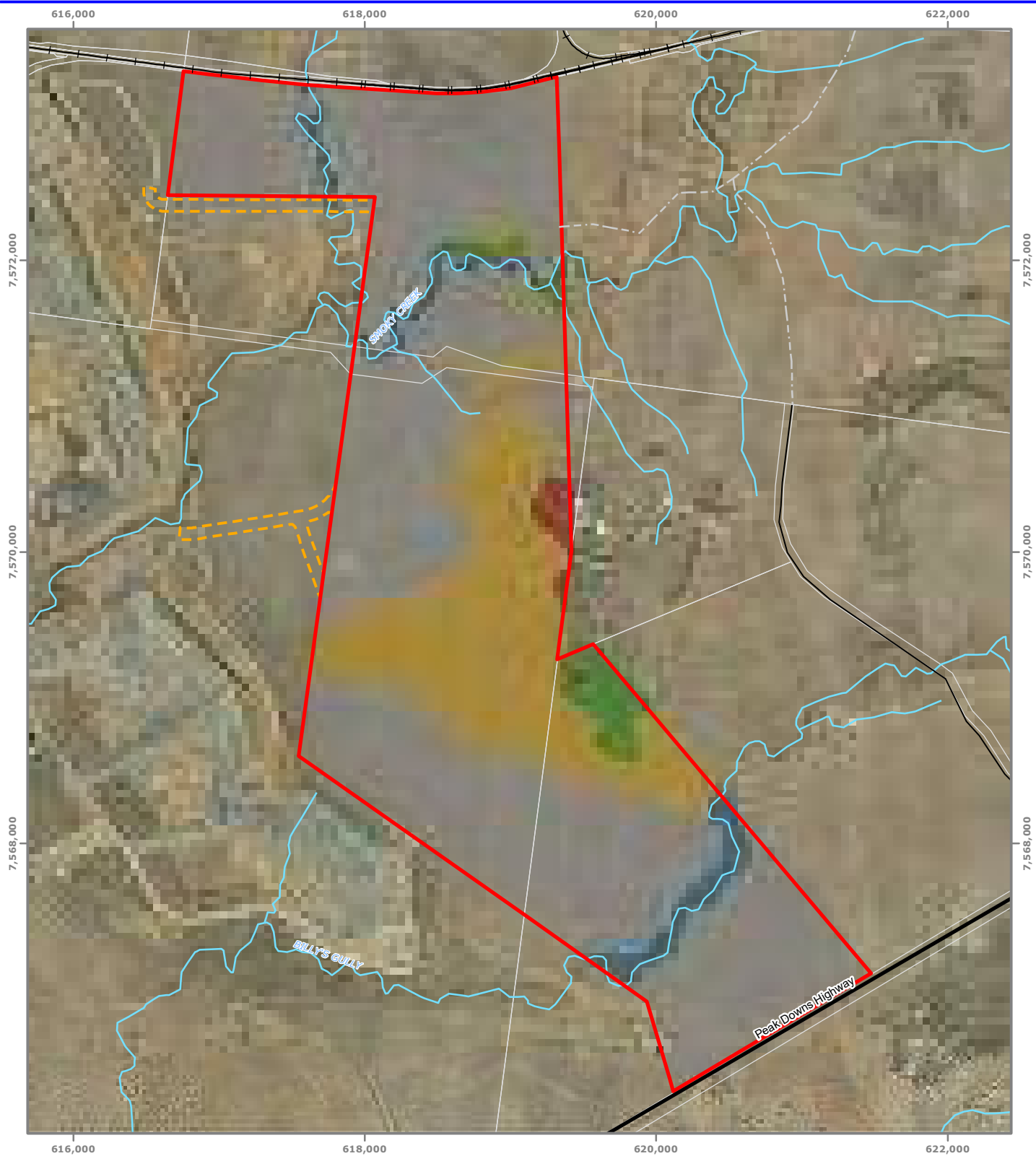
**Figure 12 : Notable weeds identified in the project site**

Isaac Plains East Project  
Terrestrial Ecology Assessment

Map Number: 15046\_EAR\_12\_G  
Date: 29 August 2016  
Map Projection: GDA 1994 MGA Zone 55  
Imagery: Stanmore Coal - Sept 2015  
Data: DCDB, Roads, Railway, Watercourse - (c)DNRM 2016







**Legend**

- Project Site
- Proposed Haul Road Connections
- Highway
- Local Road
- Vehicular Track
- + Railway
- Vegetation Management Act Watercourse
- Cadastral Boundary

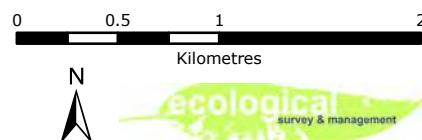
**Broad Habitat Types**

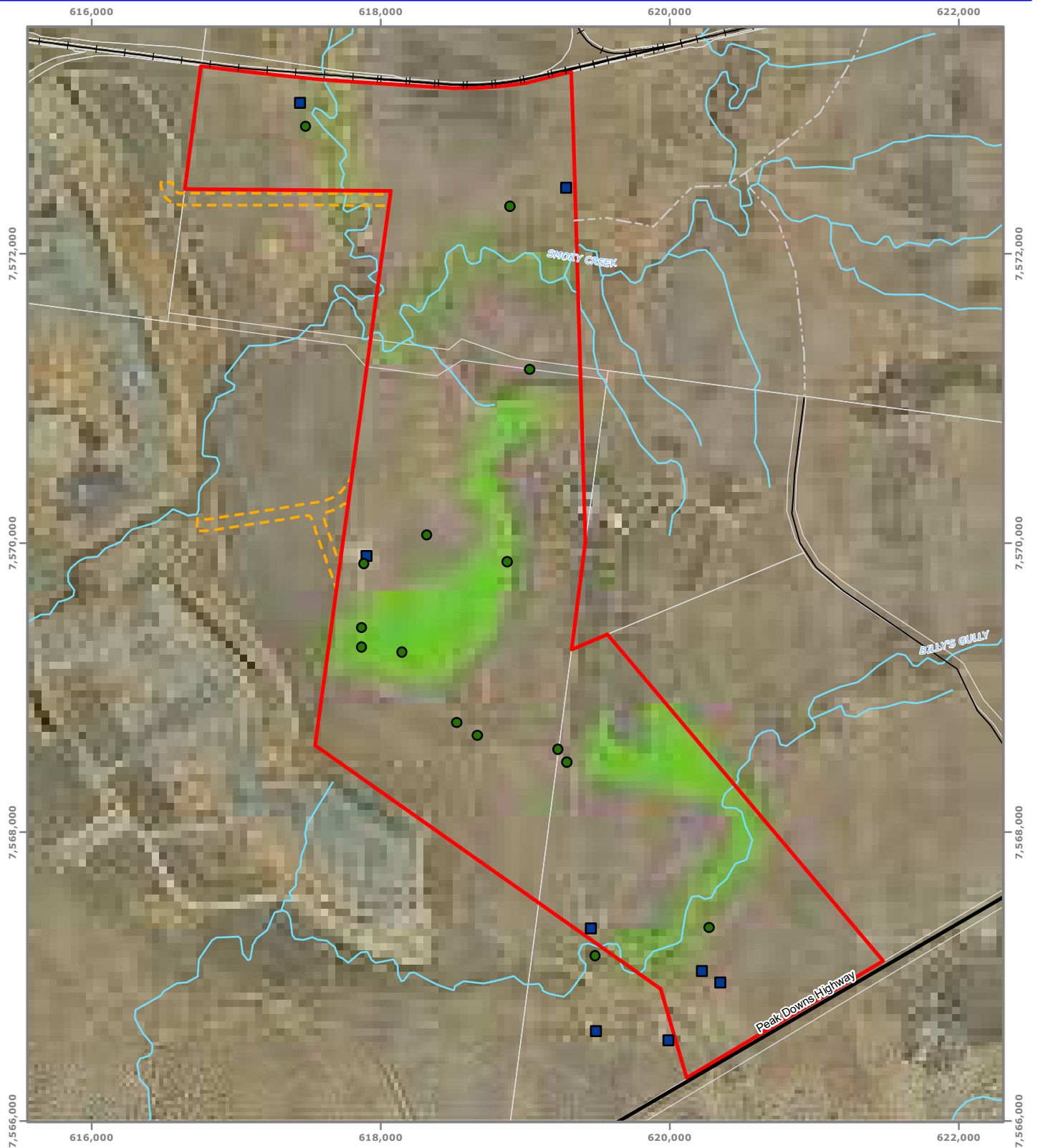
- Riparian vegetation
- Woodlands and open woodlands
- Lancewood with emergent gums
- Regenerating shrubby woodland with emergent gums
- Cleared and disturbed areas

**Figure 13 : Broad habitat types in the ecology study area**

Isaac Plains East Project  
Terrestrial Ecology Assessment

Map Number: 15046\_EAR\_13\_G  
Date: 30 August 2016  
Map Projection: GDA 1994 MGA Zone 55  
Imagery: Stanmore Coal - Sept 2015  
Data: DCDB, Roads, Railway, Watercourse - (c)DNRM 2016





**Legend**

- Project Site
- Proposed Haul Road Connections
- Highway
- Local Road
- Vehicular Track
- Railway
- Vegetation Management Act Watercourse
- Cadastral Boundary

**Water Source**

- Water Point

**Recorded Locations**

- Squatter Pigeon (southern) (*Geophaps scripta scripta*) - Vulnerable (EPBC Act and NC Act)

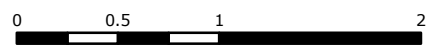
**Habitat Mapping**

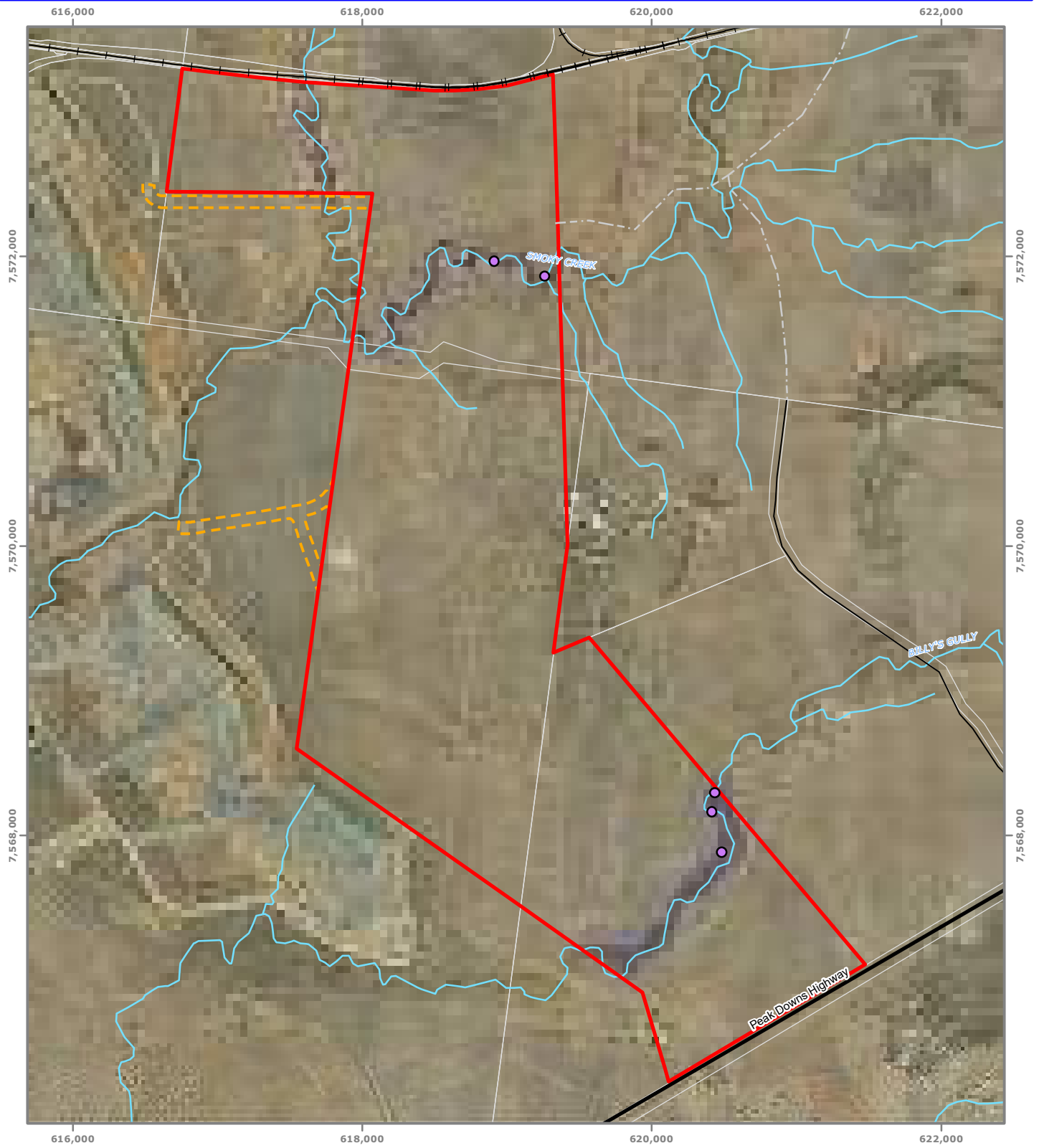
- Squatter Pigeon (southern) (*Geophaps scripta scripta*) - Vulnerable (EPBC Act and NC Act)

**Figure 14 : Squatter Pigeon records and potential habitat within the ecology study area**

Isaac Plains East Project  
Terrestrial Ecology Assessment

Map Number: 15046\_EAR\_14\_G  
Date: 29 August 2016  
Map Projection: GDA 1994 MGA Zone 55  
Imagery: Stanmore Coal - Sept 2015  
Data: DCDB, Roads, Railway, Watercourse - (c)DNRM 2016





**Legend**

- Project Site
- Proposed Haul Road Connections
- Highway
- Local Road
- Vehicular Track
- Railway
- Vegetation Management Act Watercourse
- Cadastral Boundary

**Recorded Locations**

- Greater Glider (*Petauroides volans*) – Vulnerable (EPBC Act)

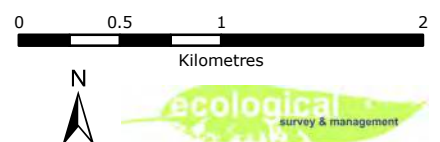
**Habitat Mapping**

- Greater Glider (*Petauroides volans*) – Vulnerable (EPBC Act)

**Figure 15 : Greater Glider records and potential habitat within the ecology study area**

Isaac Plains East Project  
Terrestrial Ecology Assessment

Map Number: 15046\_EAR\_15\_E  
Date: 29 August 2016  
Map Projection: GDA 1994 MGA Zone 55  
Imagery: Stanmore Coal - Sept 2015  
Data: DCDB, Roads, Railway - (c)DNRM 2016





**Legend**

- Project Site
- Proposed Haul Road Connections
- Highway
- Local Road
- Vehicular Track
- + Railway
- Vegetation Management Act Watercourse
- Cadastral Boundary

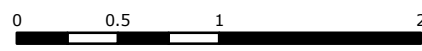
**Recorded Locations**

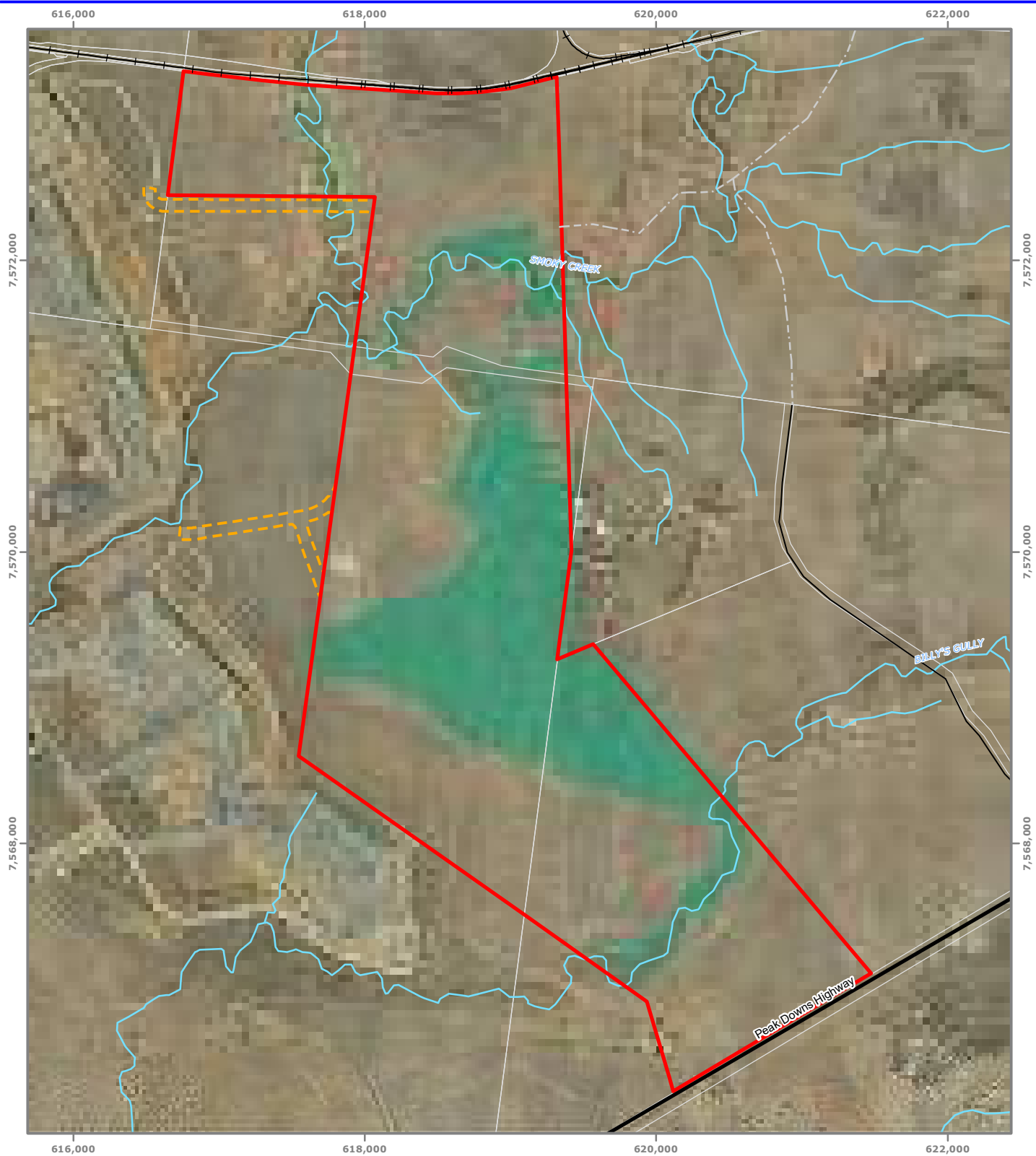
- Ornamental Snake (*Denisonia maculata*) – Vulnerable (EPBC Act and NC Act)

**Figure 16 : Ornamental Snake record for the ecology study area**

Isaac Plains East Project  
Terrestrial Ecology Assessment

Map Number: 15046\_EAR\_16\_G  
Date: 29 August 2016  
Map Projection: GDA 1994 MGA Zone 55  
Imagery: Stanmore Coal - Sept 2015  
Data: DCDB, Roads, Railway, Watercourse - (c)DNRM 2016





**Legend**

- Project Site
- Proposed Haul Road Connections
- Highway
- Local Road
- Vehicular Track
- Railway
- Vegetation Management Act Watercourse
- Cadastral Boundary

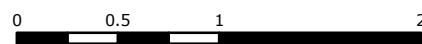
**Potential Habitat Mapping**

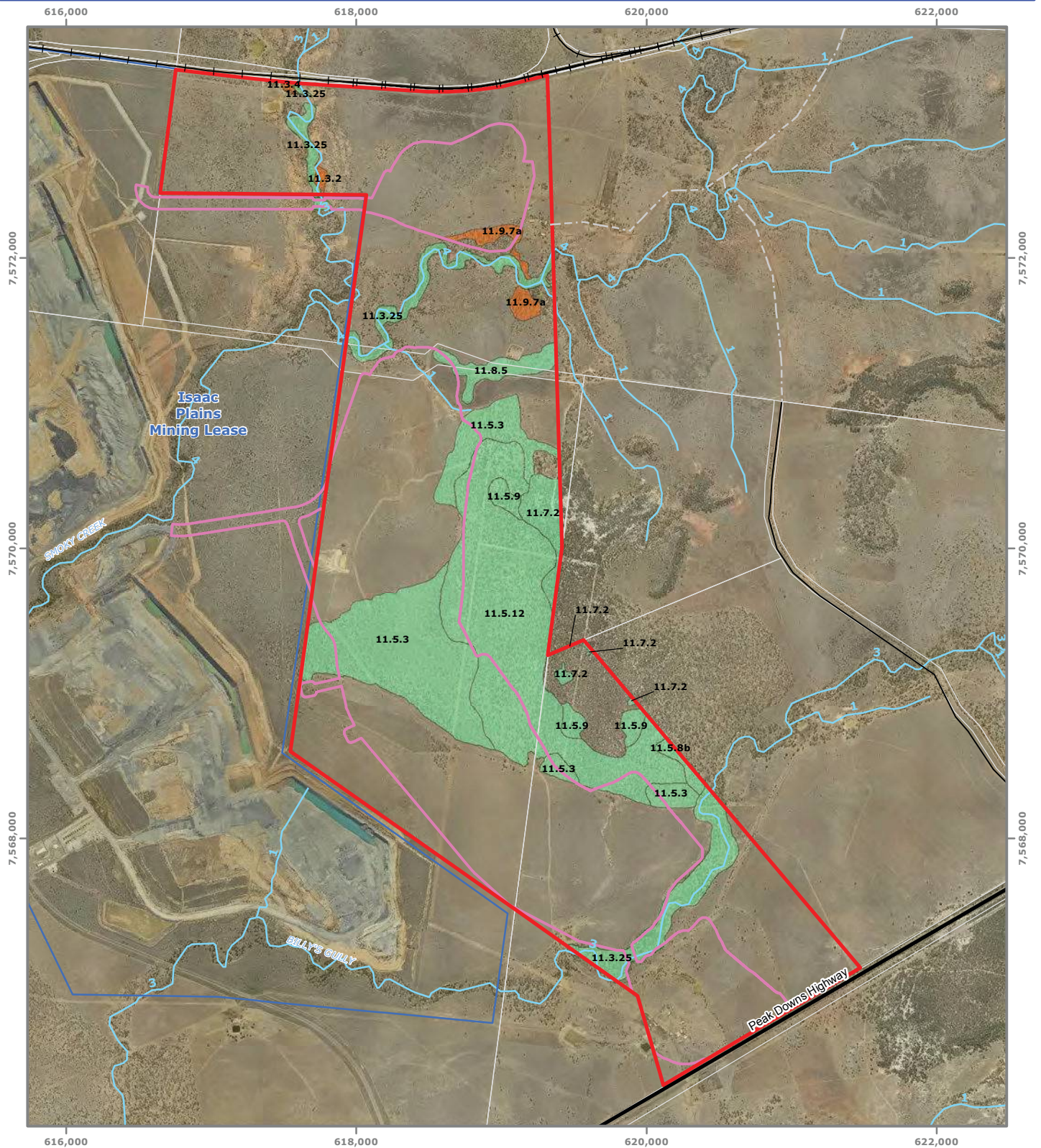
- Koala (*Phascolarctos cinereus*) – Vulnerable (EPBC Act and NC Act)

**Figure 17 : Potential Koala habitat within the ecology study area**

Isaac Plains East Project  
Terrestrial Ecology Assessment

Map Number: 15046\_EAR\_17\_E  
Date: 29 August 2016  
Map Projection: GDA 1994 MGA Zone 55  
Imagery: Stanmore Coal - Sept 2015  
Data: DCDB, Roads, Railway, Watercourse - (c)DNRM 2016





**Legend**

- Project Site
- Disturbance Footprint
- Isaac Plains Mining Lease
- Highway
- Local Road
- Vehicular Track
- Railway
- Vegetation Management Act Watercourse
- Cadastral Boundary

**Remnant Vegetation**

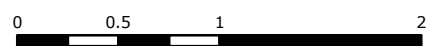
**Vegetation Management Act Status**

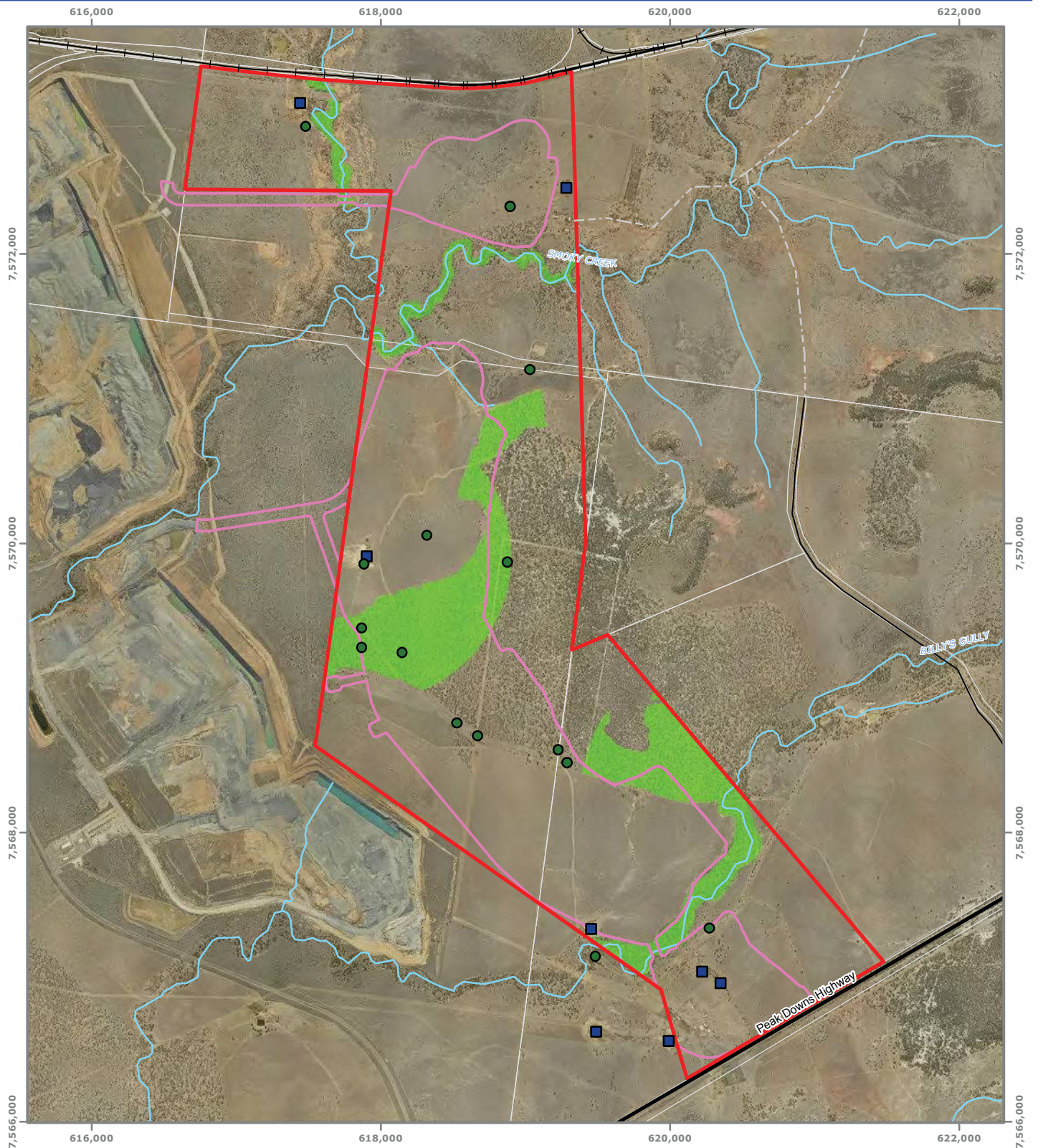
- Of concern
- Least concern

**Figure 18 : Field-validated regional ecosystems proposed to be impacted by the project**

Isaac Plains East Project  
Terrestrial Ecology Assessment

Map Number: 15046\_EAR\_18\_F  
Date: 29 August 2016  
Map Projection: GDA 1994 MGA Zone 55  
Imagery: Stanmore Coal - Sept 2015  
Data: DCDB, Roads, Railway, Watercourse - (c)DNRM 2016





**Legend**

- Project Site
- Disturbance Footprint
- Highway
- Local Road
- Vehicular Track
- Railway
- Vegetation Management Act Watercourse
- Cadastral Boundary

**Water Source**

- Water Point

**Recorded Locations**

- Squatter Pigeon (southern) (*Geophaps scripta scripta*) - Vulnerable (EPBC Act and NC Act)

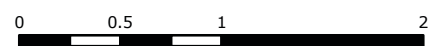
**Habitat Mapping**

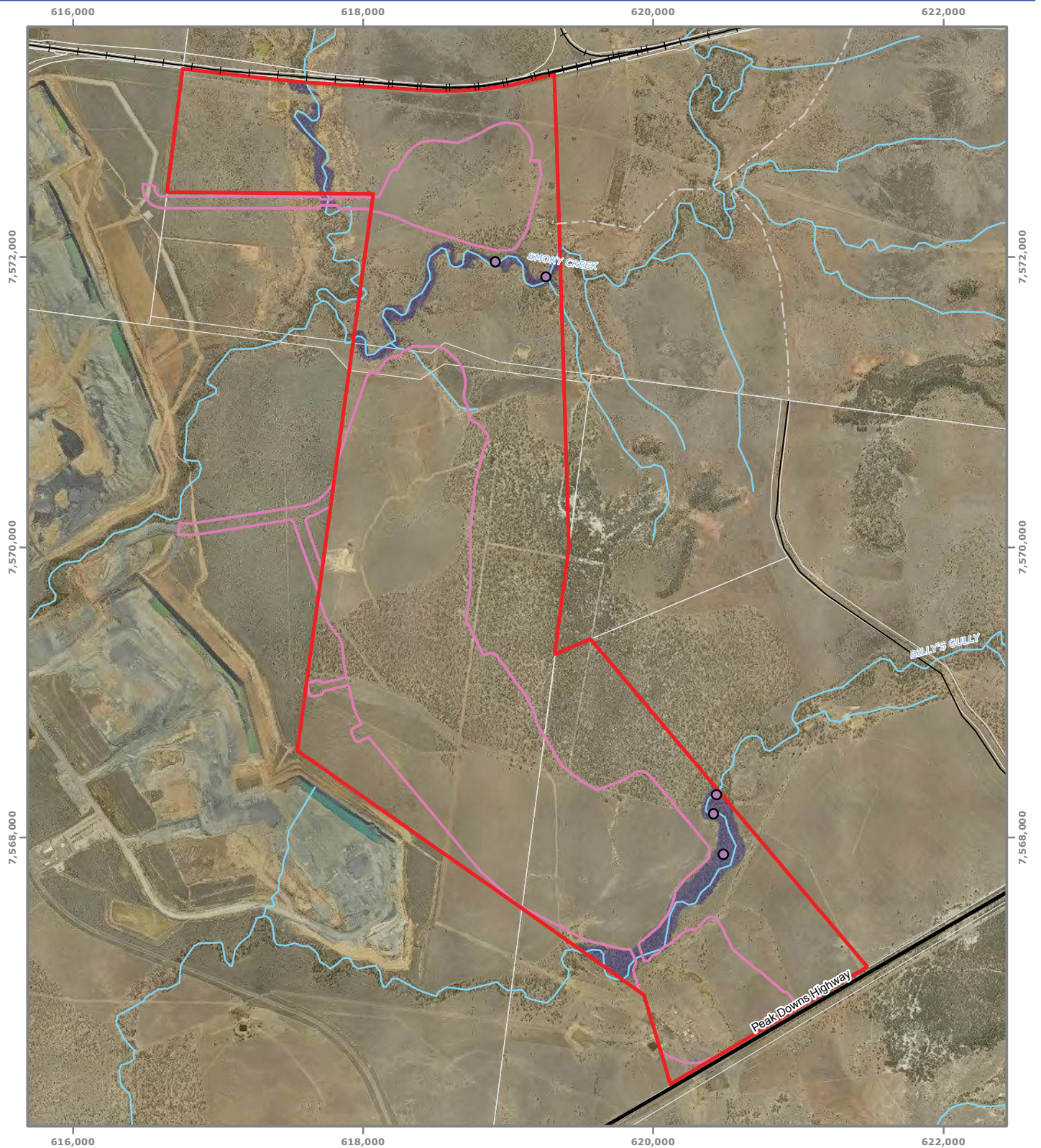
- Squatter Pigeon (southern) (*Geophaps scripta scripta*) - Vulnerable (EPBC Act and NC Act)

**Figure 19 : Squatter Pigeon habitat proposed to be impacted by the project**

Isaac Plains East Project  
Terrestrial Ecology Assessment

Map Number: 15046\_EAR\_19\_F  
Date: 29 August 2016  
Map Projection: GDA 1994 MGA Zone 55  
Imagery: Stanmore Coal - Sept 2015  
Data: DCDB, Roads, Railway, Watercourse - (c)DNRM 2016





**Legend**

- Project Site
- Disturbance Footprint
- Highway
- Local Road
- Vehicular Track
- Railway
- Vegetation Management Act Watercourse
- Cadastral Boundary

**Recorded Locations**

- Greater Glider (*Petauroides volans*) – Vulnerable (EPBC Act)

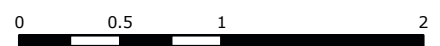
**Habitat Mapping**

- Greater Glider (*Petauroides volans*) – Vulnerable (EPBC Act)

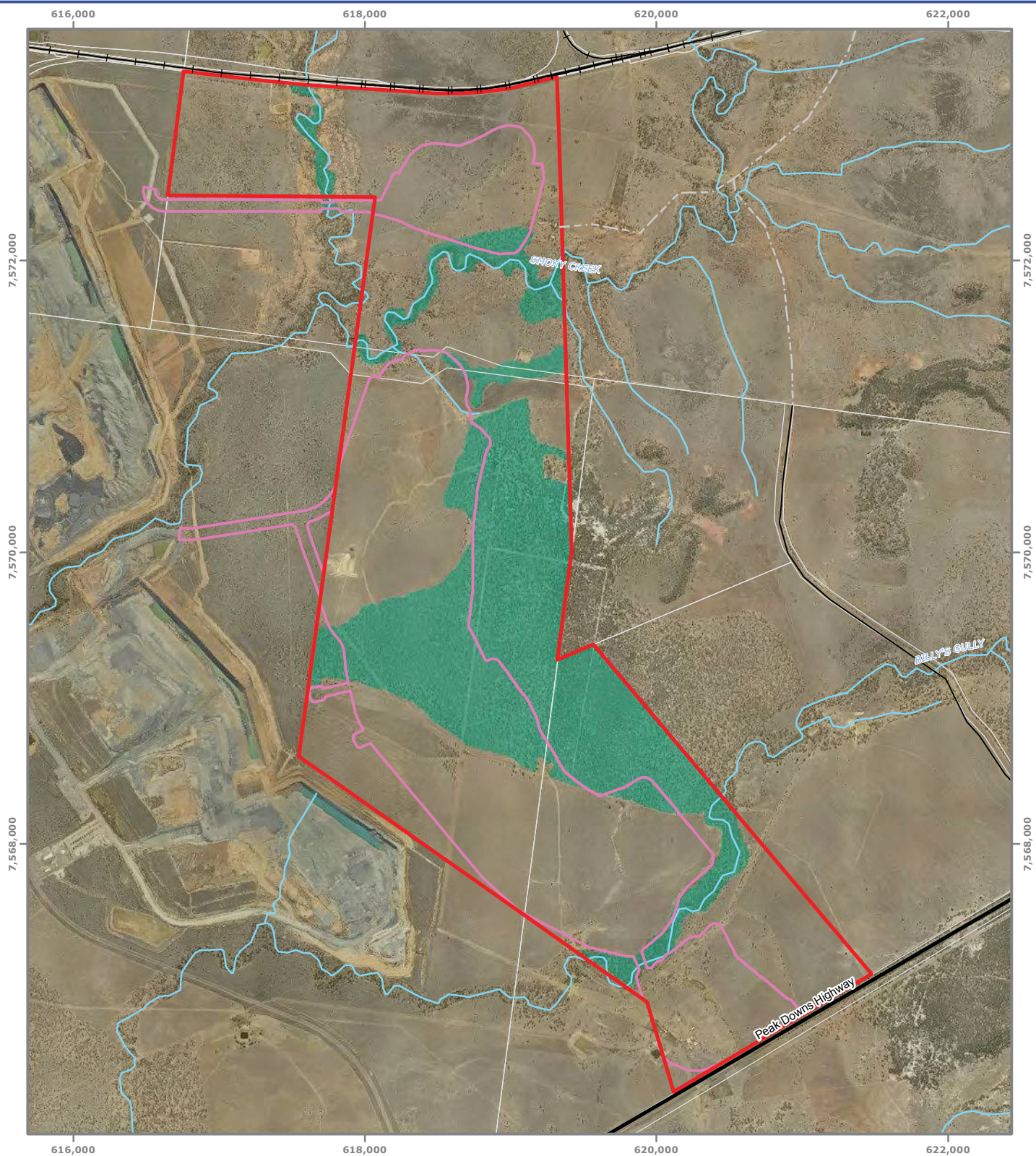
**Figure 20 : Greater Glider habitat proposed to be impacted by the project**

Isaac Plains East Project  
Terrestrial Ecology Assessment

Map Number: 15046\_EAR\_20\_C  
Date: 29 August 2016  
Map Projection: GDA 1994 MGA Zone 55  
Imagery: Stanmore Coal - Sept 2015  
Data: DCDB, Roads, Railway - (c)DNRM 2016







**Legend**

- Project Site
- Disturbance Footprint
- Highway
- Local Road
- Vehicular Track
- + Railway
- Vegetation Management Act Watercourse
- Cadastral Boundary

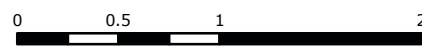
**Potential Habitat Mapping**

- Koala (*Phascolarctos cinereus*) - Vulnerable (EPBC Act and NC Act)

**Figure 21 : Potential Koala habitat proposed to be impacted by the project**

Isaac Plains East Project  
Terrestrial Ecology Assessment

Map Number: 15046\_EAR\_21\_B  
Date: 29 August 2016  
Map Projection: GDA 1994 MGA Zone 55  
Imagery: Stanmore Coal - Sept 2015  
Data: DCDB, Roads, Railway, Watercourse - (c)DNRM 2016



## **Appendix A**

### EPBC Act Protected Matters Search Report



# EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 11/10/16 14:28:18

[Summary](#)

[Details](#)

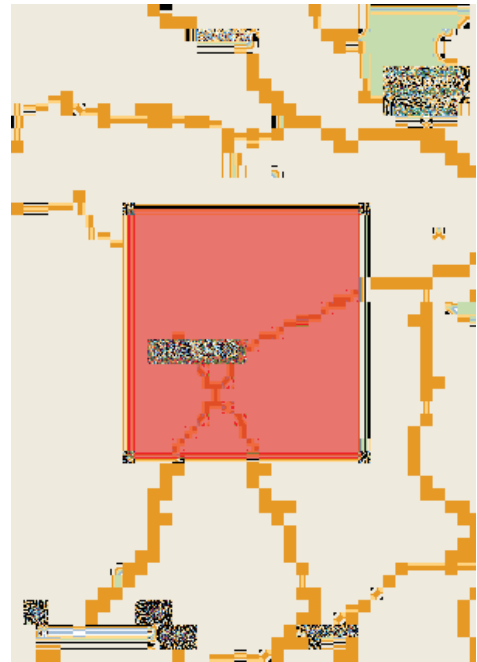
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

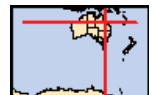
[Acknowledgements](#)



This map may contain data which are  
©Commonwealth of Australia  
(Geoscience Australia), ©PSMA 2010

[Coordinates](#)

Buffer: 0.0Km



# Summary

## Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the [Administrative Guidelines on Significance](#).

<a href="#">World Heritage Properties:</a>	None
<a href="#">National Heritage Places:</a>	None
<a href="#">Wetlands of International Importance:</a>	None
<a href="#">Great Barrier Reef Marine Park:</a>	None
<a href="#">Commonwealth Marine Area:</a>	None
<a href="#">Listed Threatened Ecological Communities:</a>	4
<a href="#">Listed Threatened Species:</a>	22
<a href="#">Listed Migratory Species:</a>	9

## Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at <http://www.environment.gov.au/heritage>

A [permit](#) may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

<a href="#">Commonwealth Land:</a>	None
<a href="#">Commonwealth Heritage Places:</a>	None
<a href="#">Listed Marine Species:</a>	15
<a href="#">Whales and Other Cetaceans:</a>	None
<a href="#">Critical Habitats:</a>	None
<a href="#">Commonwealth Reserves Terrestrial:</a>	None
<a href="#">Commonwealth Reserves Marine:</a>	None

## Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

<a href="#">State and Territory Reserves:</a>	None
<a href="#">Regional Forest Agreements:</a>	None
<a href="#">Invasive Species:</a>	19
<a href="#">Nationally Important Wetlands:</a>	None
<a href="#">Key Ecological Features (Marine)</a>	None

# Details

## Matters of National Environmental Significance

### Listed Threatened Ecological Communities [ [Resource Information](#) ]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
<a href="#">Brigalow (Acacia harpophylla dominant and co-dominant)</a>	Endangered	Community known to occur within area
<a href="#">Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin</a>	Endangered	Community likely to occur within area
<a href="#">Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions</a>	Endangered	Community likely to occur within area
<a href="#">Weeping Myall Woodlands</a>	Endangered	Community may occur within area

### Listed Threatened Species [ [Resource Information](#) ]

Name	Status	Type of Presence
<b>Birds</b>		
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Erythrotriorchis radiatus</a> Red Goshawk [942]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Geophaps scripta scripta</a> Squatter Pigeon (southern) [64440]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Grantiella picta</a> Painted Honeyeater [470]	Vulnerable	Species or species habitat may occur within area
<a href="#">Neochmia ruficauda ruficauda</a> Star Finch (eastern), Star Finch (southern) [26027]	Endangered	Species or species habitat likely to occur within area
<a href="#">Rostratula australis</a> Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
<b>Mammals</b>		
<a href="#">Dasyurus hallucatus</a> Northern Quoll, Digul [331]	Endangered	Species or species habitat likely to occur within area
<a href="#">Macroderma gigas</a> Ghost Bat [174]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Nyctophilus corbeni</a> Corben's Long-eared Bat, South-eastern Long-eared Bat [83395]	Vulnerable	Species or species habitat may occur within area

Name	Status	Type of Presence
<a href="#">Petauroides volans</a> Greater Glider [254]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)</a>		
Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
Other		
<a href="#">Cycas ophiolitica</a> [55797]	Endangered	Species or species habitat likely to occur within area
Plants		
<a href="#">Dichanthium queenslandicum</a> King Blue-grass [5481]	Endangered	Species or species habitat likely to occur within area
<a href="#">Dichanthium setosum</a> bluegrass [14159]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Eucalyptus raveretiana</a> Black Ironbox [16344]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Samadera bidwillii</a> [29708]	Vulnerable	Species or species habitat likely to occur within area
Reptiles		
<a href="#">Denisonia maculata</a> Ornamental Snake [1193]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Egernia rugosa</a> Yakka Skink [1420]	Vulnerable	Species or species habitat may occur within area
<a href="#">Elseya albagula</a> Southern Snapping Turtle, White-throated Snapping Turtle [81648]	Critically Endangered	Species or species habitat likely to occur within area
<a href="#">Furina dunmali</a> Dunmall's Snake [59254]	Vulnerable	Species or species habitat may occur within area
<a href="#">Lerista allanae</a> Allan's Lerista, Retro Slider [1378]	Endangered	Species or species habitat may occur within area
<a href="#">Rheodytes leukops</a> Fitzroy River Turtle, Fitzroy Tortoise, Fitzroy Turtle, White-eyed River Diver [1761]	Vulnerable	Species or species habitat may occur within area
Listed Migratory Species		<a href="#">[ Resource Information ]</a>
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Migratory Marine Birds		
<a href="#">Apus pacificus</a> Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
<a href="#">Cuculus optatus</a> Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area
<a href="#">Monarcha melanopsis</a> Black-faced Monarch [609]		Species or species habitat known to occur

Name	Threatened	Type of Presence
<a href="#">Motacilla flava</a> Yellow Wagtail [644]		within area  Species or species habitat may occur within area
<a href="#">Myiagra cyanoleuca</a> Satin Flycatcher [612]		Species or species habitat may occur within area
<b>Migratory Wetlands Species</b>		
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Gallinago hardwickii</a> Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
<a href="#">Pandion haliaetus</a> Osprey [952]		Species or species habitat likely to occur within area
<a href="#">Tringa nebularia</a> Common Greenshank, Greenshank [832]		Species or species habitat may occur within area

## Other Matters Protected by the EPBC Act

Listed Marine Species		[ Resource Information ]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
<b>Birds</b>		
<a href="#">Anseranas semipalmata</a> Magpie Goose [978]		Species or species habitat may occur within area
<a href="#">Apus pacificus</a> Fork-tailed Swift [678]		Species or species habitat likely to occur within area
<a href="#">Ardea alba</a> Great Egret, White Egret [59541]		Species or species habitat known to occur within area
<a href="#">Ardea ibis</a> Cattle Egret [59542]		Species or species habitat may occur within area
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Cuculus saturatus</a> Oriental Cuckoo, Himalayan Cuckoo [710]		Species or species habitat may occur within area
<a href="#">Gallinago hardwickii</a> Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
<a href="#">Haliaeetus leucogaster</a> White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
<a href="#">Merops ornatus</a> Rainbow Bee-eater [670]		Species or species habitat may occur within

Name	Threatened	Type of Presence area
<a href="#">Monarcha melanopsis</a> Black-faced Monarch [609]		Species or species habitat known to occur within area
<a href="#">Motacilla flava</a> Yellow Wagtail [644]		Species or species habitat may occur within area
<a href="#">Myiagra cyanoleuca</a> Satin Flycatcher [612]		Species or species habitat may occur within area
<a href="#">Pandion haliaetus</a> Osprey [952]		Species or species habitat likely to occur within area
<a href="#">Rostratula benghalensis (sensu lato)</a> Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
<a href="#">Tringa nebularia</a> Common Greenshank, Greenshank [832]		Species or species habitat may occur within area

## Extra Information

### Invasive Species [ [Resource Information](#) ]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resources Audit, 2001.

Name	Status	Type of Presence
<b>Birds</b>		
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
<b>Frogs</b>		
Rhinella marina Cane Toad [83218]		Species or species habitat likely to occur within area
<b>Mammals</b>		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area



Name	Status	Type of Presence
<i>Felis catus</i> Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
<i>Mus musculus</i> House Mouse [120]		Species or species habitat likely to occur within area
<i>Oryctolagus cuniculus</i> Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
<i>Sus scrofa</i> Pig [6]		Species or species habitat likely to occur within area
<i>Vulpes vulpes</i> Red Fox, Fox [18]		Species or species habitat likely to occur within area

### Plants

<i>Acacia nilotica</i> subsp. <i>indica</i> Prickly Acacia [6196]		Species or species habitat may occur within area
<i>Cryptostegia grandiflora</i> Rubber Vine, Rubbervine, India Rubber Vine, India Rubbervine, Palay Rubbervine, Purple Allamanda [18913]		Species or species habitat likely to occur within area
<i>Jatropha gossypifolia</i> Cotton-leaved Physic-Nut, Bellyache Bush, Cotton-leaf Physic Nut, Cotton-leaf <i>Jatropha</i> , Black Physic Nut [7507]		Species or species habitat likely to occur within area
<i>Lantana camara</i> Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
<i>Parkinsonia aculeata</i> Parkinsonia, Jerusalem Thorn, Jelly Bean Tree, Horse Bean [12301]		Species or species habitat likely to occur within area
<i>Parthenium hysterophorus</i> Parthenium Weed, Bitter Weed, Carrot Grass, False Ragweed [19566]		Species or species habitat likely to occur within area
<i>Vachellia nilotica</i> Prickly Acacia, Blackthorn, Prickly Mimosa, Black Piquant, Babul [84351]		Species or species habitat likely to occur within area

### Reptiles

<i>Hemidactylus frenatus</i> Asian House Gecko [1708]		Species or species habitat likely to occur within area
--	--	--

# Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

# Coordinates

-21.71492 147.89652,-21.71492 148.41903,-22.22927 148.41903,-22.22927 147.89652,-21.71492 147.89652

# Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- [-Office of Environment and Heritage, New South Wales](#)
- [-Department of Environment and Primary Industries, Victoria](#)
- [-Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [-Department of Environment, Water and Natural Resources, South Australia](#)
- [-Parks and Wildlife Commission NT, Northern Territory Government](#)
- [-Department of Environmental and Heritage Protection, Queensland](#)
- [-Department of Parks and Wildlife, Western Australia](#)
- [-Environment and Planning Directorate, ACT](#)
- [-Birdlife Australia](#)
- [-Australian Bird and Bat Banding Scheme](#)
- [-Australian National Wildlife Collection](#)
- Natural history museums of Australia
- [-Museum Victoria](#)
- [-Australian Museum](#)
- [-South Australian Museum](#)
- [-Queensland Museum](#)
- [-Online Zoological Collections of Australian Museums](#)
- [-Queensland Herbarium](#)
- [-National Herbarium of NSW](#)
- [-Royal Botanic Gardens and National Herbarium of Victoria](#)
- [-Tasmanian Herbarium](#)
- [-State Herbarium of South Australia](#)
- [-Northern Territory Herbarium](#)
- [-Western Australian Herbarium](#)
- [-Australian National Herbarium, Atherton and Canberra](#)
- [-University of New England](#)
- [-Ocean Biogeographic Information System](#)
- [-Australian Government, Department of Defence  
Forestry Corporation, NSW](#)
- [-Geoscience Australia](#)
- [-CSIRO](#)
- Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the [Contact Us](#) page.

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## **Appendix B**

Queensland Wildlife Online Database search results



# Queensland Government

## Wildlife Online Extract

Search Criteria: Species List for a Defined Area  
Species: All  
Type: All  
Status: All  
Records: All  
Date: All  
Latitude: 21.7149 to 22.2293  
Longitude: 147.8965 to 148.4190  
Email: meredith.watherston@ecosm.com.au  
Date submitted: Wednesday 06 Jul 2016 14:13:10  
Date extracted: Wednesday 06 Jul 2016 14:20:02

The number of records retrieved = 672

### **Disclaimer**

As the DSITIA is still in a process of collating and vetting data, it is possible the information given is not complete. The information provided should only be used for the project for which it was requested and it should be appropriately acknowledged as being derived from Wildlife Online when it is used.

The State of Queensland does not invite reliance upon, nor accept responsibility for this information. Persons should satisfy themselves through independent means as to the accuracy and completeness of this information.

No statements, representations or warranties are made about the accuracy or completeness of this information. The State of Queensland disclaims all responsibility for this information and all liability (including without limitation, liability in negligence) for all expenses, losses, damages and costs you may incur as a result of the information being inaccurate or incomplete in any way for any reason.

Feedback about Wildlife Online should be emailed to [wildlife.online@science.dsitia.qld.gov.au](mailto:wildlife.online@science.dsitia.qld.gov.au)

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	amphibians	Bufonidae	<i>Rhinella marina</i>	cane toad	Y			21
animals	amphibians	Hylidae	<i>Litoria rubella</i>	ruddy treefrog		C		10
animals	amphibians	Hylidae	<i>Litoria caerulea</i>	common green treefrog		C		47
animals	amphibians	Hylidae	<i>Cyclorana brevipes</i>	superb collared frog		C		1
animals	amphibians	Hylidae	<i>Cyclorana verrucosa</i>	rough collared frog		C		2/1
animals	amphibians	Hylidae	<i>Litoria latopalmata</i>	broad palmed rocketfrog		C		3
animals	amphibians	Hylidae	<i>Cyclorana alboguttata</i>	greenstripe frog		C		7
animals	amphibians	Hylidae	<i>Cyclorana novaehollandiae</i>	eastern snapping frog		C		17
animals	amphibians	Hylidae	<i>Litoria rothii</i>	northern laughing treefrog		C		1
animals	amphibians	Hylidae	<i>Litoria inermis</i>	bumpy rocketfrog		C		4
animals	amphibians	Limnodynastidae	<i>Limnodynastes salmini</i>	salmon striped frog		C		5
animals	amphibians	Limnodynastidae	<i>Platyplectrum ornatum</i>	ornate burrowing frog		C		23
animals	amphibians	Limnodynastidae	<i>Limnodynastes tasmaniensis</i>	spotted grassfrog		C		10
animals	amphibians	Limnodynastidae	<i>Limnodynastes terraereginae</i>	scarlet sided pobblebonk		C		3
animals	amphibians	Myobatrachidae	<i>Uperoleia sp.</i>					1
animals	birds	Acanthizidae	<i>Acanthiza nana</i>	yellow thornbill		C		2
animals	birds	Acanthizidae	<i>Gerygone olivacea</i>	white-throated gerygone		C		26
animals	birds	Acanthizidae	<i>Acanthiza apicalis</i>	inland thornbill		C		3
animals	birds	Acanthizidae	<i>Acanthiza reguloides</i>	buff-rumped thornbill		C		6
animals	birds	Acanthizidae	<i>Sericornis frontalis</i>	white-browed scrubwren		C		2
animals	birds	Acanthizidae	<i>Acanthiza chrysorrhoa</i>	yellow-rumped thornbill		C		2
animals	birds	Acanthizidae	<i>Chthonicola sagittata</i>	speckled warbler		C		7
animals	birds	Acanthizidae	<i>Smicromis brevirostris</i>	weebill		C		57
animals	birds	Accipitridae	<i>Accipiter cirrocephalus</i>	collared sparrowhawk		C		2
animals	birds	Accipitridae	<i>Hieraaetus morphnoides</i>	little eagle		C		1
animals	birds	Accipitridae	<i>Haliastur sphenurus</i>	whistling kite		C		14
animals	birds	Accipitridae	<i>Accipiter fasciatus</i>	brown goshawk		C		2
animals	birds	Accipitridae	<i>Elanus axillaris</i>	black-shouldered kite		C		2
animals	birds	Accipitridae	<i>Circus assimilis</i>	spotted harrier		C		1
animals	birds	Accipitridae	<i>Aquila audax</i>	wedge-tailed eagle		C		9
animals	birds	Accipitridae	<i>Milvus migrans</i>	black kite		C		5
animals	birds	Acrocephalidae	<i>Acrocephalus australis</i>	Australian reed-warbler		SL		1
animals	birds	Aegothelidae	<i>Aegotheles cristatus</i>	Australian owl-nightjar		C		4
animals	birds	Alaudidae	<i>Mirafra javanica</i>	Horsfield's bushlark		C		3
animals	birds	Anatidae	<i>Aythya australis</i>	hardhead		C		3
animals	birds	Anatidae	<i>Cygnus atratus</i>	black swan		C		3
animals	birds	Anatidae	<i>Malacorhynchus membranaceus</i>	pink-eared duck		C		1
animals	birds	Anatidae	<i>Anas superciliosa</i>	Pacific black duck		C		11
animals	birds	Anatidae	<i>Dendrocygna eytoni</i>	plumed whistling-duck		C		3
animals	birds	Anatidae	<i>Chenonetta jubata</i>	Australian wood duck		C		12
animals	birds	Anatidae	<i>Nettapus coromandelianus</i>	cotton pygmy-goose		C		2
animals	birds	Anatidae	<i>Anas gracilis</i>	grey teal		C		10
animals	birds	Anhingidae	<i>Anhinga novaehollandiae</i>	Australasian darter		C		9
animals	birds	Ardeidae	<i>Egretta novaehollandiae</i>	white-faced heron		C		14
animals	birds	Ardeidae	<i>Nycticorax caledonicus</i>	nankeen night-heron		C		1
animals	birds	Ardeidae	<i>Ardea alba modesta</i>	eastern great egret		SL		4

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	birds	Ardeidae	<i>Ardea intermedia</i>	intermediate egret		C		3
animals	birds	Ardeidae	<i>Ardea pacifica</i>	white-necked heron		C		10
animals	birds	Ardeidae	<i>Ardea ibis</i>	cattle egret		SL		2
animals	birds	Artamidae	<i>Artamus leucorhynchus</i>	white-breasted woodswallow		C		5
animals	birds	Artamidae	<i>Cracticus torquatus</i>	grey butcherbird		C		36
animals	birds	Artamidae	<i>Strepera graculina</i>	pieb currawong		C		26
animals	birds	Artamidae	<i>Cracticus tibicen</i>	Australian magpie		C		55
animals	birds	Artamidae	<i>Artamus cinereus</i>	black-faced woodswallow		C		6
animals	birds	Artamidae	<i>Cracticus nigrogularis</i>	pieb butcherbird		C		55
animals	birds	Burhinidae	<i>Burhinus grallarius</i>	bush stone-curlew		C		3
animals	birds	Cacatuidae	<i>Cacatua galerita</i>	sulphur-crested cockatoo		C		27
animals	birds	Cacatuidae	<i>Nymphicus hollandicus</i>	cockatiel		C		2
animals	birds	Cacatuidae	<i>Eolophus roseicapillus</i>	galah		C		24
animals	birds	Campephagidae	<i>Coracina novaehollandiae</i>	black-faced cuckoo-shrike		C		28
animals	birds	Campephagidae	<i>Coracina tenuirostris</i>	cicadabird		C		18
animals	birds	Campephagidae	<i>Coracina papuensis</i>	white-bellied cuckoo-shrike		C		3
animals	birds	Campephagidae	<i>Lalage tricolor</i>	white-winged triller		C		8
animals	birds	Campephagidae	<i>Coracina maxima</i>	ground cuckoo-shrike		C		2
animals	birds	Casuariidae	<i>Dromaius novaehollandiae</i>	emu		C		8
animals	birds	Charadriidae	<i>Vanellus miles miles</i>	masked lapwing (northern subspecies)		C		2
animals	birds	Charadriidae	<i>Elseyornis melanops</i>	black-fronted dotterel		C		7
animals	birds	Charadriidae	<i>Vanellus tricolor</i>	banded lapwing		C		1
animals	birds	Charadriidae	<i>Vanellus miles</i>	masked lapwing		C		6
animals	birds	Ciconiidae	<i>Ephippiorhynchus asiaticus</i>	black-necked stork		C		2
animals	birds	Cisticolidae	<i>Cisticola exilis</i>	golden-headed cisticola		C		3
animals	birds	Columbidae	<i>Geophaps scripta scripta</i>	squatter pigeon (southern subspecies)		V	V	19
animals	birds	Columbidae	<i>Geopelia striata</i>	peaceful dove		C		22
animals	birds	Columbidae	<i>Geopelia humeralis</i>	bar-shouldered dove		C		8
animals	birds	Columbidae	<i>Phaps chalcoptera</i>	common bronzewing		C		1
animals	birds	Columbidae	<i>Ocyphaps lophotes</i>	crested pigeon		C		13
animals	birds	Coraciidae	<i>Eurystomus orientalis</i>	dollarbird		C		17
animals	birds	Corcoracidae	<i>Corcorax melanorhamphos</i>	white-winged chough		C		6
animals	birds	Corcoracidae	<i>Struthidea cinerea</i>	apostlebird		C		27
animals	birds	Corvidae	<i>Corvus orru</i>	Torresian crow		C		80
animals	birds	Corvidae	<i>Corvus bennetti</i>	little crow		C		1
animals	birds	Cuculidae	<i>Cacomantis flabelliformis</i>	fan-tailed cuckoo		C		3
animals	birds	Cuculidae	<i>Scythrops novaehollandiae</i>	channel-billed cuckoo		C		6
animals	birds	Cuculidae	<i>Chalcites basalis</i>	Horsfield's bronze-cuckoo		C		4
animals	birds	Cuculidae	<i>Chalcites lucidus</i>	shining bronze-cuckoo		C		3
animals	birds	Cuculidae	<i>Cacomantis pallidus</i>	pallid cuckoo		C		6
animals	birds	Cuculidae	<i>Chalcites minutillus</i>	little bronze-cuckoo		C		3
animals	birds	Cuculidae	<i>Eudynamys orientalis</i>	eastern koel		C		5
animals	birds	Cuculidae	<i>Centropus phasianinus</i>	pheasant coucal		C		14
animals	birds	Dicruridae	<i>Dicrurus bracteatus</i>	spangled drongo		C		4
animals	birds	Estrildidae	<i>Taeniopygia guttata</i>	zebra finch		C		3
animals	birds	Estrildidae	<i>Lonchura castaneothorax</i>	chestnut-breasted mannikin		C		1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	birds	Estrildidae	<i>Taeniopygia bichenovii</i>	double-barred finch		C		16
animals	birds	Eurostopodidae	<i>Eurostopodus mystacalis</i>	white-throated nightjar		C		2
animals	birds	Falconidae	<i>Falco berigora</i>	brown falcon		C		8
animals	birds	Falconidae	<i>Falco longipennis</i>	Australian hobby		C		3
animals	birds	Falconidae	<i>Falco cenchroides</i>	nankeen kestrel		C		15
animals	birds	Gruidae	<i>Grus rubicunda</i>	brolga		C		10
animals	birds	Halcyonidae	<i>Dacelo leachii</i>	blue-winged kookaburra		C		5
animals	birds	Halcyonidae	<i>Todiramphus macleayii</i>	forest kingfisher		C		8
animals	birds	Halcyonidae	<i>Todiramphus sanctus</i>	sacred kingfisher		C		9
animals	birds	Halcyonidae	<i>Todiramphus pyrrhopygius</i>	red-backed kingfisher		C		5
animals	birds	Halcyonidae	<i>Dacelo novaeguineae</i>	laughing kookaburra		C		40
animals	birds	Hirundinidae	<i>Petrochelidon nigricans</i>	tree martin		C		4
animals	birds	Hirundinidae	<i>Petrochelidon ariel</i>	fairy martin		C		6
animals	birds	Hirundinidae	<i>Hirundo neoxena</i>	welcome swallow		C		4
animals	birds	Jacanidae	<i>Irediparra gallinacea</i>	comb-crested jacana		C		2
animals	birds	Maluridae	<i>Malurus cyaneus</i>	superb fairy-wren		C		1
animals	birds	Maluridae	<i>Malurus melanocephalus</i>	red-backed fairy-wren		C		29
animals	birds	Maluridae	<i>Malurus lamberti</i>	variegated fairy-wren		C		17
animals	birds	Megaluridae	<i>Megalurus timoriensis</i>	tawny grassbird		C		2
animals	birds	Megaluridae	<i>Cincloramphus mathewsi</i>	rufous songlark		C		2
animals	birds	Megapodiidae	<i>Alectura lathamii</i>	Australian brush-turkey		C		2
animals	birds	Meliphagidae	<i>Philemon corniculatus</i>	noisy friarbird		C		41
animals	birds	Meliphagidae	<i>Manorina melanocephala</i>	noisy miner		C		9
animals	birds	Meliphagidae	<i>Philemon citreogularis</i>	little friarbird		C		29
animals	birds	Meliphagidae	<i>Acanthagenys rufogularis</i>	spiny-cheeked honeyeater		C		2
animals	birds	Meliphagidae	<i>Melithreptus albogularis</i>	white-throated honeyeater		C		45
animals	birds	Meliphagidae	<i>Plectorhyncha lanceolata</i>	striped honeyeater		C		14
animals	birds	Meliphagidae	<i>Lichmera indistincta</i>	brown honeyeater		C		12
animals	birds	Meliphagidae	<i>Gavicalis virescens</i>	singing honeyeater		C		12
animals	birds	Meliphagidae	<i>Manorina flavigula</i>	yellow-throated miner		C		17
animals	birds	Meliphagidae	<i>Entomyzon cyanotis</i>	blue-faced honeyeater		C		29
animals	birds	Meliphagidae	<i>Caligavis chrysops</i>	yellow-faced honeyeater		C		1
animals	birds	Meliphagidae	<i>Meliphaga lewinii</i>	Lewin's honeyeater		C		7
animals	birds	Meliphagidae	<i>Melithreptus gularis</i>	black-chinned honeyeater		C		1
animals	birds	Meropidae	<i>Merops ornatus</i>	rainbow bee-eater		SL		36
animals	birds	Monarchidae	<i>Grallina cyanoleuca</i>	magpie-lark		C		32
animals	birds	Monarchidae	<i>Myiagra rubecula</i>	leaden flycatcher		C		12
animals	birds	Motacillidae	<i>Anthus novaeseelandiae</i>	Australasian pipit		C		7
animals	birds	Nectariniidae	<i>Dicaeum hirundinaceum</i>	mistletoebird		C		25
animals	birds	Neosittidae	<i>Daphoenositta chrysoptera</i>	varied sittella		C		13
animals	birds	Oriolidae	<i>Oriolus sagittatus</i>	olive-backed oriole		C		11
animals	birds	Oriolidae	<i>Sphecotheres vieilloti</i>	Australasian figbird		C		5
animals	birds	Otididae	<i>Ardeotis australis</i>	Australian bustard		C		10
animals	birds	Pachycephalidae	<i>Pachycephala rufiventris</i>	rufous whistler		C		16
animals	birds	Pachycephalidae	<i>Colluricincla harmonica</i>	grey shrike-thrush		C		27
animals	birds	Pardalotidae	<i>Pardalotus striatus</i>	striated pardalote		C		59



Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	birds	Passeridae	<i>Passer domesticus</i>	house sparrow	Y			1
animals	birds	Pelecanidae	<i>Pelecanus conspicillatus</i>	Australian pelican		C		2
animals	birds	Petroicidae	<i>Microeca fascinans</i>	jacky winter		C		4
animals	birds	Phalacrocoracidae	<i>Microcarbo melanoleucos</i>	little pied cormorant		C		8
animals	birds	Phalacrocoracidae	<i>Phalacrocorax sulcirostris</i>	little black cormorant		C		3
animals	birds	Phasianidae	<i>Coturnix ypsilophora</i>	brown quail		C		3
animals	birds	Phasianidae	<i>Coturnix pectoralis</i>	stubble quail		C		2
animals	birds	Podargidae	<i>Podargus strigoides</i>	tawny frogmouth		C		5
animals	birds	Podicipedidae	<i>Podiceps cristatus</i>	great crested grebe		C		1
animals	birds	Podicipedidae	<i>Tachybaptus novaehollandiae</i>	Australasian grebe		C		6
animals	birds	Pomatostomidae	<i>Pomatostomus temporalis</i>	grey-crowned babbler		C		27
animals	birds	Psittacidae	<i>Platycercus adscitus palliceps</i>	pale-headed rosella (southern form)		C		4
animals	birds	Psittacidae	<i>Trichoglossus haematodus moluccanus</i>	rainbow lorikeet		C		39
animals	birds	Psittacidae	<i>Platycercus adscitus</i>	pale-headed rosella		C		35
animals	birds	Psittacidae	<i>Aprosmictus erythropterus</i>	red-winged parrot		C		21
animals	birds	Psittacidae	<i>Trichoglossus chlorolepidotus</i>	scaly-breasted lorikeet		C		1
animals	birds	Ptilonorhynchidae	<i>Ptilonorhynchus nuchalis</i>	great bowerbird		C		1
animals	birds	Ptilonorhynchidae	<i>Ptilonorhynchus maculatus</i>	spotted bowerbird		C		5
animals	birds	Rallidae	<i>Fulica atra</i>	Eurasian coot		C		2
animals	birds	Rallidae	<i>Gallinula tenebrosa</i>	dusky moorhen		C		2
animals	birds	Rallidae	<i>Porphyrio melanotus</i>	purple swamphen		C		1
animals	birds	Rallidae	<i>Gallirallus philippensis</i>	buff-banded rail		C		1
animals	birds	Recurvirostridae	<i>Himantopus himantopus</i>	black-winged stilt		C		1
animals	birds	Rhipiduridae	<i>Rhipidura albiscapa</i>	grey fantail		C		16
animals	birds	Rhipiduridae	<i>Rhipidura leucophrys</i>	willie wagtail		C		17
animals	birds	Strigidae	<i>Ninox connivens</i>	barking owl		C		1
animals	birds	Strigidae	<i>Ninox boobook</i>	southern boobook		C		6
animals	birds	Threskiornithidae	<i>Threskiornis molucca</i>	Australian white ibis		C		1
animals	birds	Threskiornithidae	<i>Threskiornis spinicollis</i>	straw-necked ibis		C		6
animals	birds	Threskiornithidae	<i>Platalea flavipes</i>	yellow-billed spoonbill		C		1
animals	birds	Threskiornithidae	<i>Platalea regia</i>	royal spoonbill		C		1
animals	birds	Timaliidae	<i>Zosterops lateralis</i>	silveryeye		C		1
animals	birds	Turnicidae	<i>Turnix varius</i>	painted button-quail		C		1
animals	birds	Tytonidae	<i>Tyto delicatula</i>	eastern barn owl		C		1
animals	insects	Nymphalidae	<i>Danaus petilia</i>	lesser wanderer				1
animals	insects	Nymphalidae	<i>Euploea core corinna</i>	common crow				6
animals	insects	Nymphalidae	<i>Melanitis leda bankia</i>	common evening-brown				1
animals	insects	Nymphalidae	<i>Acraea andromacha andromacha</i>	glasswing				2
animals	insects	Nymphalidae	<i>Tirumala hamata hamata</i>	blue tiger				1
animals	insects	Nymphalidae	<i>Hypolimnas bolina nerina</i>	varied eggfly				1
animals	insects	Nymphalidae	<i>Junonia orithya albicincta</i>	blue argus				2
animals	insects	Nymphalidae	<i>Junonia villida calybe</i>	meadow argus				5
animals	insects	Papilionidae	<i>Papilio anactus</i>	dingy swallowtail				2
animals	insects	Papilionidae	<i>Cressida cressida cressida</i>	greasy swallowtail				1
animals	insects	Pieridae	<i>Eurema smilax</i>	small grass-yellow				1
animals	insects	Pieridae	<i>Elodina parthia</i>	striated pearl-white				1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	insects	Pieridae	<i>Cepora perimale scyllara</i>	caper gull (Australian subspecies)				1
animals	insects	Pieridae	<i>Catopsilia pomona pomona</i>	lemon migrant				6
animals	insects	Pieridae	<i>Belenois java teutonia</i>	caper white				6
animals	mammals	Bovidae	<i>Bos taurus</i>	European cattle	Y			1
animals	mammals	Canidae	<i>Canis sp.</i>					9
animals	mammals	Canidae	<i>Canis lupus familiaris</i>	dog	Y			1
animals	mammals	Canidae	<i>Vulpes vulpes</i>	red fox	Y			1
animals	mammals	Canidae	<i>Canis lupus dingo</i>	dingo				1
animals	mammals	Dasyuridae	<i>Planigale ingrami</i>	long-tailed planigale			C	1
animals	mammals	Dasyuridae	<i>Sminthopsis macroura</i>	stripe-faced dunnart			C	14
animals	mammals	Dasyuridae	<i>Sminthopsis crassicaudata</i>	fat-tailed dunnart			C	1
animals	mammals	Emballonuridae	<i>Saccolaimus flaviventris</i>	yellow-bellied sheathtail bat			C	4
animals	mammals	Emballonuridae	<i>Taphozous troughtoni</i>	Troughton's sheathtail bat			C	2
animals	mammals	Felidae	<i>Felis catus</i>	cat	Y			4
animals	mammals	Leporidae	<i>Oryctolagus cuniculus</i>	rabbit	Y			4
animals	mammals	Macropodidae	<i>Petrogale inornata</i>	unadorned rock-wallaby			C	1
animals	mammals	Macropodidae	<i>Petrogale herberti</i>	Herbert's rock-wallaby			C	1
animals	mammals	Macropodidae	<i>Macropus giganteus</i>	eastern grey kangaroo			C	7
animals	mammals	Macropodidae	<i>Macropus robustus</i>	common wallaroo			C	2
animals	mammals	Macropodidae	<i>Macropus dorsalis</i>	black-striped wallaby			C	2
animals	mammals	Macropodidae	<i>Wallabia bicolor</i>	swamp wallaby			C	2
animals	mammals	Macropodidae	<i>Lagorchestes conspicillatus</i>	spectacled hare-wallaby			C	1
animals	mammals	Macropodidae	<i>Macropus rufus</i>	red kangaroo			C	1
animals	mammals	Miniopteridae	<i>Miniopterus australis</i>	little bent-wing bat			C	8
animals	mammals	Molossidae	<i>Mormopterus sp.</i>					2
animals	mammals	Molossidae	<i>Mormopterus ridei</i>	eastern free-tailed bat			C	2
animals	mammals	Molossidae	<i>Tadarida australis</i>	white-striped freetail bat			C	1
animals	mammals	Molossidae	<i>Chaerephon jobensis</i>	northern freetail bat			C	6
animals	mammals	Molossidae	<i>Mormopterus lumsdenae</i>	northern free-tailed bat			C	3
animals	mammals	Muridae	<i>Rattus fuscipes</i>	bush rat			C	1
animals	mammals	Muridae	<i>Mus musculus</i>	house mouse	Y			10
animals	mammals	Muridae	<i>Pseudomys delicatulus</i>	delicate mouse			C	5
animals	mammals	Muridae	<i>Hydromys chrysogaster</i>	water rat			C	1
animals	mammals	Peramelidae	<i>Isoodon macrourus</i>	northern brown bandicoot			C	1
animals	mammals	Petauridae	<i>Petaurus breviceps</i>	sugar glider			C	1
animals	mammals	Phalangeridae	<i>Trichosurus vulpecula</i>	common brushtail possum			C	3
animals	mammals	Phascolarctidae	<i>Phascolarctos cinereus</i>	koala		V	V	3
animals	mammals	Potoroidae	<i>Aepyprymnus rufescens</i>	rufous bettong			C	3
animals	mammals	Pseudocheiridae	<i>Petauroides volans</i>	greater glider			C	3
animals	mammals	Pteropodidae	<i>Pteropus scapulatus</i>	little red flying-fox			C	1
animals	mammals	Suidae	<i>Sus scrofa</i>	pig	Y			7
animals	mammals	Tachyglossidae	<i>Tachyglossus aculeatus</i>	short-beaked echidna			SL	7
animals	mammals	Vespertilionidae	<i>Chalinolobus picatus</i>	little pied bat			C	10
animals	mammals	Vespertilionidae	<i>Chalinolobus gouldii</i>	Gould's wattled bat			C	12
animals	mammals	Vespertilionidae	<i>Scotorepens greyii</i>	little broad-nosed bat			C	11
animals	mammals	Vespertilionidae	<i>Nyctophilus gouldi</i>	Gould's long-eared bat			C	5

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	mammals	Vespertilionidae	<i>Chalinolobus morio</i>	chocolate wattled bat		C		6
animals	mammals	Vespertilionidae	<i>Scotorepens sp.</i>					1
animals	mammals	Vespertilionidae	<i>Nyctophilus sp.</i>					1
animals	mammals	Vespertilionidae	<i>Scotorepens balstoni</i>	inland broad-nosed bat		C		1
animals	mammals	Vespertilionidae	<i>Scotorepens sanborni</i>	northern broad-nosed bat		C		1
animals	mammals	Vespertilionidae	<i>Vespadelus troughtoni</i>	eastern cave bat		C		5
animals	mammals	Vespertilionidae	<i>Chalinolobus nigrogriseus</i>	hoary wattled bat		C		8
animals	mammals	Vespertilionidae	<i>Vespadelus baverstocki</i>	inland forest bat		C		1
animals	reptiles	Agamidae	<i>Pogona barbata</i>	bearded dragon		C		26
animals	reptiles	Agamidae	<i>Amphibolurus burnsii</i>	Burns's dragon		C		3
animals	reptiles	Agamidae	<i>Chlamydosaurus kingii</i>	frilled lizard		C		1
animals	reptiles	Agamidae	<i>Diporiphora australis</i>	tommy roundhead		C		13
animals	reptiles	Boidae	<i>Antaresia maculosa</i>	spotted python		C		28
animals	reptiles	Boidae	<i>Aspidites melanocephalus</i>	black-headed python		C		6
animals	reptiles	Carphodactylidae	<i>Nephrurus asper</i>	spiny knob-tailed gecko		C		7
animals	reptiles	Chelidae	<i>Emydura sp.</i>					1
animals	reptiles	Chelidae	<i>Chelodina longicollis</i>	eastern snake-necked turtle		C		1
animals	reptiles	Colubridae	<i>Dendrelaphis punctulatus</i>	green tree snake		C		1
animals	reptiles	Colubridae	<i>Tropidonophis mairii</i>	freshwater snake		C		1
animals	reptiles	Colubridae	<i>Boiga irregularis</i>	brown tree snake		C		2
animals	reptiles	Diplodactylidae	<i>Oedura monilis</i>	ocellated velvet gecko		C		17
animals	reptiles	Diplodactylidae	<i>Strophurus williamsi</i>	soft-spined gecko		C		21
animals	reptiles	Diplodactylidae	<i>Diplodactylus vittatus</i>	wood gecko		C		10
animals	reptiles	Diplodactylidae	<i>Lucasium steindachneri</i>	Steindachner's gecko		C		33
animals	reptiles	Diplodactylidae	<i>Diplodactylus platyurus</i>	eastern fat-tailed gecko		C		27
animals	reptiles	Elapidae	<i>Pseudonaja textilis</i>	eastern brown snake		C		7
animals	reptiles	Elapidae	<i>Vermicella annulata</i>	bandy-bandy		C		2
animals	reptiles	Elapidae	<i>Acanthophis antarcticus</i>	common death adder		V		1
animals	reptiles	Elapidae	<i>Brachyurophis australis</i>	coral snake		C		4
animals	reptiles	Elapidae	<i>Hoplocephalus bitorquatus</i>	pale-headed snake		C		3
animals	reptiles	Elapidae	<i>Suta suta</i>	myall snake		C		30
animals	reptiles	Elapidae	<i>Furina diadema</i>	red-naped snake		C		2
animals	reptiles	Elapidae	<i>Denisonia maculata</i>	ornamental snake		V	V	12
animals	reptiles	Elapidae	<i>Demansia psammophis</i>	yellow-faced whipsnake		C		21
animals	reptiles	Elapidae	<i>Cryptophis boschmai</i>	Carpentaria whip snake		C		20
animals	reptiles	Gekkonidae	<i>Heteronotia binoei</i>	Bynoe's gecko		C		50
animals	reptiles	Gekkonidae	<i>Gehyra versicolor</i>			C		1
animals	reptiles	Gekkonidae	<i>Gehyra catenata</i>	chain-backed dtella		C		7
animals	reptiles	Gekkonidae	<i>Gehyra dubia</i>	dubious dtella		C		34/1
animals	reptiles	Pygopodidae	<i>Lialis burtonis</i>	Burton's legless lizard		C		31
animals	reptiles	Pygopodidae	<i>Paradelma orientalis</i>	brigalow scaly-foot		C		1
animals	reptiles	Scincidae	<i>Cryptoblepharus virgatus sensu lato</i>			C		7
animals	reptiles	Scincidae	<i>Cryptoblepharus pulcher pulcher</i>	elegant snake-eyed skink		C		8
animals	reptiles	Scincidae	<i>Carlia pectoralis sensu lato</i>			C		19
animals	reptiles	Scincidae	<i>Glaphyromorphus punctulatus</i>	fine-spotted mulch-skink		C		2
animals	reptiles	Scincidae	<i>Lerista punctatovittata</i>	eastern robust slider		C		2

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	reptiles	Scincidae	<i>Cryptoblepharus pannosus</i>	ragged snake-eyed skink		C		4
animals	reptiles	Scincidae	<i>Eremiascincus fasciolatus</i>	narrow-banded sand swimmer		C		1
animals	reptiles	Scincidae	<i>Pygmaeascincus timlowi</i>	dwarf litter-skink		C		5
animals	reptiles	Scincidae	<i>Ctenotus taeniolatus</i>	copper-tailed skink		C		16
animals	reptiles	Scincidae	<i>Morethia boulengeri</i>	south-eastern morethia skink		C		20
animals	reptiles	Scincidae	<i>Lygisaurus foliorum</i>	tree-base litter-skink		C		19
animals	reptiles	Scincidae	<i>Carlia munda</i>	shaded-litter rainbow-skink		C		3
animals	reptiles	Scincidae	<i>Carlia rubigo</i>	orange-flanked rainbow skink		C		38
animals	reptiles	Scincidae	<i>Eulamprus sp.</i>					1
animals	reptiles	Scincidae	<i>Menetia greyii</i>	common dwarf skink		C		5
animals	reptiles	Scincidae	<i>Ctenotus ingrami</i>	unspotted yellow-sided ctenotus		C		9
animals	reptiles	Scincidae	<i>Lerista fragilis</i>	eastern mulch slider		C		11
animals	reptiles	Scincidae	<i>Bellatorias frerei</i>	major skink		C		1
animals	reptiles	Scincidae	<i>Ctenotus spaldingi</i>	straight-browed ctenotus		C		28
animals	reptiles	Scincidae	<i>Ctenotus strauchii</i>	eastern barred wedgesnout ctenotus		C		2
animals	reptiles	Scincidae	<i>Ctenotus allotropis</i>	brown-blazed wedgesnout ctenotus		C		1
animals	reptiles	Typhlopidae	<i>Anilius sp.</i>					1
animals	reptiles	Typhlopidae	<i>Anilius affinis</i>	small-headed blind snake		C		1
animals	reptiles	Typhlopidae	<i>Anilius ligatus</i>	robust blind snake		C		14
animals	reptiles	Typhlopidae	<i>Anilius unguirostris</i>	claw-snouted blind snake		C		2
animals	reptiles	Varanidae	<i>Varanus tristis</i>	black-tailed monitor		C		5
fungi	sac fungi	Cladiaceae	<i>Cladia muelleri</i>			C		1/1
fungi	sac fungi	Lecideaceae	<i>Lecidea</i>			C		3/3
fungi	sac fungi	Lichen	<i>Lichen</i>			C		1/1
fungi	sac fungi	Parmeliaceae	<i>Xanthoparmelia ballingalliana</i>			C		2/2
fungi	sac fungi	Peltulaceae	<i>Peltula placodizans</i>			C		1/1
fungi	sac fungi	Ramalinaceae	<i>Ramalinora glaucolivida</i>			C		1/1
fungi	sac fungi	Teloschistaceae	<i>Caloplaca cinnabarina</i>			C		1/1
fungi	sac fungi	Trichotheliaceae	<i>Porina subargillacea</i>			C		1/1
plants	ferns	Adiantaceae	<i>Cheilanthes distans</i>	bristly cloak fern		C		1/1
plants	ferns	Marsileaceae	<i>Marsilea exarata</i>	sway-back nardoo		C		1/1
plants	ferns	Marsileaceae	<i>Marsilea mutica</i>	shiny nardoo		C		1
plants	higher dicots	Acanthaceae	<i>Pseuderanthemum variabile</i>	pastel flower		C		2/1
plants	higher dicots	Acanthaceae	<i>Harnieria sp. (Lornesleigh E.J.Thompson+ CHA75)</i>			C		1/1
plants	higher dicots	Acanthaceae	<i>Dipteracanthus australasicus subsp. corynothecus</i>			C		1/1
plants	higher dicots	Acanthaceae	<i>Rostellularia adscendens</i>			C		26/1
plants	higher dicots	Acanthaceae	<i>Brunoniella australis</i>	blue trumpet		C		11
plants	higher dicots	Aizoaceae	<i>Trianthema triquetra</i>	red spinach		C		1
plants	higher dicots	Aizoaceae	<i>Trianthema portulacastrum</i>	black pigweed	Y			1
plants	higher dicots	Amaranthaceae	<i>Alternanthera denticulata var. micrantha</i>			C		1
plants	higher dicots	Amaranthaceae	<i>Kelita uncinella</i>			E		1/1
plants	higher dicots	Amaranthaceae	<i>Ptilotus</i>			C		1
plants	higher dicots	Amaranthaceae	<i>Alternanthera nana</i>	hairy joyweed		C		1/1
plants	higher dicots	Apiaceae	<i>Eryngium plantagineum</i>	long eryngium		C		2/2
plants	higher dicots	Apocynaceae	<i>Marsdenia australis</i>	doubah		C		1
plants	higher dicots	Apocynaceae	<i>Parsonsia lanceolata</i>	northern silkpod		C		3/2

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	higher dicots	Apocynaceae	<i>Alstonia constricta</i>	bitterbark		C		1
plants	higher dicots	Apocynaceae	<i>Wrightia saligna</i>			C		1/1
plants	higher dicots	Apocynaceae	<i>Cerbera dumicola</i>			NT		4/4
plants	higher dicots	Apocynaceae	<i>Carissa ovata</i>	currantbush		C		2
plants	higher dicots	Apocynaceae	<i>Marsdenia</i>			C		1
plants	higher dicots	Araliaceae	<i>Astrotricha biddulphiana</i>			C		1/1
plants	higher dicots	Asteraceae	<i>Minuria integerrima</i>	smooth minuria		C		1/1
plants	higher dicots	Asteraceae	<i>Sphaeromorphaea subintegra</i>			C		1/1
plants	higher dicots	Asteraceae	<i>Apowollastonia spilanthoides</i>			C		7/3
plants	higher dicots	Asteraceae	<i>Pterocaulon serrulatum var. serrulatum</i>			C		1/1
plants	higher dicots	Asteraceae	<i>Senecio pinnatifolius var. pinnatifolius</i>			C		2
plants	higher dicots	Asteraceae	<i>Calotis cuneifolia</i>	burr daisy		C		3/2
plants	higher dicots	Asteraceae	<i>Tridax procumbens</i>	tridax daisy	Y			1/1
plants	higher dicots	Asteraceae	<i>Sonchus oleraceus</i>	common sowthistle	Y			1
plants	higher dicots	Asteraceae	<i>Pluchea dentex</i>	bowl daisy			C	1/1
plants	higher dicots	Asteraceae	<i>Parthenium hysterophorus</i>	parthenium weed	Y			33
plants	higher dicots	Asteraceae	<i>Gamochaeta pensylvanica</i>		Y			1/1
plants	higher dicots	Asteraceae	<i>Acanthospermum hispidum</i>	star burr	Y			1/1
plants	higher dicots	Asteraceae	<i>Cyanthillium cinereum</i>				C	1/1
plants	higher dicots	Asteraceae	<i>Vittadinia pustulata</i>				C	1/1
plants	higher dicots	Asteraceae	<i>Peripleura hispidula</i>				C	1
plants	higher dicots	Asteraceae	<i>Streptoglossa adscendens</i>	desert daisy			C	1/1
plants	higher dicots	Asteraceae	<i>Sphaeromorphaea australis</i>				C	1/1
plants	higher dicots	Bignoniaceae	<i>Pandorea</i>				C	1/1
plants	higher dicots	Boraginaceae	<i>Trichodesma zeylanicum</i>				C	5
plants	higher dicots	Boraginaceae	<i>Ehretia membranifolia</i>	weeping koda			C	1
plants	higher dicots	Cactaceae	<i>Opuntia</i>				C	1
plants	higher dicots	Cactaceae	<i>Harrisia martinii</i>		Y			3
plants	higher dicots	Caesalpiniaceae	<i>Lysiphyllum</i>				C	1
plants	higher dicots	Caesalpiniaceae	<i>Senna</i>				C	1
plants	higher dicots	Caesalpiniaceae	<i>Senna costata</i>				C	1/1
plants	higher dicots	Caesalpiniaceae	<i>Cassia brewsteri</i>				C	5
plants	higher dicots	Caesalpiniaceae	<i>Lysiphyllum carronii</i>	ebony tree			C	1
plants	higher dicots	Caesalpiniaceae	<i>Petalostylis labicheoides</i>				C	1/1
plants	higher dicots	Caesalpiniaceae	<i>Senna artemisioides subsp. zygophylla</i>				C	1
plants	higher dicots	Campanulaceae	<i>Wahlenbergia queenslandica</i>				C	1/1
plants	higher dicots	Campanulaceae	<i>Lobelia leucotos</i>				C	1/1
plants	higher dicots	Capparaceae	<i>Apophyllum anomalum</i>	broom bush			C	3
plants	higher dicots	Capparaceae	<i>Capparis loranthifolia</i>				C	1
plants	higher dicots	Capparaceae	<i>Capparis</i>				C	1
plants	higher dicots	Capparaceae	<i>Capparis lasiantha</i>	nipan			C	4
plants	higher dicots	Capparaceae	<i>Capparis mitchellii</i>				C	1
plants	higher dicots	Caryophyllaceae	<i>Polycarpaea longiflora</i>				C	5
plants	higher dicots	Casuarinaceae	<i>Allocasuarina luehmannii</i>	bull oak			C	1
plants	higher dicots	Casuarinaceae	<i>Casuarina cunninghamiana</i>				C	1
plants	higher dicots	Celastraceae	<i>Denhamia cunninghamii</i>				C	2/1

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plants	higher dicots	Chenopodiaceae	<i>Maireana microphylla</i>			C		1/1
plants	higher dicots	Chenopodiaceae	<i>Sclerolaena muricata</i> var. <i>muricata</i>			C		2
plants	higher dicots	Chenopodiaceae	<i>Dysphania kalpari</i>			C		1/1
plants	higher dicots	Chenopodiaceae	<i>Enchylaena tomentosa</i>			C		5
plants	higher dicots	Chenopodiaceae	<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>			C		1/1
plants	higher dicots	Chenopodiaceae	<i>Sclerolaena tetracuspis</i>	brigalow burr		C		1/1
plants	higher dicots	Chenopodiaceae	<i>Sclerolaena muricata</i> var. <i>villosa</i>			C		3
plants	higher dicots	Cleomaceae	<i>Cleome viscosa</i>	tick-weed		C		6
plants	higher dicots	Clusiaceae	<i>Hypericum gramineum</i>			C		3/3
plants	higher dicots	Combretaceae	<i>Terminalia oblongata</i>			C		1
plants	higher dicots	Convolvulaceae	<i>Ipomoea calobra</i>			C		1/1
plants	higher dicots	Convolvulaceae	<i>Polymeria pusilla</i>			C		7
plants	higher dicots	Convolvulaceae	<i>Evolvulus alsinoides</i> var. <i>decumbens</i>			C		1
plants	higher dicots	Convolvulaceae	<i>Jacquemontia paniculata</i>			C		4/2
plants	higher dicots	Convolvulaceae	<i>Ipomoea brownii</i>			C		1/1
plants	higher dicots	Convolvulaceae	<i>Polymeria longifolia</i>	polymeria		C		17
plants	higher dicots	Convolvulaceae	<i>Ipomoea lonchophylla</i>			C		29
plants	higher dicots	Convolvulaceae	<i>Xenostegia tridentata</i>			C		1/1
plants	higher dicots	Convolvulaceae	<i>Evolvulus alsinoides</i>			C		2
plants	higher dicots	Cucurbitaceae	<i>Cucumis melo</i>			C		5
plants	higher dicots	Erythroxylaceae	<i>Erythroxylum australe</i>	cocaine tree		C		1
plants	higher dicots	Euphorbiaceae	<i>Croton insularis</i>	Queensland cascarilla		C		1/1
plants	higher dicots	Euphorbiaceae	<i>Bertya pedicellata</i>			NT		10/10
plants	higher dicots	Euphorbiaceae	<i>Croton pheballoides</i>	narrow-leaved croton		C		2/2
plants	higher dicots	Euphorbiaceae	<i>Euphorbia drummondii</i>			C		8
plants	higher dicots	Euphorbiaceae	<i>Euphorbia sarcostemmoides</i>	climbing caustic		C		1/1
plants	higher dicots	Euphorbiaceae	<i>Adriana tomentosa</i> var. <i>tomentosa</i>			C		1/1
plants	higher dicots	Euphorbiaceae	<i>Euphorbia</i>			C		1/1
plants	higher dicots	Euphorbiaceae	<i>Euphorbia coghlanii</i>			C		6
plants	higher dicots	Fabaceae	<i>Crotalaria</i>			C		1
plants	higher dicots	Fabaceae	<i>Zornia muelleriana</i> subsp. <i>muelleriana</i>			C		1/1
plants	higher dicots	Fabaceae	<i>Glycine falcata</i>			C		14
plants	higher dicots	Fabaceae	<i>Vigna lanceolata</i>			C		29
plants	higher dicots	Fabaceae	<i>Crotalaria juncea</i>	sunhemp	Y	C		17/1
plants	higher dicots	Fabaceae	<i>Galactia muelleri</i>			C		7
plants	higher dicots	Fabaceae	<i>Glycine latifolia</i>			C		2
plants	higher dicots	Fabaceae	<i>Rhynchosia minima</i>			C		1
plants	higher dicots	Fabaceae	<i>Tephrosia filipes</i>			C		3
plants	higher dicots	Fabaceae	<i>Crotalaria montana</i>			C		4
plants	higher dicots	Fabaceae	<i>Glycine tomentella</i>	woolly glycine		C		1/1
plants	higher dicots	Fabaceae	<i>Sesbania cannabina</i>			C		7
plants	higher dicots	Fabaceae	<i>Aeschynomene indica</i>	budda pea		C		1
plants	higher dicots	Fabaceae	<i>Desmodium filiforme</i>			C		1/1
plants	higher dicots	Fabaceae	<i>Desmodium tortuosum</i>	Florida beggar-weed	Y	C		1/1
plants	higher dicots	Fabaceae	<i>Galactia tenuiflora</i>			C		1
plants	higher dicots	Fabaceae	<i>Stylosanthes hamata</i>		Y			2/1

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plants	higher dicots	Fabaceae	<i>Tephrosia barbatala</i>			C		1/1
plants	higher dicots	Fabaceae	<i>Indigofera linifolia</i>			C		8
plants	higher dicots	Fabaceae	<i>Desmodium macrocarpum</i>			C		7/7
plants	higher dicots	Fabaceae	<i>Desmodium campylocaulon</i>			C		8
plants	higher dicots	Fabaceae	<i>Macroptilium atropurpureum</i>	siratro	Y			1
plants	higher dicots	Fabaceae	<i>Vigna radiata var. sublobata</i>			C		5
plants	higher dicots	Fabaceae	<i>Rhynchosia minima var. minima</i>			C		18
plants	higher dicots	Fabaceae	<i>Zornia prostrata var. prostrata</i>			C		1/1
plants	higher dicots	Fabaceae	<i>Zornia muriculata subsp. muriculata</i>			C		1/1
plants	higher dicots	Fabaceae	<i>Indigofera australis subsp. australis</i>			C		1/1
plants	higher dicots	Fabaceae	<i>Cullen tenax</i>	emu-foot		C		9
plants	higher dicots	Goodeniaceae	<i>Goodenia glabra</i>			C		18
plants	higher dicots	Goodeniaceae	<i>Goodenia hirsuta</i>			C		1/1
plants	higher dicots	Goodeniaceae	<i>Goodenia sp. (Mt Castletower M.D.Crisp 2753)</i>			C		1/1
plants	higher dicots	Goodeniaceae	<i>Goodenia grandiflora</i>			C		1/1
plants	higher dicots	Goodeniaceae	<i>Goodenia gracilis</i>			C		1/1
plants	higher dicots	Haloragaceae	<i>Haloragis stricta</i>			C		13
plants	higher dicots	Lamiaceae	<i>Mentha</i>			C		1
plants	higher dicots	Lamiaceae	<i>Ocimum tenuiflorum</i>			C		3
plants	higher dicots	Lamiaceae	<i>Prostanthera collina</i>			C		2/2
plants	higher dicots	Lamiaceae	<i>Leucas lavandulifolia</i>		Y			1/1
plants	higher dicots	Lamiaceae	<i>Teucrium integrifolium</i>			C		1/1
plants	higher dicots	Lamiaceae	<i>Basilicum polystachyon</i>			C		1
plants	higher dicots	Loganiaceae	<i>Mitrasacme</i>			C		1/1
plants	higher dicots	Loranthaceae	<i>Lysiana subfalcata</i>			C		1/1
plants	higher dicots	Malvaceae	<i>Hibiscus sp. (Emerald S.L.Everist 2124)</i>			C		1/1
plants	higher dicots	Malvaceae	<i>Sida sp. (Charters Towers E.J.Thompson+ CHA456)</i>			C		1/1
plants	higher dicots	Malvaceae	<i>Abutilon</i>			C		1/1
plants	higher dicots	Malvaceae	<i>Sida spinosa</i>	spiny sida	Y			23/1
plants	higher dicots	Malvaceae	<i>Sida corrugata</i>			C		22
plants	higher dicots	Malvaceae	<i>Abutilon hannii</i>			C		2
plants	higher dicots	Malvaceae	<i>Sida fibulifera</i>			C		1/1
plants	higher dicots	Malvaceae	<i>Sida trichopoda</i>			C		15/1
plants	higher dicots	Malvaceae	<i>Abutilon fraseri</i>	dwarf lantern flower		C		1
plants	higher dicots	Malvaceae	<i>Hibiscus sturtii</i>			C		1/1
plants	higher dicots	Malvaceae	<i>Hibiscus trionum</i>			C		29
plants	higher dicots	Malvaceae	<i>Sida atherophora</i>			C		1/1
plants	higher dicots	Malvaceae	<i>Sida everistiana</i>			C		1
plants	higher dicots	Malvaceae	<i>Sida cunninghamii</i>			C		2
plants	higher dicots	Malvaceae	<i>Hibiscus divaricatus</i>			C		1/1
plants	higher dicots	Malvaceae	<i>Hibiscus meraukensis</i>	Merauke hibiscus		C		1
plants	higher dicots	Malvaceae	<i>Hibiscus verdcourtii</i>			C		1/1
plants	higher dicots	Malvaceae	<i>Abelmoschus ficulneus</i>	native rosella		C		12/1
plants	higher dicots	Malvaceae	<i>Abutilon micropetalum</i>			C		1/1
plants	higher dicots	Malvaceae	<i>Malvastrum americanum</i>		Y			20
plants	higher dicots	Malvaceae	<i>Sida aprica var. aprica</i>			C		1/1

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plants	higher dicots	Malvaceae	<i>Sida sp. (Aramac E.J.Thompson+ JER192)</i>			C		1/1
plants	higher dicots	Meliaceae	<i>Owenia x reliqua</i>			C		1/1
plants	higher dicots	Meliaceae	<i>Owenia acidula</i>	emu apple		C		2
plants	higher dicots	Mimosaceae	<i>Acacia faucium</i>			C		1/1
plants	higher dicots	Mimosaceae	<i>Acacia conferta</i>			C		2/2
plants	higher dicots	Mimosaceae	<i>Acacia oswaldii</i>	miljee		C		1
plants	higher dicots	Mimosaceae	<i>Acacia shirleyi</i>	lancewood		C		1
plants	higher dicots	Mimosaceae	<i>Acacia excelsa</i>			C		2
plants	higher dicots	Mimosaceae	<i>Acacia crassa</i>			C		1
plants	higher dicots	Mimosaceae	<i>Neptunia monosperma</i>			C		1/1
plants	higher dicots	Mimosaceae	<i>Acacia fodinalis</i>			C		1/1
plants	higher dicots	Mimosaceae	<i>Acacia bancroftiorum</i>			C		3/3
plants	higher dicots	Mimosaceae	<i>Vachellia farnesiana</i>		Y			23
plants	higher dicots	Mimosaceae	<i>Archidendropsis basaltica</i>	red lancewood		C		2
plants	higher dicots	Mimosaceae	<i>Acacia blakei subsp. blakei</i>			C		1/1
plants	higher dicots	Mimosaceae	<i>Neptunia gracilis forma gracilis</i>			C		22
plants	higher dicots	Mimosaceae	<i>Acacia julifera subsp. curvinervia</i>			C		2/2
plants	higher dicots	Mimosaceae	<i>Acacia harpophylla</i>	brigalow		C		2
plants	higher dicots	Mimosaceae	<i>Acacia catenulata</i>	bendee		C		1
plants	higher dicots	Mimosaceae	<i>Prosopis pallida</i>		Y			1/1
plants	higher dicots	Molluginaceae	<i>Glinus lotoides</i>	hairy carpet weed		C		1/1
plants	higher dicots	Myrtaceae	<i>Corymbia tessellaris</i>	Moreton Bay ash		C		1
plants	higher dicots	Myrtaceae	<i>Eucalyptus tenuipes</i>	narrow-leaved white mahogany		C		1/1
plants	higher dicots	Myrtaceae	<i>Eucalyptus populnea</i>	poplar box		C		1
plants	higher dicots	Myrtaceae	<i>Eucalyptus exserta</i>	Queensland peppermint		C		2/2
plants	higher dicots	Myrtaceae	<i>Melaleuca nervosa</i>			C		2/1
plants	higher dicots	Myrtaceae	<i>Eucalyptus crebra</i>	narrow-leaved red ironbark		C		1
plants	higher dicots	Myrtaceae	<i>Corymbia aureola</i>			C		6/6
plants	higher dicots	Myrtaceae	<i>Corymbia clarksoniana</i>			C		2/1
plants	higher dicots	Myrtaceae	<i>Lysicarpus angustifolius</i>	budgeroo		C		1/1
plants	higher dicots	Myrtaceae	<i>Eucalyptus drepanophylla</i>			C		1/1
plants	higher dicots	Myrtaceae	<i>Micromyrtus capricornia</i>			C		1/1
plants	higher dicots	Myrtaceae	<i>Rhodamnia pauciovulata</i>			C		1/1
plants	higher dicots	Myrtaceae	<i>Eucalyptus tholiformis</i>			C		1/1
plants	higher dicots	Myrtaceae	<i>Eucalyptus orgadophila</i>	mountain coolibah		C		1
plants	higher dicots	Myrtaceae	<i>Corymbia erythrophloia</i>	variable-barked bloodwood		C		3
plants	higher dicots	Myrtaceae	<i>Eucalyptus thozetiana</i>			C		1/1
plants	higher dicots	Myrtaceae	<i>Eucalyptus persistens</i>			C		2/2
plants	higher dicots	Nyctaginaceae	<i>Boerhavia dominii</i>			C		2
plants	higher dicots	Nyctaginaceae	<i>Boerhavia burbridgeana</i>			C		1
plants	higher dicots	Oleaceae	<i>Jasminum didymum subsp. lineare</i>			C		1
plants	higher dicots	Onagraceae	<i>Ludwigia octovalvis</i>	willow primrose		C		1
plants	higher dicots	Oxalidaceae	<i>Oxalis radicata</i>			C		3
plants	higher dicots	Passifloraceae	<i>Passiflora foetida</i>		Y			1/1
plants	higher dicots	Phyllanthaceae	<i>Phyllanthus carpentariae</i>			C		1/1
plants	higher dicots	Phyllanthaceae	<i>Phyllanthus virgatus</i>			C		10



Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	higher dicots	Phyllanthaceae	<i>Phyllanthus maderaspatensis</i>			C		3
plants	higher dicots	Phyllanthaceae	<i>Phyllanthus</i>			C		1/1
plants	higher dicots	Picrodendraceae	<i>Petalostigma pubescens</i>	quinine tree		C		1
plants	higher dicots	Pittosporaceae	<i>Bursaria incana</i>			C		1/1
plants	higher dicots	Pittosporaceae	<i>Pittosporum angustifolium</i>			C		1
plants	higher dicots	Plantaginaceae	<i>Scoparia dulcis</i>	scoparia	Y	C		1/1
plants	higher dicots	Polygalaceae	<i>Polygala crassitesta</i>			C		13
plants	higher dicots	Polygalaceae	<i>Polygala pycnantha</i>			C		1/1
plants	higher dicots	Portulacaceae	<i>Portulaca oleracea</i>	pigweed	Y	C		1
plants	higher dicots	Proteaceae	<i>Grevillea pteridifolia</i>	golden parrot tree		C		2/1
plants	higher dicots	Proteaceae	<i>Hakea lorea subsp. lorea</i>			C		1
plants	higher dicots	Proteaceae	<i>Persoonia amaliae</i>			C		1/1
plants	higher dicots	Rhamnaceae	<i>Alphitonia excelsa</i>	soap tree		C		1
plants	higher dicots	Rhamnaceae	<i>Ventilago viminalis</i>	supplejack		C		5
plants	higher dicots	Rubiaceae	<i>Larsenaikia ochreatea</i>			C		2/2
plants	higher dicots	Rubiaceae	<i>Richardia brasiliensis</i>	white eye	Y	C		1/1
plants	higher dicots	Rubiaceae	<i>Spermacoce brachystema</i>			C		1/1
plants	higher dicots	Rubiaceae	<i>Oldenlandia coerulescens</i>			C		1/1
plants	higher dicots	Rubiaceae	<i>Oldenlandia mitrasacmoides subsp. trachymenoides</i>			C		6
plants	higher dicots	Rutaceae	<i>Flindersia dissosperma</i>			C		1
plants	higher dicots	Rutaceae	<i>Phebalium glandulosum subsp. glandulosum</i>			C		1/1
plants	higher dicots	Santalaceae	<i>Santalum lanceolatum</i>			C		3
plants	higher dicots	Sapindaceae	<i>Atalaya hemiglauca</i>			C		5
plants	higher dicots	Sapindaceae	<i>Alectryon oleifolius subsp. elongatus</i>			C		3
plants	higher dicots	Sapindaceae	<i>Dodonaea viscosa subsp. spatulata</i>			C		1/1
plants	higher dicots	Sapindaceae	<i>Diploglottis macrantha</i>			C		1
plants	higher dicots	Sapindaceae	<i>Atalaya</i>			C		1
plants	higher dicots	Sapotaceae	<i>Planchonella pohlmaniana var. (Gilbert River C.T.White 1409)</i>			C		1/1
plants	higher dicots	Sapotaceae	<i>Planchonella pohlmaniana</i>			C		2/2
plants	higher dicots	Scrophulariaceae	<i>Eremophila bignoniiflora</i>	eurah		C		1
plants	higher dicots	Scrophulariaceae	<i>Eremophila debilis</i>	winter apple		C		4
plants	higher dicots	Scrophulariaceae	<i>Eremophila mitchellii</i>			C		1
plants	higher dicots	Scrophulariaceae	<i>Eremophila longifolia</i>	berrigan		C		1/1
plants	higher dicots	Scrophulariaceae	<i>Myoporum acuminatum</i>	coastal boobialla		C		3/2
plants	higher dicots	Scrophulariaceae	<i>Eremophila maculata</i>			C		1
plants	higher dicots	Solanaceae	<i>Solanum adenophorum</i>			E		1/1
plants	higher dicots	Solanaceae	<i>Solanum parvifolium subsp. parvifolium</i>			C		2/2
plants	higher dicots	Solanaceae	<i>Solanum esuriale</i>	quena		C		8
plants	higher dicots	Solanaceae	<i>Datura stramonium</i>	common thornapple	Y	C		3
plants	higher dicots	Sparrmanniaceae	<i>Grewia latifolia</i>	dysentery plant		C		3
plants	higher dicots	Sparrmanniaceae	<i>Grewia retusifolia</i>			C		2
plants	higher dicots	Sparrmanniaceae	<i>Corchorus aestuans</i>			C		1/1
plants	higher dicots	Sparrmanniaceae	<i>Corchorus trilocularis</i>			C		11
plants	higher dicots	Sterculiaceae	<i>Brachychiton populneus subsp. trilobus</i>			C		1/1
plants	higher dicots	Stylidiaceae	<i>Stylidium eglandulosum</i>			C		1/1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	higher dicots	Thymelaeaceae	<i>Pimelea microcephala</i>			C		1
plants	higher dicots	Thymelaeaceae	<i>Pimelea haematostachya</i>			C		19
plants	higher dicots	Verbenaceae	<i>Verbena macrostachya</i>			C		1
plants	higher dicots	Verbenaceae	<i>Glandularia aristigera</i>		Y			1
plants	higher dicots	Zygophyllaceae	<i>Tribulus eichlerianus</i>	bull head		C		1
plants	liverworts	Frullaniaceae	<i>Frullania</i>			C		1/1
plants	lower dicots	Phrymaceae	<i>Glossostigma diandrum</i>			C		1/1
plants	monocots	Amaryllidaceae	<i>Crinum</i>			C		1
plants	monocots	Asphodelaceae	<i>Bulbine bulbosa</i>	golden lily		C		2
plants	monocots	Commelinaceae	<i>Commelina diffusa</i>	wandering jew		C		4
plants	monocots	Commelinaceae	<i>Commelina</i>			C		1
plants	monocots	Commelinaceae	<i>Cyanotis axillaris</i>			C		1/1
plants	monocots	Cyperaceae	<i>Cyperus concinnus</i>			C		2/1
plants	monocots	Cyperaceae	<i>Cyperus exaltatus</i>	tall flatsedge		C		1
plants	monocots	Cyperaceae	<i>Cyperus javanicus</i>			C		1/1
plants	monocots	Cyperaceae	<i>Cyperus compressus</i>		Y			1/1
plants	monocots	Cyperaceae	<i>Cyperus isabellinus</i>			C		1/1
plants	monocots	Cyperaceae	<i>Cyperus victoriensis</i>			C		1/1
plants	monocots	Cyperaceae	<i>Fimbristylis quinquangularis</i>			C		1/1
plants	monocots	Cyperaceae	<i>Schoenoplectiella dissachantha</i>			C		1/1
plants	monocots	Cyperaceae	<i>Cyperus polystachyos var. polystachyos</i>			C		1/1
plants	monocots	Cyperaceae	<i>Cyperus gracilis</i>			C		1/1
plants	monocots	Cyperaceae	<i>Cyperus gilesii</i>			C		22
plants	monocots	Cyperaceae	<i>Cyperus betchei</i>			C		2
plants	monocots	Cyperaceae	<i>Cyperus fulvus</i>			C		1/1
plants	monocots	Cyperaceae	<i>Gahnia aspera</i>			C		1/1
plants	monocots	Cyperaceae	<i>Cyperus iria</i>			C		2/2
plants	monocots	Hemerocallidaceae	<i>Dianella longifolia</i>			C		3
plants	monocots	Juncaceae	<i>Juncus subglaucus</i>			C		1/1
plants	monocots	Laxmanniaceae	<i>Laxmannia gracilis</i>	slender wire lily		C		1/1
plants	monocots	Laxmanniaceae	<i>Lomandra longifolia</i>			C		1/1
plants	monocots	Laxmanniaceae	<i>Lomandra multiflora</i>			C		3
plants	monocots	Poaceae	<i>Panicum effusum</i>			C		2/1
plants	monocots	Poaceae	<i>Sehima nervosum</i>			C		1/1
plants	monocots	Poaceae	<i>Setaria surgens</i>			C		2/2
plants	monocots	Poaceae	<i>Chloris truncata</i>			C		1
plants	monocots	Poaceae	<i>Digitaria blakei</i>			C		1/1
plants	monocots	Poaceae	<i>Eriochloa crebra</i>	spring grass		C		29/1
plants	monocots	Poaceae	<i>Themeda triandra</i>	kangaroo grass		C		10/1
plants	monocots	Poaceae	<i>Astrebla lappacea</i>	curly mitchell grass		C		7
plants	monocots	Poaceae	<i>Cenchrus ciliaris</i>		Y			37/1
plants	monocots	Poaceae	<i>Digitaria brownii</i>			C		1/1
plants	monocots	Poaceae	<i>Enneapogon virens</i>			C		3/2
plants	monocots	Poaceae	<i>Sporobolus caroli</i>	fairy grass		C		3
plants	monocots	Poaceae	<i>Sporobolus creber</i>			C		15
plants	monocots	Poaceae	<i>Thellungia advena</i>	coolibah grass		C		5/2

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	monocots	Poaceae	<i>Aristida latifolia</i>	feathertop wiregrass		C		30/2
plants	monocots	Poaceae	<i>Aristida leptopoda</i>	white speargrass		C		12
plants	monocots	Poaceae	<i>Aristida personata</i>			C		4
plants	monocots	Poaceae	<i>Astrelba elymoides</i>	hoop mitchell grass		C		3
plants	monocots	Poaceae	<i>Astrelba squarrosa</i>	bull mitchell grass		C		24
plants	monocots	Poaceae	<i>Chloris divaricata</i>			C		2/2
plants	monocots	Poaceae	<i>Chrysopogon fallax</i>			C		4/2
plants	monocots	Poaceae	<i>Digitaria ciliaris</i>	summer grass	Y			1/1
plants	monocots	Poaceae	<i>Echinochloa colona</i>	awnless barnyard grass	Y			1/1
plants	monocots	Poaceae	<i>Eragrostis sororia</i>			C		2/1
plants	monocots	Poaceae	<i>Eriachne mucronata</i>			C		1
plants	monocots	Poaceae	<i>Ophiuros exaltatus</i>			C		3
plants	monocots	Poaceae	<i>Digitaria ammophila</i>	silky umbrella grass		C		1
plants	monocots	Poaceae	<i>Digitaria ramularis</i>			C		1/1
plants	monocots	Poaceae	<i>Eragrostis elongata</i>			C		1/1
plants	monocots	Poaceae	<i>Eragrostis speciosa</i>			C		1/1
plants	monocots	Poaceae	<i>Leptochloa digitata</i>			C		1
plants	monocots	Poaceae	<i>Bothriochloa pertusa</i>		Y			3/2
plants	monocots	Poaceae	<i>Dichanthium sericeum</i>			C		29
plants	monocots	Poaceae	<i>Erneapogon truncatus</i>			C		22
plants	monocots	Poaceae	<i>Eragrostis lacunaria</i>	purple lovegrass		C		2/1
plants	monocots	Poaceae	<i>Eragrostis tenellula</i>	delicate lovegrass		C		6/1
plants	monocots	Poaceae	<i>Paspalum mandiocanum</i>		Y			1/1
plants	monocots	Poaceae	<i>Sporobolus scabridus</i>			C		1/1
plants	monocots	Poaceae	<i>Alloteropsis cimicina</i>			C		1/1
plants	monocots	Poaceae	<i>Dichanthium aristatum</i>	angleton grass	Y			1/1
plants	monocots	Poaceae	<i>Heteropogon contortus</i>	black speargrass		C		16
plants	monocots	Poaceae	<i>Iseilema vaginiflorum</i>	red flinders grass		C		34/1
plants	monocots	Poaceae	<i>Pseudoraphis paradoxa</i>	slender mudgrass		C		1/1
plants	monocots	Poaceae	<i>Schizachyrium fragile</i>	firegrass		C		1/1
plants	monocots	Poaceae	<i>Setaria oplismenoides</i>			C		1/1
plants	monocots	Poaceae	<i>Alloteropsis semialata</i>	cockatoo grass		C		1
plants	monocots	Poaceae	<i>Arundinella nepalensis</i>	reedgrass		C		1/1
plants	monocots	Poaceae	<i>Bothriochloa ewartiana</i>	desert bluegrass		C		30/1
plants	monocots	Poaceae	<i>Brachyachne convergens</i>	common native couch		C		32
plants	monocots	Poaceae	<i>Enteropogon acicularis</i>	curly windmill grass		C		2
plants	monocots	Poaceae	<i>Moorochloa eruciformis</i>		Y			8
plants	monocots	Poaceae	<i>Panicum queenslandicum</i>			C		8
plants	monocots	Poaceae	<i>Paspalidium globoideum</i>	sago grass		C		21
plants	monocots	Poaceae	<i>Setaria paspalidioides</i>			C		1/1
plants	monocots	Poaceae	<i>Thyridolepis xerophila</i>			C		1/1
plants	monocots	Poaceae	<i>Urochloa mosambicensis</i>	sabi grass	Y			1/1
plants	monocots	Poaceae	<i>Ancistrachne uncinulata</i>	hooky grass		C		2/2
plants	monocots	Poaceae	<i>Dactyloctenium radulans</i>	button grass		C		1
plants	monocots	Poaceae	<i>Cenchrus pennisetiformis</i>		Y			1/1
plants	monocots	Poaceae	<i>Paspalidium albobillosum</i>			C		2/2

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	monocots	Poaceae	<i>Thaumastochloa pubescens</i>			C		1/1
plants	monocots	Poaceae	<i>Bothriochloa erianthoides</i>	satintop grass		C		2
plants	monocots	Poaceae	<i>Dichanthium queenslandicum</i>			V	E	2/2
plants	monocots	Poaceae	<i>Diplachne fusca var. fusca</i>			C		1/1
plants	monocots	Poaceae	<i>Eriochloa pseudoacrotricha</i>			C		25
plants	monocots	Poaceae	<i>Eragrostis longipedicellata</i>			C		1/1
plants	monocots	Poaceae	<i>Hyparrhenia rufa subsp. rufa</i>		Y			1/1
plants	monocots	Poaceae	<i>Aristida calycina var. calycina</i>			C		1/1
plants	monocots	Poaceae	<i>Aristida benthamii var. benthamii</i>			C		1/1
plants	monocots	Poaceae	<i>Aristida holathera var. holathera</i>			C		3/2
plants	monocots	Poaceae	<i>Chloris divaricata var. divaricata</i>	slender chloris		C		1/1
plants	monocots	Poaceae	<i>Dichanthium sericeum subsp. sericeum</i>			C		4/4
plants	monocots	Poaceae	<i>Bothriochloa decipiens var. decipiens</i>			C		2/2
plants	monocots	Poaceae	<i>Panicum decompositum var. decompositum</i>			C		24/1
plants	monocots	Poaceae	<i>Aristida jerichoensis var. subspinulifera</i>			C		3/3
plants	monocots	Poaceae	<i>Calyptochloa gracillima subsp. gracillima</i>			C		4/4
plants	monocots	Poaceae	<i>Eriachne mucronata forma (Alpha C.E.Hubbard 7882)</i>			C		1/1
plants	monocots	Poaceae	<i>Poaceae</i>			C		1
plants	monocots	Poaceae	<i>Eragrostis</i>			C		1
plants	monocots	Poaceae	<i>Eriachne rara</i>			C		2/2
plants	monocots	Poaceae	<i>Melinis repens</i>	red natal grass	Y			11
plants	monocots	Poaceae	<i>Sarga plumosum</i>			C		1/1
plants	monocots	Poaceae	<i>Chloris inflata</i>	purpletop chloris	Y			1
plants	monocots	Poaceae	<i>Chloris virgata</i>	feathertop rhodes grass	Y			8
plants	monocots	Pontederiaceae	<i>Monochoria cyanea</i>			C		1
plants	mosses	Erpodiaceae	<i>Erpodium hodgkinsoniae</i>			C		1/1
plants	mosses	Fabroniaceae	<i>Fabronia australis</i>			C		1/1
plants	mosses	Ptychomitriaceae	<i>Ptychomitrium muelleri</i>			C		1/1
plants	mosses	Stereophyllaceae	<i>Stereophyllum radiculosum</i>			C		1/1

#### CODES

I - Y indicates that the taxon is introduced to Queensland and has naturalised.

Q - Indicates the Queensland conservation status of each taxon under the *Nature Conservation Act 1992*. The codes are Extinct in the Wild (PE), Endangered (E), Vulnerable (V), Near Threatened (NT), Least Concern (C) or Not Protected ( ).

A - Indicates the Australian conservation status of each taxon under the *Environment Protection and Biodiversity Conservation Act 1999*. The values of EPBC are Conservation Dependent (CD), Critically Endangered (CE), Endangered (E), Extinct (EX), Extinct in the Wild (XW) and Vulnerable (V).

Records – The first number indicates the total number of records of the taxon for the record option selected (i.e. All, Confirmed or Specimens).

This number is output as 99999 if it equals or exceeds this value. The second number located after the / indicates the number of specimen records for the taxon.

This number is output as 999 if it equals or exceeds this value.

## **Appendix C**

Queensland Herbarium (HERBRECS) Database search results

**Table C1: Queensland Herbarium (HERBRECS) database search results for the search area**

Family Name	Botanical Name	NC Act Status <sup>1</sup>
Malvaceae	<i>Abelmoschus ficulneus</i> (L.) Wight & Arn. ex Wight	LC
Cyperaceae	<i>Abildgaardia ovata</i> (Burm.f.) Kral	LC
Malvaceae	<i>Abutilon</i>	LC
Malvaceae	<i>Abutilon fraseri</i> (Hook.) Hook. ex Walp. subsp. <i>fraseri</i>	LC
Malvaceae	<i>Abutilon micropetalum</i> Benth.	LC
Malvaceae	<i>Abutilon subviscosum</i> Benth.	LC
Mimosaceae	<i>Acacia bancroftiorum</i> Maiden	LC
Mimosaceae	<i>Acacia blakei</i> Pedley subsp. <i>blakei</i>	LC
Mimosaceae	<i>Acacia conferta</i> A.Cunn. ex Benth.	LC
Mimosaceae	<i>Acacia cretata</i> Pedley - <i>A.leiocalyx</i> (Domin) Pedley	LC
Mimosaceae	<i>Acacia faucium</i> Pedley	LC
Mimosaceae	<i>Acacia fodinalis</i> Pedley	LC
Mimosaceae	<i>Acacia holosericea</i> A.Cunn. ex G.Don	LC
Mimosaceae	<i>Acacia julifera</i> Benth. subsp. <i>julifera</i>	LC
Mimosaceae	<i>Acacia julifera</i> subsp. <i>curvinervia</i> (Maiden) Pedley	LC
Mimosaceae	<i>Acacia ligulata</i> A.Cunn. ex Benth.	LC
Mimosaceae	<i>Acacia shirleyi</i> Maiden	LC
Asteraceae	<i>Acanthospermum hispidum</i> DC.	*
Euphorbiaceae	<i>Adriana tomentosa</i> Gaudich. var. <i>tomentosa</i>	LC
Poaceae	<i>Alloteropsis cimicina</i> (L.) Stapf	LC
Poaceae	<i>Ancistrachne uncinulata</i> (R.Br.) S.T.Blake	LC
Rubiaceae	<i>Antirhea putaminosa</i> (F.Muell.) F.M.Bailey	LC
Asteraceae	<i>Apowollastonia spilanthis</i> (F.Muell.) Orchard	LC
Poaceae	<i>Aristida benthamii</i> Henrard var. <i>benthamii</i>	LC
Poaceae	<i>Aristida calycina</i> R.Br. var. <i>calycina</i>	LC
Poaceae	<i>Aristida caput-medusae</i> Domin	LC
Poaceae	<i>Aristida holathera</i> Domin var. <i>holathera</i>	LC
Poaceae	<i>Aristida jerichoensis</i> var. <i>subspinulifera</i> Henrard	LC
Poaceae	<i>Aristida latifolia</i> Domin	LC
Poaceae	<i>Arundinella nepalensis</i> Trin.	LC
Araliaceae	<i>Astrotricha biddulphiana</i> F.Muell.	LC
Chenopodiaceae	<i>Atriplex lindleyi</i> Moq.	LC
Pittosporaceae	<i>Auranticarpa rhombifolia</i> (A.Cunn. ex Hook.) L.Cayzer, Crisp & I.Telford	LC
Euphorbiaceae	<i>Bertya pedicellata</i> F.Muell.	NT
Poaceae	<i>Bothriochloa decipiens</i> (Hack.) C.E.Hubb. var. <i>decipiens</i>	LC
Poaceae	<i>Bothriochloa erianthoides</i> (F.Muell.) C.E.Hubb.	LC
Poaceae	<i>Bothriochloa ewartiana</i> (Domin) C.E.Hubb.	LC
Poaceae	<i>Bothriochloa pertusa</i> (L.) A.Camus	*
Sterculiaceae	<i>Brachychiton populneus</i> subsp. <i>trilobus</i> Guymer	LC
Phyllanthaceae	<i>Breynia oblongifolia</i> (Muell.Arg.) Muell.Arg.	LC

Family Name	Botanical Name	NC Act Status <sup>1</sup>
Cyperaceae	<i>Bulbostylis barbata</i> (Rottb.) C.B.Clarke	LC
Pittosporaceae	<i>Bursaria incana</i> Lindl.	LC
Teloschistaceae	<i>Caloplaca cinnabarina</i> (Ach.) Zahlbr.	LC
Asteraceae	<i>Calotis cuneifolia</i> R.Br.	LC
Asteraceae	<i>Calotis squamigera</i> C.T.White	LC
Poaceae	<i>Calyptochloa gracillima</i> C.E.Hubb. subsp. <i>gracillima</i>	LC
Poaceae	<i>Cenchrus ciliaris</i> L.	*
Poaceae	<i>Cenchrus pennisetiformis</i> Hochst. & Steud.	*
Apocynaceae	<i>Cerbera dumicola</i> P.I.Forst.	NT
Adiantaceae	<i>Cheilanthes distans</i> (R.Br.) Mett.	LC
Poaceae	<i>Chloris divaricata</i> R.Br.	LC
Poaceae	<i>Chloris divaricata</i> R.Br. var. <i>divaricata</i>	LC
Poaceae	<i>Chrysopogon fallax</i> S.T.Blake	LC
Rutaceae	<i>Citrus glauca</i> (Lindl.) Burkill	LC
Cladiaceae	<i>Cladia muelleri</i> (Hampe) Parnmen & Lumbsch	LC
Lamiaceae	<i>Clerodendrum floribundum</i> R.Br.	LC
Rubiaceae	<i>Coelospermum reticulatum</i> (F.Muell.) Benth.	LC
Sparrmanniaceae	<i>Corchorus aestuans</i> L.	LC
Myrtaceae	<i>Corymbia aureola</i> (Brooker & A.R.Bean) K.D.Hill & L.A.S.Johnson	LC
Myrtaceae	<i>Corymbia clarksoniana</i> (D.J.Carr & S.G.M.Carr) K.D.Hill & L.A.S.Johnson	LC
Fabaceae	<i>Crotalaria juncea</i> L.	*
Fabaceae	<i>Crotalaria laburnifolia</i> L.	*
Euphorbiaceae	<i>Croton insularis</i> Baill.	LC
Euphorbiaceae	<i>Croton phebaloides</i> F.Muell. ex Muell.Arg.	LC
Commelinaceae	<i>Cyanotis axillaris</i> (L.) D.Don	LC
Asteraceae	<i>Cyanthillium cinereum</i> (L.) H.Rob.	LC
Poaceae	<i>Cymbopogon refractus</i> (R.Br.) A.Camus	LC
Cyperaceae	<i>Cyperus bifax</i> C.B.Clarke	LC
Cyperaceae	<i>Cyperus compressus</i> L.	*
Cyperaceae	<i>Cyperus concinnus</i> R.Br.	LC
Cyperaceae	<i>Cyperus difformis</i> L.	LC
Cyperaceae	<i>Cyperus esculentus</i> L.	*
Cyperaceae	<i>Cyperus fulvus</i> R.Br.	LC
Cyperaceae	<i>Cyperus gracilis</i> R.Br.	LC
Cyperaceae	<i>Cyperus iria</i> L.	LC
Cyperaceae	<i>Cyperus isabellinus</i> K.L.Wilson	LC
Cyperaceae	<i>Cyperus javanicus</i> Houtt.	LC
Cyperaceae	<i>Cyperus leiocaulon</i> Benth.	LC
Cyperaceae	<i>Cyperus polystachyos</i> Rottb. var. <i>polystachyos</i>	LC
Cyperaceae	<i>Cyperus sesquiflorus</i> (Torr.) Mattf. & Kuek.	*
Cyperaceae	<i>Cyperus victoriensis</i> C.B.Clarke	LC
Poaceae	<i>Dactyloctenium radulans</i> (R.Br.) P.Beauv.	LC

Family Name	Botanical Name	NC Act Status <sup>1</sup>
Celastraceae	<i>Denhamia cunninghamii</i> (Hook.) M.P.Simmons	LC
Celastraceae	<i>Denhamia oleaster</i> (Lindl.) F.Muell.	LC
Fabaceae	<i>Desmodium filiforme</i> Zoll. & Moritzi	LC
Fabaceae	<i>Desmodium macrocarpum</i> Domin	LC
Fabaceae	<i>Desmodium tortuosum</i> (Sw.) DC.	*
Poaceae	<i>Dichanthium annulatum</i> (Forssk.) Stapf	*
Poaceae	<i>Dichanthium aristatum</i> (Poir.) C.E.Hubb.	*
Poaceae	<i>Dichanthium queenslandicum</i> B.K.Simon	V
Poaceae	<i>Dichanthium sericeum</i> (R.Br.) A.Camus subsp. <i>sericeum</i>	LC
Poaceae	<i>Dichanthium setosum</i> S.T.Blake	LC
Poaceae	<i>Digitaria blakei</i> Henrard	LC
Poaceae	<i>Digitaria brownii</i> (Roem. & Schult.) Hughes	LC
Poaceae	<i>Digitaria ciliaris</i> (Retz.) Koeler	*
Poaceae	<i>Digitaria ramularis</i> (Trin.) Henrard	LC
Poaceae	<i>Dinebra decipiens</i> var. <i>asthenes</i> (Roem. & Schult.) P.M.Peterson & N.Snow	LC
Poaceae	<i>Dinebra ligulata</i> (Lazarides) P.M.Peterson & N.Snow	LC
Poaceae	<i>Diplachne fusca</i> (L.) P.Beauv. ex Roem. & Schult. var. <i>fusca</i>	LC
Acanthaceae	<i>Dipteracanthus australasicus</i> F.Muell.	LC
Acanthaceae	<i>Dipteracanthus australasicus</i> subsp. <i>corynothecus</i> (F.Muell. ex Benth.) R.M.Barker	LC
Sapindaceae	<i>Dodonaea viscosa</i> subsp. <i>spatulata</i> (Sm.) J.G.West	LC
Chenopodiaceae	<i>Dysphania kalpari</i> Paul G.Wilson	LC
Poaceae	<i>Echinochloa colona</i> (L.) Link	*
Chenopodiaceae	<i>Einadia nutans</i> (R.Br.) A.J.Scott subsp. <i>nutans</i>	LC
Chenopodiaceae	<i>Einadia nutans</i> subsp. <i>linifolia</i> (R.Br.) Paul G.Wilson	LC
Celastraceae	<i>Elaeodendron australe</i> Vent. var. <i>australe</i>	LC
Chenopodiaceae	<i>Enchylaena tomentosa</i> R.Br. var. <i>tomentosa</i>	LC
Poaceae	<i>Enneapogon lindleyanus</i> (Domin) C.E.Hubb.	LC
Poaceae	<i>Enneapogon truncatus</i> Kakudidi	LC
Poaceae	<i>Enneapogon virens</i> (Lindl.) Kakudidi	LC
Poaceae	<i>Eragrostis elongata</i> (Willd.) J.Jacq.	LC
Poaceae	<i>Eragrostis exigua</i> Lazarides	LC
Poaceae	<i>Eragrostis lacunaria</i> F.Muell. ex Benth.	LC
Poaceae	<i>Eragrostis longipedicellata</i> B.K.Simon	LC
Poaceae	<i>Eragrostis sororia</i> Domin	LC
Poaceae	<i>Eragrostis speciosa</i> (Roem. & Schult.) Steud.	LC
Poaceae	<i>Eragrostis tenellula</i> (Kunth) Steud.	LC
Scrophulariaceae	<i>Eremophila longifolia</i> (R.Br.) F.Muell.	LC
Poaceae	<i>Eriachne mucronata</i> forma (Alpha C.E.Hubbard 7882)	LC
Poaceae	<i>Eriachne rara</i> R.Br.	LC
Poaceae	<i>Eriochloa crebra</i> S.T.Blake	LC
Poaceae	<i>Eriochloa pseudoacrotricha</i> (Stapf ex Thell.) J.M.Black	LC
Erpodiaceae	<i>Erpodium hodgkinsoniae</i> Hampe & Muell.Hal.	LC



Family Name	Botanical Name	NC Act Status <sup>1</sup>
Apiaceae	<i>Eryngium plantagineum</i> F.Muell.	LC
Erythroxylaceae	<i>Erythroxylum australe</i> F.Muell.	LC
Myrtaceae	<i>Eucalyptus cloeziana</i> F.Muell.	LC
Myrtaceae	<i>Eucalyptus crebra</i> F.Muell.	LC
Myrtaceae	<i>Eucalyptus crebra</i> F.Muell. x <i>E.orgadophila</i> Maiden & Blakely	LC
Myrtaceae	<i>Eucalyptus crebra</i> F.Muell. x <i>E.populnea</i> F.Muell.	LC
Myrtaceae	<i>Eucalyptus drepanophylla</i> F.Muell. ex Benth.	LC
Myrtaceae	<i>Eucalyptus exserta</i> F.Muell.	LC
Myrtaceae	<i>Eucalyptus persistens</i> L.A.S.Johnson & K.D.Hill	LC
Myrtaceae	<i>Eucalyptus tenuipes</i> (Maiden & Blakely) Blakely & C.T.White	LC
Myrtaceae	<i>Eucalyptus tholiformis</i> A.R.Bean & Brooker	LC
Myrtaceae	<i>Eucalyptus thozetiana</i> F.Muell. ex R.T.Baker	LC
Euphorbiaceae	<i>Euphorbia</i>	LC
Euphorbiaceae	<i>Euphorbia drummondii</i> Boiss.	LC
Euphorbiaceae	<i>Euphorbia sarcostemmoides</i> J.H.Willis	LC
Convolvulaceae	<i>Evolvulus alsinoides</i> var. <i>decumbens</i> (R.Br.) Ooststr.	LC
Fabroniaceae	<i>Fabronia australis</i> Hook.	LC
Cyperaceae	<i>Fimbristylis quinquangularis</i> (M.Vahl) Kunth	LC
Rutaceae	<i>Flindersia australis</i> R.Br.	LC
Frullaniaceae	<i>Frullania</i>	LC
Cyperaceae	<i>Gahnia aspera</i> (R.Br.) Spreng.	LC
Asteraceae	<i>Gamochaeta pensylvanica</i> (Willd.) Cabrera	*
Rutaceae	<i>Geijera salicifolia</i> Schott	LC
Molluginaceae	<i>Glinus lotoides</i> L.	LC
Phrymaceae	<i>Glossostigma diandrum</i> (L.) Kuntze	LC
Fabaceae	<i>Glycine tomentella</i> Hayata	LC
Goodeniaceae	<i>Goodenia gracilis</i> R.Br.	LC
Goodeniaceae	<i>Goodenia hirsuta</i> F.Muell.	LC
Goodeniaceae	<i>Goodenia</i> sp. (Mt Castletower M.D.Crisp 2753)	LC
Proteaceae	<i>Grevillea parallela</i> Knight	LC
Proteaceae	<i>Grevillea pteridifolia</i> Knight	LC
Proteaceae	<i>Hakea lorea</i> (R.Br.) R.Br. subsp. <i>lorea</i>	LC
Acanthaceae	<i>Harnieria</i> sp. (Lornesleigh E.J.Thompson+ CHA75)	LC
Malvaceae	<i>Hibiscus divaricatus</i> Graham	LC
Malvaceae	<i>Hibiscus heterophyllus</i> Vent.	LC
Malvaceae	<i>Hibiscus</i> sp. (Emerald S.L.Everist 2124)	LC
Malvaceae	<i>Hibiscus sturtii</i> Hook.	LC
Malvaceae	<i>Hibiscus verdcourtii</i> Craven	LC
Fabaceae	<i>Hovea longipes</i> Benth.	LC
Violaceae	<i>Hybanthus enneaspermus</i> (L.) F.Muell.	LC
Violaceae	<i>Hybanthus stellarioides</i> (Domin) P.I.Forst.	LC
Poaceae	<i>Hyparrhenia rufa</i> (Nees) Stapf subsp. <i>rufa</i>	*
Clusiaceae	<i>Hypericum gramineum</i> G.Forst.	LC

Family Name	Botanical Name	NC Act Status <sup>1</sup>
Fabaceae	<i>Indigofera australis</i> Willd. subsp. <i>australis</i>	LC
Fabaceae	<i>Indigofera linnaei</i> Ali	LC
Convolvulaceae	<i>Ipomoea brownii</i> Roem. & Schult.	LC
Convolvulaceae	<i>Ipomoea calobra</i> W.Hill & F.Muell.	LC
Convolvulaceae	<i>Ipomoea plebeia</i> R.Br.	LC
Convolvulaceae	<i>Ipomoea polymorpha</i> Roem. & Schult.	LC
Poaceae	<i>Iseilema macratherum</i> Domin	LC
Poaceae	<i>Iseilema vaginiflorum</i> Domin	LC
Convolvulaceae	<i>Jacquemontia paniculata</i> (Burm.f.) Hallier f.	LC
Juncaceae	<i>Juncus subglaucus</i> L.A.S.Johnson	LC
Amaranthaceae	<i>Kelita uncinella</i> A.R.Bean	E
Byttneriaceae	<i>Keraudrenia hookeriana</i> Walp.	LC
Rubiaceae	<i>Larsenaikia ochreatea</i> (F.Muell.) Tirveng.	LC
Laxmanniaceae	<i>Laxmannia gracilis</i> R.Br.	LC
Lecideaceae	<i>Lecidea</i>	LC
Lamiaceae	<i>Leucas lavandulifolia</i> Sm.	*
Lichen	<i>Lichen</i>	LC
Campanulaceae	<i>Lobelia leucotos</i> Albr.	LC
Laxmanniaceae	<i>Lomandra longifolia</i> Labill.	LC
Myrtaceae	<i>Lophostemon grandiflorus</i> subsp. <i>riparius</i> (Domin) Peter G.Wilson & J.T.Waterh.	LC
Loranthaceae	<i>Lysiana subfalcata</i> (Hook.) Barlow	LC
Myrtaceae	<i>Lysicarpus angustifolius</i> (Hook.) Druce	LC
Chenopodiaceae	<i>Maireana microphylla</i> (Moq.) Paul G.Wilson	LC
Marsileaceae	<i>Marsilea exarata</i> A.Braun	LC
Myrtaceae	<i>Melaleuca fluviatililis</i> Barlow	LC
Myrtaceae	<i>Melaleuca nervosa</i> (Lindl.) Cheel	LC
Myrtaceae	<i>Micromyrtus capricornia</i> A.R.Bean	LC
Phrymaceae	<i>Mimulus</i>	LC
Asteraceae	<i>Minuria integerrima</i> (DC.) Benth.	LC
Loganiaceae	<i>Mitrasacme</i>	LC
Rutaceae	<i>Murraya ovatifoliolata</i> Domin	LC
Scrophulariaceae	<i>Myoporum acuminatum</i> R.Br.	LC
Mimosaceae	<i>Neptunia monosperma</i> F.Muell. ex Benth.	LC
Rubiaceae	<i>Oldenlandia coerulescens</i> (F.Muell.) F.Muell.	LC
Meliaceae	<i>Owenia x reliqua</i> P.I.Forst.	LC
Poaceae	<i>Oxychloris scariosa</i> (F.Muell.) Lazarides	LC
Bignoniaceae	<i>Pandorea</i>	LC
Poaceae	<i>Panicum buncei</i> F.Muell. ex Benth.	LC
Poaceae	<i>Panicum decompositum</i> R.Br. var. <i>decompositum</i>	LC
Poaceae	<i>Panicum effusum</i> R.Br.	LC
Poaceae	<i>Panicum simile</i> Domin	LC
Apocynaceae	<i>Parsonsia lanceolata</i> R.Br.	LC

Family Name	Botanical Name	NC Act Status <sup>1</sup>
Asteraceae	<i>Parthenium hysterophorus</i> L.	*
Poaceae	<i>Paspalidium albobillosum</i> S.T.Blake	LC
Poaceae	<i>Paspalidium caespitosum</i> C.E.Hubb.	LC
Poaceae	<i>Paspalidium criniforme</i> S.T.Blake	LC
Poaceae	<i>Paspalidium gracile</i> (R.Br.) Hughes	LC
Poaceae	<i>Paspalum mandiocanum</i> Trin.	*
Passifloraceae	<i>Passiflora foetida</i> L.	*
Peltulaceae	<i>Peltula placodizans</i> (Zahlbr.) Wetmore	LC
Polygonaceae	<i>Persicaria lapathifolia</i> (L.) Gray	LC
Proteaceae	<i>Persoonia amaliae</i> Domin	LC
Proteaceae	<i>Persoonia falcata</i> R.Br.	LC
Caesalpiniaceae	<i>Petalostylis labicheoides</i> R.Br.	LC
Rutaceae	<i>Phebalium glandulosum</i> Hook. subsp. <i>glandulosum</i>	LC
Phyllanthaceae	<i>Phyllanthus</i>	LC
Phyllanthaceae	<i>Phyllanthus carpentariae</i> Muell.Arg.	LC
Phyllanthaceae	<i>Phyllanthus fuernrohrii</i> F.Muell.	LC
Pittosporaceae	<i>Pittosporum spinescens</i> (F.Muell.) L.Cayzer, Crisp & I.Telford	LC
Sapotaceae	<i>Planchonella cotinifolia</i> var. <i>pubescens</i> P.Royen	LC
Sapotaceae	<i>Planchonella pohlmaniana</i> (F.Muell.) Pierre ex Dubard	LC
Sapotaceae	<i>Planchonella pohlmaniana</i> var. (Gilbert River C.T.White 1409)	LC
Anacardiaceae	<i>Pleiogynium timorense</i> (DC.) Leenh.	LC
Asteraceae	<i>Pluchea dentex</i> R.Br. ex Benth.	LC
Polygalaceae	<i>Polygala pycnantha</i> R.A.Kerrigan	LC
Trichotheliaceae	<i>Porina subargillacea</i> Muell.Arg.	LC
Mimosaceae	<i>Prosopis pallida</i> (Humb. & Bonpl. ex Willd.) Kunth	*
Lamiaceae	<i>Prostanthera collina</i> Domin	LC
Acanthaceae	<i>Pseuderanthemum variabile</i> (R.Br.) Radlk.	LC
Poaceae	<i>Pseudoraphis paradoxa</i> (R.Br.) Pilg.	LC
Rubiaceae	<i>Psydrax saligna</i> S.T.Reynolds & R.J.F.Hend. forma <i>saligna</i>	LC
Asteraceae	<i>Pterocaulon serrulatum</i> (Montrouz.) Guillaumin var. <i>serrulatum</i>	LC
Ptychomitriaceae	<i>Ptychomitrium muelleri</i> (Mitt.) A.Jaeger	LC
Ramalinaceae	<i>Ramalinora glaucolivida</i> (Muell.Arg.) Lumbsch, Rambold & Elix	LC
Myrtaceae	<i>Rhodamnia pauciovulata</i> Guymmer	LC
Rubiaceae	<i>Richardia brasiliensis</i> Gomes	*
Acanthaceae	<i>Rostellularia adscendens</i> (R.Br.) R.M.Barker	LC
Chenopodiaceae	<i>Salsola australis</i> R.Br.	LC
Santalaceae	<i>Santalum lanceolatum</i> R.Br.	LC
Poaceae	<i>Sarga plumosum</i> (R.Br.) Spangler	LC
Poaceae	<i>Schizachyrium fragile</i> (R.Br.) A.Camus	LC
Cyperaceae	<i>Schoenoplectiella dissachantha</i> (S.T.Blake) Lye	LC
Chenopodiaceae	<i>Sclerolaena tetracuspis</i> (C.T.White) A.J.Scott	LC
Plantaginaceae	<i>Scoparia dulcis</i> L.	*
Poaceae	<i>Sehima nervosum</i> (Rottler) Stapf	LC

Family Name	Botanical Name	NC Act Status <sup>1</sup>
Asteraceae	<i>Senecio brigalowensis</i> I.Thomps.	LC
Caesalpiniaceae	<i>Senna artemisioides</i> subsp. <i>coriacea</i> (Benth.) Randell	LC
Caesalpiniaceae	<i>Senna costata</i> (J.F.Bailey & C.T.White) Randell	LC
Poaceae	<i>Setaria oplismenoides</i> R.A.W.Herrm.	LC
Poaceae	<i>Setaria paspalidioides</i> Vickery	LC
Poaceae	<i>Setaria surgens</i> Stapf	LC
Malvaceae	<i>Sida</i>	LC
Malvaceae	<i>Sida aprica</i> Domin var. <i>aprica</i>	LC
Malvaceae	<i>Sida atherophora</i> Domin	LC
Malvaceae	<i>Sida cordifolia</i> L.	*
Malvaceae	<i>Sida fibulifera</i> Lindl.	LC
Malvaceae	<i>Sida</i> sp. (Aramac E.J.Thompson+ JER192)	LC
Malvaceae	<i>Sida</i> sp. (Charters Towers E.J.Thompson+ CHA456)	LC
Malvaceae	<i>Sida spinosa</i> L.	*
Malvaceae	<i>Sida trichopoda</i> F.Muell.	LC
Solanaceae	<i>Solanum adenophorum</i> F.Muell.	E
Solanaceae	<i>Solanum galbinum</i> A.R.Bean	LC
Solanaceae	<i>Solanum parvifolium</i> R.Br. subsp. <i>parvifolium</i>	LC
Lamiaceae	<i>Spartothamnella puberula</i> (F.Muell.) Maiden & Betche	LC
Rubiaceae	<i>Spermacoce brachystema</i> R.Br. ex Benth.	LC
Asteraceae	<i>Sphaeromorphaea australis</i> (Less.) Kitam.	LC
Asteraceae	<i>Sphaeromorphaea subintegra</i> A.R.Bean	LC
Poaceae	<i>Sporobolus australasicus</i> Domin	LC
Poaceae	<i>Sporobolus scabridus</i> S.T.Blake	LC
Stereophyllaceae	<i>Stereophyllum radiculosum</i> (Hook.) Mitt.	LC
Asteraceae	<i>Streptoglossa adscendens</i> (Benth.) Dunlop	LC
Asteraceae	<i>Streptoglossa odora</i> (F.Muell.) Dunlop	LC
Fabaceae	<i>Stylosanthes hamata</i> (L.) Taub.	*
Fabaceae	<i>Tephrosia barbatala</i> Bosman & A.J.P.De Haas	LC
Fabaceae	<i>Tephrosia filipes</i> Benth. subsp. <i>filipes</i>	LC
Lamiaceae	<i>Teucrium integrifolium</i> F.Muell.	LC
Poaceae	<i>Thaumastochloa pubescens</i> (Benth.) C.E.Hubb.	LC
Poaceae	<i>Thellungia advena</i> Stapf ex Probst	LC
Poaceae	<i>Themeda triandra</i> Forssk.	LC
Poaceae	<i>Thyridolepis xerophila</i> (Domin) S.T.Blake	LC
Aizoaceae	<i>Trianthema triquetra</i> Rottb. ex Willd.	LC
Asteraceae	<i>Tridax procumbens</i> L.	*
Poaceae	<i>Triraphis mollis</i> R.Br.	LC
Poaceae	<i>Urochloa foliosa</i> (R.Br.) R.D.Webster	LC
Poaceae	<i>Urochloa mosambicensis</i> (Hack.) Dandy	LC
Rhamnaceae	<i>Ventilago viminalis</i> Hook.	LC
Asteraceae	<i>Vittadinia pustulata</i> N.T.Burb.	LC
Campanulaceae	<i>Wahlenbergia queenslandica</i> Carolin ex P.J.Sm.	LC

<b>Family Name</b>	<b>Botanical Name</b>	<b>NC Act Status<sup>1</sup></b>
Parmeliaceae	<i>Xanthoparmelia ballingalliana</i> Elix & J. Johnst.	LC
Convolvulaceae	<i>Xenostegia tridentata</i> (L.) D.F. Austin & Staples	LC
Fabaceae	<i>Zornia dyctiocarpa</i> var. <i>filifolia</i> (Domin) S.T. Reynolds & A.E. Holland	LC
Fabaceae	<i>Zornia muelleriana</i> Mohlenbr. subsp. <i>muelleriana</i>	LC
Fabaceae	<i>Zornia muriculata</i> Mohlenbr. subsp. <i>muriculata</i>	LC
Fabaceae	<i>Zornia prostrata</i> S.T. Reynolds & A.E. Holland var. <i>prostrata</i>	LC
Zygophyllaceae	<i>Zygophyllum apiculatum</i> F. Muell.	LC

<sup>1</sup> E = Endangered, V = Vulnerable, N = Near threatened, LC = Least concern under the Queensland Nature Conservation (Wildlife) Regulation 2006

\* Exotic species

## **Appendix D**

Queensland Museum Database search results

**Table D1: Queensland Museum database search results for the search area**

Family	Taxon Name	Common Name	NC Act Status <sup>1</sup>
<b>Amphibians</b>			
Hylidae	<i>Cyclorana alboguttata</i>	Green-stripe Frog	LC
Hylidae	<i>Cyclorana brevipes</i>	Superb Collared-frog	LC
Hylidae	<i>Cyclorana novaehollandiae</i>	New Holland Frog	LC
Limnodynastidae	<i>Limnodynastes tasmaniensis</i>	Spotted Marshfrog	LC
Limnodynastidae	<i>Limnodynastes terraereginae</i>	Scarlet-sided Pobblebonk	LC
Limnodynastidae	<i>Limnodynastes sp.</i>		
Hylidae	<i>Litoria inermis</i>	Peters' Frog	LC
Hylidae	<i>Litoria latopalmata</i>	Broad-palmed Rocketfrog	LC
Hylidae	<i>Litoria rothii</i>	Roth's Tree-frog	LC
Hylidae	<i>Litoria rubella</i>	Naked Treefrog	LC
Limnodynastidae	<i>Notaden bennettii</i>	Holy Cross Toad	LC
Limnodynastidae	<i>Platyplectrum ornatum</i>	Ornate Burrowing Frog	LC
Myobatrachidae	<i>Uperoleia sp.</i>	Toadlet	LC
<b>Reptiles</b>			
Typhlopidae	<i>Anilius affinis</i>	Small-headed Blind Snake	LC
Typhlopidae	<i>Anilius ligatus</i>	Robust Blind Snake	LC
Typhlopidae	<i>Anilius unguirostris</i>	Claw-snouted Blind Snake	LC
Pythonidae	<i>Antaresia maculosa</i>	Spotted Python	LC
Elapidae	<i>Brachyuropsis australis</i>	Australian Coral Snake	LC
Scincidae	<i>Carlia munda</i>	Shaded-litter Rainbow-skink	LC
Scincidae	<i>Carlia pectoralis</i>	Open-litter Rainbow-skink	LC
Agamidae	<i>Chlamydosaurus kingii</i>	Frilled Lizard	LC
Scincidae	<i>Cryptoblepharus adamsi</i>	Adam's Snake-eyed Skink	LC
Scincidae	<i>Cryptoblepharus sp.</i>	Callose-palmed Shinning-skink	LC
Scincidae	<i>Cryptoblepharus sp.</i>	Wall Skink	LC
Elapidae	<i>Cryptophis boschmai</i>	Carpentaria Snake	LC
Scincidae	<i>Ctenotus strauchii</i>	Eastern Barred Wedge-snout Ctenotus	LC
Scincidae	<i>Ctenotus taeniolatus</i>	Copper-tailed Skink	LC
Elapidae	<i>Demansia psammophis</i>	Yellow-faced Whip Snake	LC
Elapidae	<i>Denisonia maculata</i>	Ornamental Snake	V
Diplodactylidae	<i>Diplodactylus platyurus</i>	Eastern Fat-tailed Gecko	LC
Diplodactylidae	<i>Diplodactylus vittatus</i>	Stone Gecko	LC
Agamidae	<i>Diporiphora australis</i>	Tommy Round-head	LC
Scincidae	<i>Egernia striolata</i>	Tree Skink	LC
Scincidae	<i>Eremiascincus fasciolatus</i>	Narrow-banded Sand-swimmer	LC
Gekkonidae	<i>Gehyra catenata</i>	Chain-backed Dtella	LC
Gekkonidae	<i>Gehyra dubia</i>	Dubious Dtella	LC
Gekkonidae	<i>Heteronotia binoei</i>	Bynoe's Gecko	LC
Elapidae	<i>Hoplocephalus bitorquatus</i>	Pale-headed Snake	LC

Family	Taxon Name	Common Name	NC Act Status <sup>1</sup>
Scincidae	<i>Lampropholis delicata</i>	Garden Skink	LC
Scincidae	<i>Lerista fragilis</i>	Eastern Mulch-slider	LC
Scincidae	<i>Lerista punctatovittata</i>	Eastern Robust Slider	LC
Pygopodidae	<i>Lialis burtonis</i>	Burton's Snake Lizard	LC
Diplodactylidae	<i>Lucasium steindachneri</i>	Box-patterned Gecko	LC
Scincidae	<i>Lygisaurus foliorum</i>	Burnett's Skink	LC
Scincidae	<i>Menetia greyii</i>	Common Dwarf Skink	LC
Scincidae	<i>Morethia boulengeri</i>	South-eastern Morethia Skink	LC
Scincidae	<i>Morethia taeniopleura</i>	North-eastern Firetail Skink	LC
Carphodactylidae	<i>Nephrurus asper</i>	Prickly Knob-tailed Gecko	LC
Diplodactylidae	<i>Oedura ocellata</i>	Ocellated Velvet Gecko	LC
Agamidae	<i>Pogona barbata</i>	Common Bearded Dragon	LC
Scincidae	<i>Pygmaescincus timlowi</i>	Dwarf Litter-skink	LC
Diplodactylidae	<i>Strophurus williamsi</i>	Eastern Spiny-tailed Gecko	LC
Elapidae	<i>Suta suta</i>	Myall Snake	LC
Colubridae	<i>Tropidonophis mairii</i>	Freshwater Snake	LC
Varanidae	<i>Varanus tristis</i>	Black-headed Monitor	LC
<b>Birds</b>			
Corvidae	<i>Corvus orru</i>	Australian Crow	LC
Strigidae	<i>Ninox novaeseelandiae</i>	Boobook Owl	LC
<b>Mammals</b>			
Potoroidae	<i>Aepyprymnus rufescens</i>	Rufous Bettong	LC
Peramelidae	<i>Isodon macrourus</i>	Northern Brown Bandicoot	LC
Muridae	<i>Mus musculus musculus</i>	House Mouse	*
Petauridae	<i>Petaurus breviceps longicaudatus</i>	Sugar Glider	LC
Macropodidae	<i>Petrogale inornata</i>	Unadorned Rock-wallaby	LC
Dasyuridae	<i>Planigale maculata maculata</i>	Common Planigale	LC
Dasyuridae	<i>Planigale tenuirostris</i>	Narrow-nosed Planigale	LC
Muridae	<i>Pseudomys delicatulus</i>	Delicate Mouse	LC
Muridae	<i>Rattus sordidus</i>	Canefield rat	LC
Emballonuridae	<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tailed Bat	LC
Dasyuridae	<i>Sminthopsis macroura macroura</i>	Stripe-faced Dunnart	LC
Muridae	<i>Zyomys argurus</i>	Common Rock-rat	LC

<sup>1</sup> E = Endangered, V = Vulnerable, N = Near threatened, LC = Least concern under the Queensland Nature Conservation (Wildlife) Regulation 2006

\* Exotic species



## **Appendix E**

BirdLife Atlas Database search results

**Table E1: Birdlife Atlas database search results for the search area**

Common Name	Scientific Name	NC Act Status <sup>1</sup>
Apostlebird	<i>Struthidea cinerea</i>	LC
Australasian Darter	<i>Anhinga novaehollandiae</i>	LC
Australasian Figbird	<i>Sphecotheres vieilloti</i>	LC
Australasian Grebe	<i>Tachybaptus novaehollandiae</i>	LC
Australasian Pipit	<i>Anthus novaeseelandiae</i>	LC
Australian Brush-turkey	<i>Alectura lathami</i>	LC
Australian Bustard	<i>Ardeotis australis</i>	LC
Australian Hobby	<i>Falco longipennis</i>	LC
Australian Magpie	<i>Cracticus tibicen</i>	LC
Australian Painted Snipe	<i>Rostratula australis</i>	V
Australian Pelican	<i>Pelecanus conspicillatus</i>	LC
Australian Raven	<i>Corvus coronoides</i>	LC
Australian Reed-Warbler	<i>Acrocephalus australis</i>	SLC
Australian Swiftlet	<i>Aerodramus terrareginae</i>	NT
Australian White Ibis	<i>Threskiornis molucca</i>	LC
Australian Wood Duck	<i>Chenonetta jubata</i>	LC
Azure Kingfisher	<i>Ceyx azureus</i>	LC
Barking Owl	<i>Ninox connivens</i>	LC
Bar-shouldered Dove	<i>Geopelia humeralis</i>	LC
Black Bittern	<i>Ixobrychus flavicollis</i>	LC
Black Honeyeater	<i>Sugomel niger</i>	LC
Black Kite	<i>Milvus migrans</i>	LC
Black Swan	<i>Cygnus atratus</i>	LC
Black-breasted Buzzard	<i>Hamirostra melanosternon</i>	LC
Black-chinned Honeyeater	<i>Melithreptus gularis</i>	NT
Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>	LC
Black-faced Woodswallow	<i>Artamus cinereus</i>	LC
Black-fronted Dotterel	<i>Elseya melanops</i>	LC
Black-necked Stork	<i>Ephippiorhynchus asiaticus</i>	LC
Black-shouldered Kite	<i>Elanus axillaris</i>	LC
Black-tailed Native-hen	<i>Tribonyx ventralis</i>	LC
Black-winged Stilt	<i>Himantopus himantopus</i>	LC
Blue-faced Honeyeater	<i>Entomyzon cyanotis</i>	LC
Blue-winged Kookaburra	<i>Dacelo leachii</i>	LC
Brolga	<i>Grus rubicunda</i>	LC
Brown Falcon	<i>Falco berigora</i>	LC
Brown Goshawk	<i>Accipiter fasciatus</i>	LC
Brown Honeyeater	<i>Lichmera indistincta</i>	LC
Brown Quail	<i>Coturnix ypsilophora</i>	LC
Brown Treecreeper	<i>Climacteris picumnus</i>	LC
Budgerigar	<i>Melopsittacus undulatus</i>	LC
Bush Stone-curlew	<i>Burhinus grallarius</i>	LC

Common Name	Scientific Name	NC Act Status <sup>1</sup>
Cattle Egret	<i>Ardea ibis</i>	SLC
Channel-billed Cuckoo	<i>Scythrops novaehollandiae</i>	LC
Chestnut-breasted Mannikin	<i>Lonchura castaneothorax</i>	LC
Cicadabird	<i>Coracina tenuirostris</i>	LC
Cockatiel	<i>Nymphicus hollandicus</i>	LC
Common Bronzewing	<i>Phaps chalcoptera</i>	LC
Common Greenshank	<i>Tringa nebularia</i>	SLC
Crested Pigeon	<i>Ocyphaps lophotes</i>	LC
Crow & Raven species		LC
Diamond Dove	<i>Geopelia cuneata</i>	LC
Dollarbird	<i>Eurystomus orientalis</i>	LC
Double-barred Finch	<i>Taeniopygia bichenovii</i>	LC
Dusky Moorhen	<i>Gallinula tenebrosa</i>	LC
Eastern Barn Owl	<i>Tyto javanica</i>	LC
Eastern Great Egret	<i>Ardea modesta</i>	SLC
Eastern Koel	<i>Eudynamys orientalis</i>	LC
Emu	<i>Dromaius novaehollandiae</i>	LC
Eurasian Coot	<i>Fulica atra</i>	LC
Fairy Martin	<i>Petrochelidon ariel</i>	LC
Forest Kingfisher	<i>Todiramphus macleayii</i>	LC
Fork-tailed Swift	<i>Apus pacificus</i>	SLC
Galah	<i>Eolophus roseicapillus</i>	LC
Golden-headed Cisticola	<i>Cisticola exilis</i>	LC
Great Bowerbird	<i>Ptilonorhynchus nuchalis</i>	LC
Grey Butcherbird	<i>Cracticus torquatus</i>	LC
Grey Fantail	<i>Rhipidura albiscapa</i>	LC
Grey Goshawk	<i>Accipiter novaehollandiae</i>	LC
Grey Shrike-thrush	<i>Colluricincla harmonica</i>	LC
Grey Teal	<i>Anas gracilis</i>	LC
Grey-crowned Babbler	<i>Pomatostomus temporalis</i>	LC
Ground Cuckoo-shrike	<i>Coracina maxima</i>	LC
Hardhead	<i>Aythya australis</i>	LC
Horsfield's Bushlark	<i>Mirafrja javanica</i>	LC
Horsfield's Bronze-Cuckoo	<i>Chalcites basalis</i>	LC
House Sparrow	<i>Passer domesticus</i>	LC
Intermediate Egret	<i>Ardea intermedia</i>	LC
Jacky Winter	<i>Microeca fascinans</i>	LC
Laughing Kookaburra	<i>Dacelo novaeguineae</i>	LC
Leaden Flycatcher	<i>Myiagra rubecula</i>	LC
Letter-winged Kite	<i>Elanus scriptus</i>	LC
Little Black Cormorant	<i>Phalacrocorax sulcirostris</i>	LC
Little Crow	<i>Corvus bennetti</i>	LC
Little Eagle	<i>Hieraaetus morphnoides</i>	LC

Common Name	Scientific Name	NC Act Status <sup>1</sup>
Little Egret	<i>Egretta garzetta</i>	LC
Little Friarbird	<i>Philemon citreogularis</i>	LC
Little Pied Cormorant	<i>Microcarbo melanoleucos</i>	LC
Little Woodswallow	<i>Artamus minor</i>	LC
Magpie-lark	<i>Grallina cyanoleuca</i>	LC
Masked Lapwing	<i>Vanellus miles</i>	LC
Mistletoebird	<i>Dicaeum hirundinaceum</i>	LC
Nankeen Kestrel	<i>Falco cenchroides</i>	LC
Noisy Friarbird	<i>Philemon corniculatus</i>	LC
Noisy Miner	<i>Manorina melanocephala</i>	LC
Olive-backed Oriole	<i>Oriolus sagittatus</i>	LC
Pacific Baza	<i>Aviceda subcristata</i>	LC
Pacific Black Duck	<i>Anas superciliosa</i>	LC
Pale-headed Rosella	<i>Platyercus adscitus</i>	LC
Pallid Cuckoo	<i>Cacomantis pallidus</i>	LC
Peaceful Dove	<i>Geopelia striata</i>	LC
Pheasant Coucal	<i>Centropus phasianinus</i>	LC
Pictorella Mannikin	<i>Heteromunia pectoralis</i>	NT
Pied Butcherbird	<i>Cracticus nigrogularis</i>	LC
Pied Currawong	<i>Strepera graculina</i>	LC
Plumed Whistling-Duck	<i>Dendrocygna eytoni</i>	LC
Purple Swampphen	<i>Porphyrio porphyrio</i>	LC
Rainbow Bee-eater	<i>Merops ornatus</i>	LC
Rainbow Lorikeet	<i>Trichoglossus haematodus</i>	LC
Red-backed Fairy-wren	<i>Malurus melanocephalus</i>	LC
Red-backed Kingfisher	<i>Todiramphus pyrrhopygius</i>	LC
Red-capped Robin	<i>Petroica goodenovii</i>	LC
Red-winged Parrot	<i>Aprosmictus erythropterus</i>	LC
Restless Flycatcher	<i>Myiagra inquieta</i>	LC
Royal Spoonbill	<i>Platalea regia</i>	LC
Rufous Fantail	<i>Rhipidura rufifrons</i>	SLC
Rufous Songlark	<i>Cincloramphus mathewsi</i>	LC
Rufous Whistler	<i>Pachycephala rufiventris</i>	LC
Sacred Kingfisher	<i>Todiramphus sanctus</i>	LC
Scaly-breasted Lorikeet	<i>Trichoglossus chlorolepidotus</i>	LC
Scarlet Honeyeater	<i>Myzomela sanguinolenta</i>	LC
Silvereye	<i>Zosterops lateralis</i>	LC
Singing Honeyeater	<i>Lichenostomus virescens</i>	LC
Southern Boobook	<i>Ninox novaeseelandiae</i>	LC
Spiny-cheeked Honeyeater	<i>Acanthagenys rufogularis</i>	LC
Spotted Bowerbird	<i>Ptilonorhynchus maculatus</i>	LC
Squatter Pigeon	<i>Geophaps scripta</i>	V
Straw-necked Ibis	<i>Threskiornis spinicollis</i>	LC

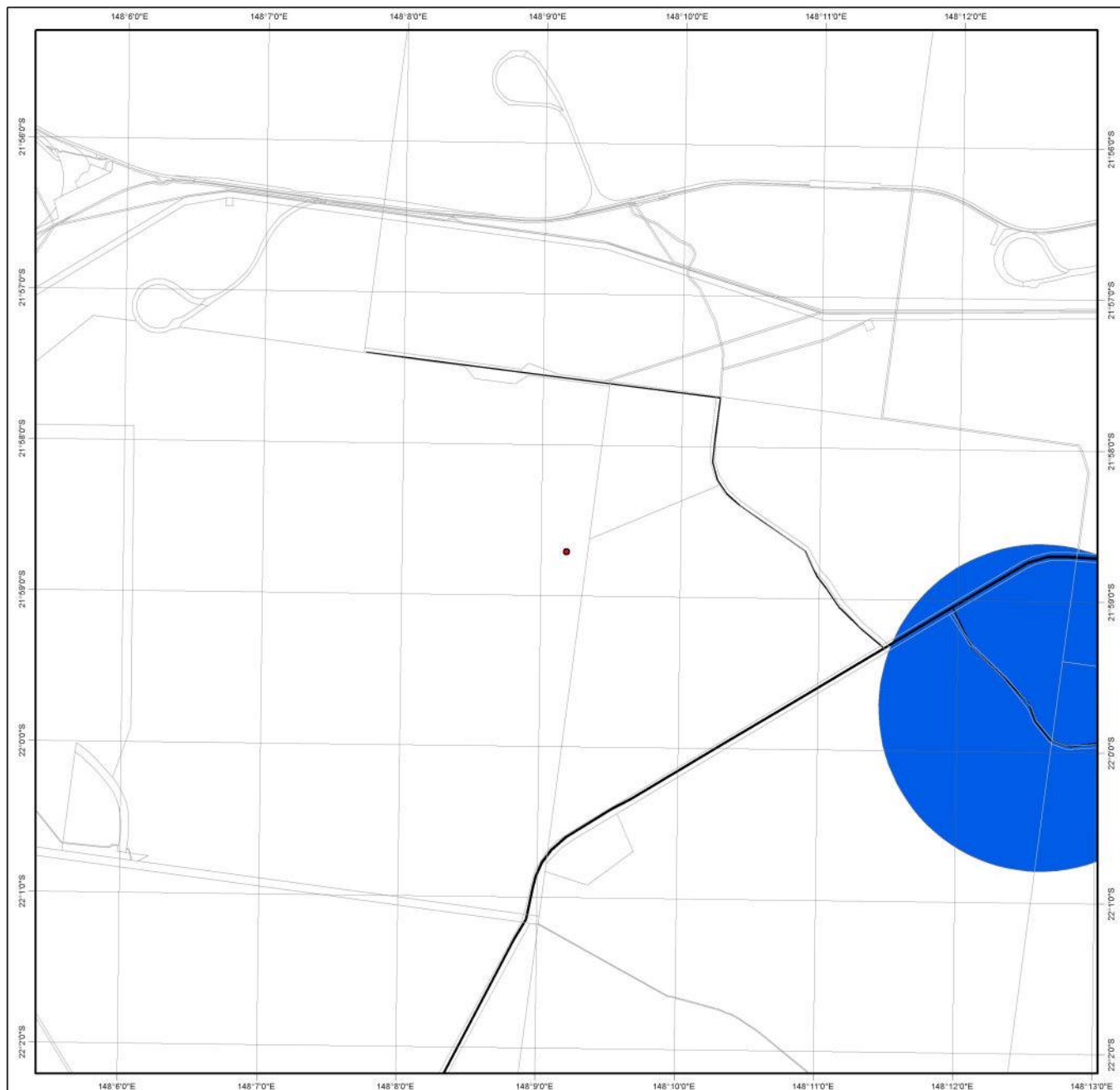
Common Name	Scientific Name	NC Act Status <sup>1</sup>
Striated Pardalote	<i>Pardalotus striatus</i>	LC
Striped Honeyeater	<i>Plectorhyncha lanceolata</i>	LC
Sulphur-crested Cockatoo	<i>Cacatua galerita</i>	LC
Torresian Crow	<i>Corvus orru</i>	LC
Tree Martin	<i>Petrochelidon nigricans</i>	LC
Varied Sittella	<i>Daphoenositta chrysoptera</i>	LC
Variegated Fairy-wren	<i>Malurus lamberti</i>	LC
Wandering Whistling-Duck	<i>Dendrocygna arcuata</i>	LC
Wedge-tailed Eagle	<i>Aquila audax</i>	LC
Weebill	<i>Smicrornis brevirostris</i>	LC
Welcome Swallow	<i>Hirundo neoxena</i>	LC
Whimbrel	<i>Numenius phaeopus</i>	SLC
Whiskered Tern	<i>Chlidonias hybrida</i>	LC
Whistling Kite	<i>Haliastur sphenurus</i>	LC
White-bellied Cuckoo-shrike	<i>Coracina papuensis</i>	LC
White-breasted Woodswallow	<i>Artamus leucorhynchus</i>	LC
White-browed Woodswallow	<i>Artamus superciliosus</i>	LC
White-faced Heron	<i>Egretta novaehollandiae</i>	LC
White-necked Heron	<i>Ardea pacifica</i>	LC
White-plumed Honeyeater	<i>Lichenostomus penicillatus</i>	LC
White-throated Gerygone	<i>Gerygone albogularis</i>	LC
White-throated Honeyeater	<i>Melithreptus albogularis</i>	LC
White-throated Needletail	<i>Hirundapus caudacutus</i>	SLC
White-throated Nightjar	<i>Eurostopodus mystacalis</i>	LC
White-winged Chough	<i>Corcorax melanorhamphos</i>	LC
White-winged Fairy-wren	<i>Malurus leucopterus</i>	LC
White-winged Triller	<i>Lalage sueurii</i>	LC
Willie Wagtail	<i>Rhipidura leucophrys</i>	LC
Yellow-billed Spoonbill	<i>Platalea flavipes</i>	LC
Yellow-faced Honeyeater	<i>Lichenostomus chrysops</i>	LC
Yellow-rumped Thornbill	<i>Acanthiza chrysorrhoa</i>	LC
Yellow-throated Miner	<i>Manorina flavigula</i>	LC
Zebra Finch	<i>Taeniopygia guttata</i>	LC

<sup>1</sup> E = Endangered, V = Vulnerable, N = Near threatened, LC = Least concern, SLC - Special least concern under the Queensland Nature Conservation (Wildlife) Regulation 2006

\* Exotic species

## **Appendix F**

Protected Plants Flora Survey Trigger Map for the study area



### Protected Plants Flora Survey Trigger Map

#### Legend

- Coordinates
- High risk area
- Cadastral line
- ⊕ Property boundaries shown are provided as a locational aid only
- Freeways / motorways / highways
- Secondary roads / streets



0 490 980 1,470 1,960 2,450 m

This product is projected into:  
GDA 1994 Queensland Albers

This map shows areas where particular provisions of the Nature Conservation Act 1992 apply to the clearing of protected plants.

This map is produced at a scale relevant to the size of the area selected and should be printed as A4 size in portrait orientation.

For further information or assistance with interpretation of this product, please contact the Department of Environment and Heritage Protection at [palm@ehp.qld.gov.au](mailto:palm@ehp.qld.gov.au)

**Disclaimer:**  
While every care is taken to ensure the accuracy of the data used to generate this product, the Queensland Government makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damages) and costs which might be incurred as a consequence of reliance on the data, or as a result of the data being inaccurate or incomplete in any way and for any reason.

## **Appendix G**

Study team



**Table G1: Ecology survey team for the Isaac Plains East Project**

<b>Team Member</b>	<b>Title</b>	<b>Years of experience</b>	<b>Qualifications</b>	<b>Role</b>
Steve Marston	Principal Ecologist - EcoSM	19	BEnvEng (Hons) MWildMgt	Fauna field survey lead, reporting and review
Chris Hansen	Principal Botanist – EcoSM	15	BSc (Hons)	Flora field survey lead, reporting and review
Monica Campbell	Senior Ecologist – EcoSM	11	BSc (Hons); PhD (Plant Ecology)	Flora field survey and reporting
Mathew Warren	Ecologist – EcoSM	7	BSc (Eco)	Fauna field survey
Meredith Watherston	Principal Ecologist – EcoSM	14	BSc (Env)	Reporting and review
Laura Knowles	Principal Environmental Scientist – Hansen Bailey	17	BSc (Hons), HDipEd, MPhil (EnvSci)	Scoping, reporting, impact assessment, mitigation and report review
Kate Everding	Environmental Scientist – Hansen Bailey	18	BAppSc (Biology), GradDip EnvQual	Reporting, impact assessment, mitigation and report review

## **Appendix H**

Commonwealth and State recommended survey guidelines

**Table H1: Comparison of field survey effort with Commonwealth and State survey guidelines for listed threatened species or communities considered to potential occur in the ecology study area \***

Survey Guidelines	Optimal Survey Conditions noted in Guidelines	Actual Survey Conditions	Recommended Survey Techniques and Survey Effort from Guidelines	Actual Survey Techniques and Effort Undertaken	Compliance with Guidelines
<b>Brigalow (<i>Acacia harpophylla</i> dominant and co-dominant) TEC</b>					
<p><b>Commonwealth:</b></p> <ul style="list-style-type: none"> <li>Approved Conservation Advice for the Brigalow (<i>Acacia harpophylla</i> dominant and co-dominant) ecological community (TSSC 2013a)</li> <li>SPRAT Profile (DotE 2016i)</li> </ul> <p><b>State:</b></p> <ul style="list-style-type: none"> <li>Guide to determining terrestrial habitat quality - A toolkit for assessing land based offsets under the Queensland Environmental Offsets Policy Version 1.1. December 2014</li> </ul>	<ul style="list-style-type: none"> <li>It is possible to assess this ecological community and its condition at most times of the year, however timing should allow for a reasonable interval after disturbance and to enable diagnostic species to be identified</li> </ul>	<ul style="list-style-type: none"> <li>Dry season survey was conducted in September and October 2015 in hot, dry conditions when a reduced level of observed flora species richness and plant vigour, particularly within the groundcover layer, was observed.</li> <li>Exotic perennial cover could not be measured in all patches during the dry season surveys due to reduced vigour of the groundcover layer.</li> <li>The post-wet season survey was completed in February 2016, following good seasonal rainfall that was sufficient to encourage</li> </ul>	<ul style="list-style-type: none"> <li>Survey must establish key diagnostic characteristics and condition thresholds of each patch in relation to: <ul style="list-style-type: none"> <li>dominant species</li> <li>corresponding regional ecosystem</li> <li>disturbance history (i.e. cleared in the last 15 years)</li> <li>patch size</li> <li>exotic perennial plant cover (100 m x 50 m sample area).</li> </ul> </li> </ul>	<p><u>Dry-season survey</u></p> <ul style="list-style-type: none"> <li>Although Brigalow trees were identified in the study area during the field surveys, they did not form a dominant canopy layer and no REs representing Brigalow vegetation were found to be present.</li> <li>There were non-remnant areas in the north of the study area where Brigalow was a common component of the community however, exotic perennial cover could not be measured in these patches during the dry season surveys due to reduced vigour of the groundcover layer.</li> </ul> <p><u>Post-wet season survey</u></p> <ul style="list-style-type: none"> <li>Two survey transects (100 m x 20 m plots) were placed in one of the patches of non-remnant Brigalow in the north-eastern portion of the study</li> </ul>	Yes

Survey Guidelines	Optimal Survey Conditions noted in Guidelines	Actual Survey Conditions	Recommended Survey Techniques and Survey Effort from Guidelines	Actual Survey Techniques and Effort Undertaken	Compliance with Guidelines
(EHP 2014c)		germination, regeneration and reproduction of vegetation, particularly in the groundcover species, and enable species detection, identification and cover to be measured.		area. This patch was assessed as this regenerating vegetation appeared to be older than 15 years and therefore had the potential to meet the Brigalow TEC condition criteria. Native grasses were also identified in this patch (S12 and T25). <ul style="list-style-type: none"> <li>A component of the Queensland Guide to determining terrestrial habitat quality was used to assess groundcover composition.</li> </ul>	
<b>Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin TEC</b>					
<p><b>Commonwealth:</b></p> <ul style="list-style-type: none"> <li>Listing Advice for the Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin ecological community (TSSC 2008b)</li> <li>SPRAT Profile (DotE 2016j)</li> </ul> <p><b>State:</b></p>	<ul style="list-style-type: none"> <li>Unless exceptional circumstances apply, to maximise the assessment of condition, sites must be assessed during a good season, two months after cessation of disturbance (fire/grazing/mowing /slashing) and within two months of effective rain (TSSC 2008b).</li> </ul>	<ul style="list-style-type: none"> <li>Dry season survey was conducted in September and October 2015 during hot, dry conditions when a low species richness and absence of annual forbs and grasses in the groundcover layer of all vegetation types throughout the project site was observed. Furthermore, the</li> </ul>	<ul style="list-style-type: none"> <li>Survey must establish key diagnostic characteristics and condition thresholds of each patch in relation to: <ul style="list-style-type: none"> <li>Absent or sparse tree canopy (&lt;10% projective crown cover)</li> <li>Patch size (5 ha depending on condition or less for patches of</li> </ul> </li> </ul>	<p><u>Dry-season survey</u></p> <ul style="list-style-type: none"> <li>There were no REs identified within the study area that corresponded to the Natural Grasslands TEC (as listed in the Listing Advice for this TEC) (e.g. RE 11.8.11), and there were no natural grassland areas or communities identified that met the key diagnostic characteristics and condition thresholds for this TEC.</li> <li>The dry conditions and lack of fertile material prevented</li> </ul>	Yes

Survey Guidelines	Optimal Survey Conditions noted in Guidelines	Actual Survey Conditions	Recommended Survey Techniques and Survey Effort from Guidelines	Actual Survey Techniques and Effort Undertaken	Compliance with Guidelines
<ul style="list-style-type: none"> <li>Guide to determining terrestrial habitat quality - A toolkit for assessing land based offsets under the Queensland Environmental Offsets Policy Version 1.1. December 2014 (EHP 2014c)</li> </ul>		<p>residual groundcover vegetation was mostly 'hayed-off' and generally lacking fertile material (i.e. inflorescence).</p> <ul style="list-style-type: none"> <li>Exotic perennial cover could not be measured in all patches during the dry season surveys due to the reduced vigour of the groundcover layer and lack of fertile material.</li> <li>The post-wet season survey was completed in February 2016, following good seasonal rainfall (i.e. &gt;300 mm in late January/early February) that was sufficient to encourage germination, regeneration and reproduction of vegetation, particularly in the groundcover species, and enable species</li> </ul>	<p>better condition)</p> <ul style="list-style-type: none"> <li>Presence and diversity of indicator grass species (at least 3 species)</li> <li>Tussock cover (at least 200 tussocks per quadrat)</li> <li>Projected cover of woody shrubs (&lt;50%)</li> <li>Introduced species (&lt;30% of total projected perennial plant cover).</li> </ul> <ul style="list-style-type: none"> <li>A quadrat size of 0.1 ha should be used.</li> </ul>	<p>assessment being performed in areas mapped on the non-statutory Queensland Herbarium maps as potential natural grassland areas in the far north of the study area (i.e. 11.8.11).</p> <p><u>Post-wet season survey</u></p> <ul style="list-style-type: none"> <li>Three transects were placed in the area mapped on the non-statutory Queensland Herbarium maps as potential natural grassland in the far north of the study area (Transects 1-3).</li> <li>The transects consisted of a 100 m transect where a 1 m x 1 m quadrat is placed at 10 m intervals along the transect and the composition and cover of groundcover species is assessed. The number of indicator species and tussock numbers of these species was also assessed across the entire plot (i.e. 1,000 m<sup>2</sup>).</li> </ul>	

Survey Guidelines	Optimal Survey Conditions noted in Guidelines	Actual Survey Conditions	Recommended Survey Techniques and Survey Effort from Guidelines	Actual Survey Techniques and Effort Undertaken	Compliance with Guidelines
		detection, identification and cover to be measured.			
<b><i>Bertya pedicellata</i> (no common name)</b>					
<p><b>State:</b></p> <ul style="list-style-type: none"> <li>Flora Survey Guidelines – Protected Plants Nature Conservation Act 1992 (EHP 2014b)</li> </ul>	<ul style="list-style-type: none"> <li>Optimal survey conditions not specified.</li> <li>It is generally recommended that survey is undertaken when there is the highest possible chance of detecting the species, i.e. February – May for flowers and fruit. However, this is not a cryptic species and is readily identifiable under all seasonal conditions.</li> </ul>	<ul style="list-style-type: none"> <li>The dry season survey was undertaken in September and October 2015</li> <li>The post-wet season survey was completed in February 2016, following good seasonal rainfall that was sufficient to encourage germination, regeneration and reproduction of vegetation, particularly in the groundcover species, and enable species detection, identification and cover to be measured. It is noted that this species is vegetatively distinct</li> </ul>	<p><u>In high risk areas:</u></p> <ul style="list-style-type: none"> <li>Timed meander method: Continue searching the study area until no new species have been recorded for 30 minutes or when the entire area of habitat type is surveyed, whichever happens sooner. 2 meanders X &lt;10 ha, 2-5 meanders X10-100 ha, 5 meanders X &gt;100 ha</li> <li>Voucher specimen(s) to be sent to the Queensland Herbarium OR</li> <li>Transect search: Parallel transects spaced equidistant over the area (peer</li> </ul>	<p><u>Dry Season Survey</u></p> <ul style="list-style-type: none"> <li>Areas of RE 11.7.2 were systematically searched - 2 person hours/1 day</li> <li>Formal assessments undertaken in the form of three Tertiary sites and two Quaternary sites.</li> </ul> <p><u>Post-wet Season Survey</u></p> <ul style="list-style-type: none"> <li>Areas of RE 11.7.2 were systematically searched - 2 person hours/1 day</li> <li>Two of the three Tertiary sites were upgraded to Secondary sites.</li> </ul>	<ul style="list-style-type: none"> <li><i>Bertya pedicellata</i> was detected in the study area during the dry season surveys.</li> <li>The Flora Survey Guidelines – Protected Plants only applies to surveys within a high risk area of the Guidelines' Flora Survey Trigger Map. The study area is not within a high risk area on the Flora Survey Trigger Map, therefore, these guidelines are not required to be met for this project.</li> </ul>

Survey Guidelines	Optimal Survey Conditions noted in Guidelines	Actual Survey Conditions	Recommended Survey Techniques and Survey Effort from Guidelines	Actual Survey Techniques and Effort Undertaken	Compliance with Guidelines
		and can be recorded at any time of the year.	reviewed method required)		
<b>Squatter Pigeon (southern) (<i>Geophaps scripta scripta</i>)</b>					
<p><b>Commonwealth:</b></p> <ul style="list-style-type: none"> <li>Survey guidelines for Australia's threatened birds (DEWHA 2010a)</li> <li>SPRAT Profile (DotE 2016k)</li> </ul>	<ul style="list-style-type: none"> <li>Mid to late dry season (May – October, inclusive).</li> <li>June is optimal for observations of juvenile birds (i.e. in breeding habitat)</li> <li>Weather conditions should not be such that visual detection is impaired e.g. windy conditions or at night time</li> <li>Most commonly detected between sunrise and 9 am and between 3:30 pm and sunset (particularly the first half hour and last half hour of daylight).</li> <li>Inspect water features, dusty roads/tracks and other patches of</li> </ul>	<ul style="list-style-type: none"> <li>Dry season survey was conducted October 2015 during dry conditions. Stock dams were holding water however both Smoky Creek and Billy's Gully were dry.</li> <li>Post-wet season survey was conducted in March 2016 following significant rainfall in the region during late January/early February 2016 (i.e. &gt; 300 mm). Light patchy rainfall occurred on a number of days during the fauna surveys. The rainfall did not hamper diurnal survey effort and generally led to good conditions for detecting all faunal</li> </ul>	<ul style="list-style-type: none"> <li>Slow drive surveys along bitumen roads, dirt roads and tracks at a constant speed (20 km/hr): 2 x same route on consecutive days, including all unsealed roads and around the perimeter of the project site. Drive each route in both directions each time.</li> <li>Waterbody surveys: 2 x consecutive days, including all waterbodies</li> <li>Area searches or transect surveys in suitable habitat: 15 person hours/3 days</li> <li>Flushing surveys or land-based area searches or line transects: 10 person</li> </ul>	<p><u>Dry Season Survey:</u></p> <ul style="list-style-type: none"> <li>Land-based area searches (bird survey) (27 hours/8 days): 1 person hours x 4 trap sites x 5 mornings, 1 person hours x 7 supplementary sites/4 days</li> <li>Sighting (active searching) (11 person hours/8 days): 1 person hours x 4 trap sites, 1 person hours x 7 supplementary sites</li> <li>Diurnal incidental observations: 98 person hours/7 days</li> </ul> <p><u>Post-wet Season Survey:</u></p> <ul style="list-style-type: none"> <li>Land-based area searches (bird survey) (28 hours/7 days): 1 person hours x 4 trap sites x 5 mornings, 1 person hours x 8 supplementary sites/4 days</li> <li>Sighting (active searching) (11 person hours/7 days): 1 person hours x 4 trap</li> </ul>	<p>In part.</p> <p>Flushing surveys are required by DotE, however, this survey technique was considered unnecessary for this survey as the Squatter Pigeon (southern) remains common in the broader Moranbah region. Also, previous experience in this area has shown that this species is typically recorded incidentally during surveys. The survey methods that were employed during the current surveys did result</p>

Survey Guidelines	Optimal Survey Conditions noted in Guidelines	Actual Survey Conditions	Recommended Survey Techniques and Survey Effort from Guidelines	Actual Survey Techniques and Effort Undertaken	Compliance with Guidelines
	bare ground adjacent to areas of native vegetation identified as habitat.	groups. One night of spotlighting was lost due to rain. Pools of water were present in sections of Smoky Creek.	hours/3 days <ul style="list-style-type: none"> <li>• Call playback is not considered useful</li> <li>• Survey effort is not defined for very large sites, i.e. greater than 50 ha</li> </ul>	sites, 1 person hours x 7 supplementary sites <ul style="list-style-type: none"> <li>• Diurnal incidental observations: 82 person hours/7 days</li> </ul>	in the Squatter Pigeon (southern) being recorded within the study area (refer Figure 14), and therefore flushing surveys were not required.
<p><b>State:</b></p> <ul style="list-style-type: none"> <li>• Terrestrial Vertebrate Fauna Survey Guidelines for Queensland (Eyre et al. 2014)</li> </ul>	<ul style="list-style-type: none"> <li>• Optimal survey conditions for individual species are not specified in Queensland Government guidelines, however, optimal time of year for vertebrate fauna surveys within the Brigalow Belt Bioregion are Spring to early Summer (September – mid-November) and Autumn (March – mid-May)</li> </ul>	<ul style="list-style-type: none"> <li>• The dry season survey was conducted in October 2015. The survey timing was consistent with the guidelines</li> <li>• Post-wet season survey was conducted in March 2016 following significant rainfall in the region during late January/early February 2016 (i.e. &gt;300 mm). Light patchy rainfall occurred on a number of days during the fauna surveys. The rainfall did not hamper survey effort and generally led to good conditions for</li> </ul>	<ul style="list-style-type: none"> <li>• Diurnal bird survey: 6 x 5-10 minute area search of 100x100 m survey site</li> <li>• Incidental observations</li> </ul>	<p><u>Dry Season Survey:</u></p> <ul style="list-style-type: none"> <li>• Land-based area searches (bird survey) (27 hours/8 days): 1 person hours x 4 trap sites x 5 mornings, 1 person hours x 7 supplementary sites/4 days</li> <li>• Sighting (active searching) (11 person hours/8 days): 1 person hours x 4 trap sites, 1 person hours x 7 supplementary sites</li> <li>• Diurnal incidental observations: 98 person hours/8 days</li> </ul> <p><u>Post-wet Season Survey:</u></p> <ul style="list-style-type: none"> <li>• Land-based area searches (bird survey) (28 hours/7 days): 1 person hours x 4 trap sites x 5 mornings, 1 person hours x 8 supplementary sites/4 days</li> </ul>	<p>In part.</p> <p>Survey techniques and effort is consistent with the guideline however, the minimum replicate sites (i.e. 3 replicate trap sites/assessment unit or habitat type) were not applied. The survey methods that were employed during the surveys did result in the Squatter Pigeon (southern) being recorded within the study area (refer Figure 14).</p>



Survey Guidelines	Optimal Survey Conditions noted in Guidelines	Actual Survey Conditions	Recommended Survey Techniques and Survey Effort from Guidelines	Actual Survey Techniques and Effort Undertaken	Compliance with Guidelines
		detecting all faunal groups.		<ul style="list-style-type: none"> <li>Sighting (active searching) (11 person hours/7 days): 1 person hours x 4 trap sites, 1 person hours x 7 supplementary sites</li> <li>Diurnal incidental observations: 82 person hours/7 days</li> </ul>	
<b>Greater Glider (<i>Petauroides volans</i>)</b>					
<p><b>Commonwealth:</b></p> <ul style="list-style-type: none"> <li>Survey guidelines for Australia's threatened mammals (SEWPaC 2011b) (For small and medium-sized arboreal species)</li> </ul> <p><i>The Greater Glider was not a listed threatened species at the time of the surveys for this project, and specific survey guidelines and the species SPRAT profile were not available.</i></p>	<ul style="list-style-type: none"> <li>Survey at dusk and during the night</li> <li>Very windy or rainy nights should be avoided as these conditions can reduce fauna activity and detectability of fauna</li> </ul>	<ul style="list-style-type: none"> <li>The dry season survey was consistent with these conditions with no rainfall experienced during the dry season fauna survey</li> <li>The post wet season survey was conducted during a wet period where patchy light showers occurred on a number of days and one night of spotlighting was cancelled due to rain.</li> </ul>	<ul style="list-style-type: none"> <li>Daytime searches of potentially suitable habitat resources for den sites and food trees and other signs (feeding, scratches on tree trunks): approx. 50-100 m interval transects over 2 hours/per hectare in a 5 ha site. Stratify for large sites</li> <li>Direct daytime searches: <math>\geq 4 \times 100</math> m transects/5 ha. Stratify for large sites</li> <li>Stag watching at dusk: 30 mins before and 60 mins</li> </ul>	<p><u>Dry Season Survey:</u></p> <ul style="list-style-type: none"> <li>Active searching – sightings and signs (11 person hours/8 days): 1 person hours x 4 trap sites, 1 person hours x 7 supplementary sites</li> <li>Spotlighting (26 person hours/8 days): 1.5 person hours x 4 trap sites, 1.5 person hours x 5 supplementary sites, 1 person hour x 2 supplementary site and 10.5 person hours from a slow moving vehicle</li> <li>Nocturnal incidental observations: 50 person hours/5 days</li> </ul> <p><u>Post-wet Season Survey</u></p>	<p><i>It should be noted that the Greater Glider was not a listed threatened species at the time of the field surveys for this project, and therefore surveys specifically targeting this species were not conducted. However, the search effort undertaken for the project is considered to meet relevant survey guidelines in part.</i></p>

Survey Guidelines	Optimal Survey Conditions noted in Guidelines	Actual Survey Conditions	Recommended Survey Techniques and Survey Effort from Guidelines	Actual Survey Techniques and Effort Undertaken	Compliance with Guidelines
			<p>after dusk</p> <ul style="list-style-type: none"> <li>Spotlighting along transects, tracks or roads: <math>\geq 2 \times 200</math> m transects/5 ha on foot over <math>\geq 2</math> nights. Stratify for large sites</li> <li>Call detection/call playback of the species and predatory owls: 2 sites/stratification unit up to 200 ha duplicated over 2 separate nights, in conjunction with stag watching</li> <li>Arboreal cage traps if necessary: 10 traps per site, <math>\geq 2</math> sites/5 ha, over 4 consecutive nights (i.e. 80 trap nights). Stratify for large sites</li> </ul>	<ul style="list-style-type: none"> <li>Active searching – sightings and signs (11 person hours/7 days): 1 person hours x 4 trap sites, 1 person hours x 7 supplementary sites</li> <li>Spotlighting (18.5 person hours/7 days): 1 person hours x 4 trap sites, 1 x person hour x 5 supplementary sites and 9.5 person hours from a slow moving vehicle</li> <li>Nocturnal incidental observations: 40 person hours/5 days</li> </ul>	Although stag watching and cage traps were not used, the survey methods and effort used during the field surveys resulted in detection of this species (refer Figure 15).
<b>Koala (<i>Phascolarctos cinereus</i>)</b>					
<p><b>Commonwealth:</b></p> <ul style="list-style-type: none"> <li>EPBC Act referral guidelines for the</li> </ul>	<ul style="list-style-type: none"> <li>Direct observation methods: between August-January.</li> </ul>	<ul style="list-style-type: none"> <li>Dry season survey was conducted in October 2015 during</li> </ul>	<ul style="list-style-type: none"> <li>Faecal pellet searches using Spot Assessment Technique (SAT),</li> </ul>	<p><u>Dry Season Survey:</u></p> <ul style="list-style-type: none"> <li>Diurnal Koala strip transects (11 transects</li> </ul>	<p>Yes.</p> <p>Koala strip transects were</p>

Survey Guidelines	Optimal Survey Conditions noted in Guidelines	Actual Survey Conditions	Recommended Survey Techniques and Survey Effort from Guidelines	Actual Survey Techniques and Effort Undertaken	Compliance with Guidelines
<p>vulnerable koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) (DotE 2014)</p> <ul style="list-style-type: none"> <li>• SPRAT Profile (DotE 2016f)</li> </ul>	<ul style="list-style-type: none"> <li>• Account for seasonal considerations.</li> <li>• Inland areas: Direct observation methods conducted during dry periods should concentrate on riparian areas, upper/mid-slope areas and other dry-period refugia.</li> </ul>	<p>dry conditions.</p> <ul style="list-style-type: none"> <li>• Post-wet season survey was conducted in March 2016 following significant rainfall in the region during February 2016. Light patchy rainfall occurred on a number of days during the fauna survey. The rainfall did not hamper survey effort and generally led to good conditions for detecting all faunal groups.</li> </ul>	<p>particularly for drier sites</p> <ul style="list-style-type: none"> <li>• Diurnal strip transect searches (&lt;30 ha)</li> <li>• Nocturnal spotlighting</li> <li>• Call playback</li> <li>• Remote sensor activated cameras</li> <li>• Survey effort not specified – site and habitat specific</li> </ul>	<p>totalling 92.8 ha)</p> <ul style="list-style-type: none"> <li>• Call playback (11 sessions): 1 person hour x 4 trap sites, 1 person hour x 7 supplementary sites/4 nights.</li> <li>• Spotlighting (26 person hours/8 days): 1.5 person hours x 4 trap sites, 1.5 person hours x 5 supplementary sites, 1 person hour x 2 supplementary site and 10.5 person hours from a slow moving vehicle</li> <li>• Active searching – sightings and signs (11 person hours/8 days): 1 person hours x 4 trap sites, 1 person hours x 7 supplementary sites</li> <li>• Infra-red camera (191 trap nights): 1 camera x 4 trap sites x 4 nights, 1 camera x 5 supplementary sites x 35 nights</li> <li>• Diurnal incidental observations: 98 person hours /8 days</li> <li>• Nocturnal incidental observations: 50 person</li> </ul>	<p>conducted which covered approximately 104.2 ha (27%) of suitable habitat present in the study area, nocturnal spotlighting, call playback and remote sensor activated cameras were used.</p>

Survey Guidelines	Optimal Survey Conditions noted in Guidelines	Actual Survey Conditions	Recommended Survey Techniques and Survey Effort from Guidelines	Actual Survey Techniques and Effort Undertaken	Compliance with Guidelines
				<p>hours/8 days</p> <p><u>Post-wet Season Survey</u></p> <ul style="list-style-type: none"> <li>• Diurnal Koala strip transects (1 transect totalling 11.4 ha)</li> <li>• Call playback (9 sessions): 1 person hour x 4 trap sites, 1 person hour x 5 supplementary sites/4 nights.</li> <li>• Spotlighting (18.5 person hours/7 days): 1 person hour x 4 trap sites, 1 person hour x 5 supplementary sites, and 9.5 person hours from a slow moving vehicle</li> <li>• Active searching – sightings and signs (11 person hours/7 days): 1 person hours x 4 trap sites, 1 person hours x 7 supplementary sites</li> <li>• Infra-red camera (64 trap nights): 1 camera x 4 trap sites x 4 nights</li> <li>• Diurnal incidental observations: 82 person hours /7 days</li> <li>• Nocturnal incidental</li> </ul>	

Survey Guidelines	Optimal Survey Conditions noted in Guidelines	Actual Survey Conditions	Recommended Survey Techniques and Survey Effort from Guidelines	Actual Survey Techniques and Effort Undertaken	Compliance with Guidelines
				observations: 40 person hours/5 days	
<p><b>State:</b></p> <ul style="list-style-type: none"> <li>Terrestrial Vertebrate Fauna Survey Guidelines for Queensland (Eyre et al. 2014)</li> </ul>	<ul style="list-style-type: none"> <li>Optimal survey conditions for individual species are not specified in Queensland Government guidelines, however, optimal time of year for vertebrate fauna surveys within the Brigalow Belt Bioregion are Spring to early Summer (September – mid-November) and Autumn (March – mid-May)</li> </ul>	<ul style="list-style-type: none"> <li>The dry season survey was conducted in October 2015. The survey timing was consistent with the guidelines</li> <li>Post-wet season survey was conducted in March 2016 following significant rainfall in the region during February 2016. Light patchy rainfall occurred on a number of days during the fauna survey. The rainfall did not hamper survey effort and generally led to good conditions for detecting all faunal groups.</li> </ul>	<ul style="list-style-type: none"> <li>Line transects: (no minimum number stipulated for large sites)</li> <li>Call playback: 2 sessions at each systematic site</li> <li>Spotlighting: 2 x 30 minute search per site</li> <li>Scat and sign searches: search each systematic site and incidentally</li> <li>Incidental observations</li> </ul>	<p><u>Dry Season Survey:</u></p> <ul style="list-style-type: none"> <li>Diurnal Koala strip transects (11 transects totalling 92.8 ha)</li> <li>Call playback (11 sessions): 1 person hour x 4 trap sites, 1 person hour x 7 supplementary sites/4 nights.</li> <li>Spotlighting (26 person hours/8 days): 1.5 person hours x 4 trap sites, 1.5 person hours x 5 supplementary sites, 1 person hour x 2 supplementary site and 10.5 person hours from a slow moving vehicle</li> <li>Active searching – sightings and signs (11 person hours/8 days): 1 person hours x 4 trap sites, 1 person hours x 7 supplementary sites</li> <li>Infra-red camera (191 trap nights): 1 camera x 4 trap sites x 4 nights, 1 camera x 5 supplementary sites x 35</li> </ul>	<p>Yes.</p> <p>Koala strip transects were conducted which covered approximately 104.2 ha (27%) of suitable habitat present in the study area, call playback (one session at each systematic site), spotlighting, scat and sign searches and incidental observations were used. Remote sensor activated cameras were also installed.</p>
<ul style="list-style-type: none"> <li>Nature Conservation (Koala) Conservation Plan 2006 and Management Program 2006-2016 (Policy 4)</li> </ul>	<ul style="list-style-type: none"> <li>Not specified</li> </ul>		<ul style="list-style-type: none"> <li>Actual animal sightings preferred, rather than indirect methods of detection</li> <li>For sites &gt;50 ha: <ul style="list-style-type: none"> <li>- Sampling transects to be uniformly positioned across the site at a constant compass</li> </ul> </li> </ul>		

Survey Guidelines	Optimal Survey Conditions noted in Guidelines	Actual Survey Conditions	Recommended Survey Techniques and Survey Effort from Guidelines	Actual Survey Techniques and Effort Undertaken	Compliance with Guidelines
			<p>bearing so as to survey a cross section of vegetation / habitat types</p> <ul style="list-style-type: none"> <li>- Transect to comprise a number of observers walking 15 m apart walking a fixed compass bearing, all maintaining the same pace</li> <li>- Each tree in transect to be searched and data collected for all Koalas sighted</li> <li>- Supplemented with indirect means of detection (i.e. scratches or faecal pellets).</li> </ul>	<p>nights</p> <ul style="list-style-type: none"> <li>• Diurnal incidental observations: 98 person hours /8 days</li> <li>• Nocturnal incidental observations: 50 person hours /8 days</li> </ul> <p><u>Post-wet Season Survey</u></p> <ul style="list-style-type: none"> <li>• Diurnal Koala strip transects (1 transect totalling 11.4 ha)</li> <li>• Call playback (9 sessions): 1 person hour x 4 trap sites, 1 person hour x 5 supplementary sites/4 nights.</li> <li>• Spotlighting (18.5 person hours/7 days): 1 person hour x 4 trap sites, 1 person hour x 5 supplementary sites, and 9.5 person hours from a slow moving vehicle</li> <li>• Active searching – sightings and signs (11 person hours/7 days): 1 person hours x 4 trap sites, 1 person hours x 7 supplementary sites</li> <li>• Infra-red camera (64 trap nights): 1 camera x 4 trap</li> </ul>	

Survey Guidelines	Optimal Survey Conditions noted in Guidelines	Actual Survey Conditions	Recommended Survey Techniques and Survey Effort from Guidelines	Actual Survey Techniques and Effort Undertaken	Compliance with Guidelines
				sites x 4 nights <ul style="list-style-type: none"> <li>• Diurnal incidental observations: 82 person hours /7 days</li> <li>• Nocturnal incidental observations: 40 person hours /5 days</li> </ul>	
<b>Short-beaked Echidna (<i>Tachyglossus aculeatus</i>)</b>					
<b>State:</b> <ul style="list-style-type: none"> <li>• Terrestrial Vertebrate Fauna Survey Guidelines for Queensland (Eyre et al. 2014)</li> </ul>	<ul style="list-style-type: none"> <li>• Optimal survey conditions for individual species are not specified in Queensland Government guidelines, however, optimal time of year for vertebrate fauna surveys within the Brigalow Belt Bioregion are Spring to early Summer (September – mid-November) and Autumn (March – mid-May)</li> </ul>	<ul style="list-style-type: none"> <li>• The dry season survey was conducted in October 2015. The survey timing was consistent with the guidelines</li> <li>• Post-wet season survey was conducted in March 2016 following significant rainfall in the region during February 2016. Light patchy rainfall occurred on a number of days during the fauna survey. The rainfall did not hamper survey effort and generally led to good conditions for</li> </ul>	<ul style="list-style-type: none"> <li>• Required survey intensity of <math>\geq 3</math> replicate fauna trapping sites in each habitat type. The following is required at each site:               <ul style="list-style-type: none"> <li>- Diurnal active searching: 2 x 30 person minutes of two different 50x50 m areas</li> <li>- Nocturnal active searching: 2 x 30 person-minutes searches of 100x100 m area</li> <li>- Spotlighting: 2 x 30 person-minutes searches of 100x100 m</li> </ul> </li> </ul>	<b>Dry Season Survey:</b> <ul style="list-style-type: none"> <li>• Active searching – sightings and signs (11 person hours/8 days): 1 person hours x 4 trap sites, 1 person hours x 7 supplementary sites</li> <li>• Spotlighting (26 person hours/8 days): 1.5 person hours x 4 trap sites, 1.5 person hours x 5 supplementary sites, 1 person hour x 2 supplementary site and 10.5 person hours from a slow moving vehicle</li> <li>• Infra-red camera (191 trap nights): 1 camera x 4 trap sites x 4 nights, 1 camera x 5 supplementary sites x 35 nights</li> <li>• Diurnal incidental</li> </ul>	In part. Survey techniques and effort is consistent with the guideline however, the minimum replicate sites (i.e. 3 replicate trap sites/assessment unit or habitat type) were not applied. Despite this, the survey methods and effort used during the field surveys resulted in detection of this species.

Survey Guidelines	Optimal Survey Conditions noted in Guidelines	Actual Survey Conditions	Recommended Survey Techniques and Survey Effort from Guidelines	Actual Survey Techniques and Effort Undertaken	Compliance with Guidelines
		detecting all faunal groups.	area - Scat and sign search: each survey site and incidentally - Incidental observations	observations: 98 person hours /8 days • Nocturnal incidental observations: 50 person hours /8 days <u>Post-wet Season Survey:</u> • Active searching – sightings and signs (11 person hours/7 days): 1 person hours x 4 trap sites, 1 person hours x 7 supplementary sites • Spotlighting (18.5 person hours/7 days): 1 person hour x 4 trap sites, 1 person hour x 5 supplementary sites, and 9.5 person hours from a slow moving vehicle • Infra-red camera (64 trap nights): 1 camera x 4 trap sites x 4 nights • Diurnal incidental observations: 82 person hours /7 days • Nocturnal incidental observations: 40 person hours /5 days	

1 Minimum survey effort is not defined for very large sites, i.e. survey effort is based on 50 ha sites for birds.

\* Table H1 includes only those species and ecological communities, which were determined as having a moderate or high likelihood of occurrence within the study area prior to the commencement of the field surveys (refer to Sections 3.3.9, 4.3, 4.4 and 6.4 of the main report).



## **Appendix I**

Assessment of likelihood for significant flora species  
to occur in the study area

**Table I 1: Significant flora identified from database searches for the search area**

Common Name (Species Name)	Status		Record Source <sup>3</sup>	Habitat Preferences	Likelihood to occur in the project area
	EPBC Act <sup>1</sup>	NC Act <sup>2</sup>			
<i>Bertya pedicellata</i> (no common name)	NL	NT	Wildlife Online, HERBRECS	<p><b>Distribution:</b> This species is confined to central and south-east Queensland, from near Aramac to Rockhampton and south to near Biggenden. There is an isolated record from the Warwick district (CSIRO 2015a).</p> <p><b>Habitat preferences:</b> This species typically grows on rocky hillsides in eucalypt forests or woodlands, <i>Acacia</i> woodlands or shrublands, and open heathland or vine thicket communities (CSIRO 2015a EHP 2014d). It is known to occur in skeletal to shallow sandy, sandy clay or clay loams overlaying rhyolite, trachyte or sandstone substrates. Associated species include <i>Corymbia trachyphloia</i>, <i>Dodonaea filifolia</i>, <i>Acacia catenulata</i>, <i>A. curvinervia</i>, <i>A. shirleyi</i>, <i>A. rhodoxylon</i>, <i>A. sparsiflora</i>, <i>Eucalyptus crebra</i>, <i>A. harpophylla</i> and <i>E. decorticans</i> (CSIRO 2015a).</p> <p><b>Notable features:</b> An extensively branched shrub growing to 6 m tall (EHP 2014d).</p> <p><b>Dispersal mode:</b> Unknown – seeds have never been seen (Bean, 1997).</p> <p><b>Nearest record:</b> The nearest record is approximately 3 km south-east of the study area (Queensland Herbarium 2015c).</p>	<p><b>Present:</b> Three small populations of this species were recorded in the study area during the flora surveys. All three populations were recorded on the edge of a lateritic jump-up, characterised by skeletal pale brown- grey sandy soils and lateritic rubble supporting fragmented Lancewood (<i>Acacia shirleyi</i>) shrubland to low woodland with emergent eucalypts (i.e. RE 11.7.2). Targeted traverses of this vegetation type were undertaken throughout the study area. To date no large populations have been recorded.</p>
<i>Cerbera dumicola</i> (no common name)	NL	NT	Wildlife Online, HERBRECS	<p><b>Distribution:</b> Coastal and sub-coastal central Queensland (Society for Growing Australia Plants 2007).</p> <p><b>Habitat preferences:</b> This species grows mostly in Lancewood scrubs but has been recorded in eucalypt woodland and open forest (DEHP 2015). This species tends to be associated with lateritic jump-up features in</p>	<p><b>Low:</b> Regional Ecosystem mapping indicates lateritic jump-ups are present and these may provide suitable habitat for this species. However, this is a very</p>

Common Name (Species Name)	Status		Record Source <sup>3</sup>	Habitat Preferences	Likelihood to occur in the project area
	EPBC Act <sup>1</sup>	NC Act <sup>2</sup>			
				<p>the landscape (C. Hansen personal observations of numerous populations in central Queensland).</p> <p><b>Notable features:</b> This is a latex producing shrub that can grow to 4 m (Fletcher 2001). Flowering has been recorded from March to November and fruiting from August to November (EHP 2013).</p> <p><b>Dispersal mode:</b> Vertebrate dispersed – fleshy fruited drupe. Water dispersed – woody endocarp assists floatation.</p> <p><b>Nearest record:</b> The nearest record is approximately 13 km north of the study area (Queensland Herbarium 2015c).</p>	<p>distinctive species with bright green foliage that seems more aligned with a tropical plant but can be deciduous during extended periods of no rainfall. No specimens were recorded within suitable habitats (i.e. lateritic jump-ups and adjacent eucalypt woodland and forest) in the study area during the flora surveys.</p>
Marlborough Blue ( <i>Cycas ophiolitica</i> )	E	E	PMST	<p><b>Distribution:</b> It occurs from Marlborough to Rockhampton and Mt Morgan.</p> <p><b>Habitat preferences:</b> This species occurs on hills and slopes in open forests and woodlands at altitudes between 80-400 m above sea level. It grows on a range of soils but appears to grow best on red clay soils derived from serpentinite (DotE 2015c Melzer et al. 2007). Associated species include <i>Corymbia dallachiana</i>, <i>C. erythrophloia</i>, <i>C. xanthope</i> and <i>Eucalyptus fibrosa</i>. This species has also been recorded with <i>Corymbia dallachiana</i>, <i>C. erythrophloia</i> and <i>E. crebra</i> on mudstone and with <i>Corymbia intermedia</i>, <i>E. drepanophylla</i> and <i>E. tereticornis</i> on alluvial loams (DotE 2015c).</p> <p><b>Notable features:</b> This is a large distinctive cycad species. This cycad has a broad, crowded crown and bluish leaflets (DotE 2015c).</p> <p><b>Seed dispersal:</b> This is limited for this species and mainly through mammals such as possums, rodents or fruit bats (DotE 2015c).</p>	<p><b>Low:</b> Underlying geology and landform is unlikely to support this species.</p> <p>This is a distinctive species that was not recorded within the study area during the flora surveys.</p>

Common Name (Species Name)	Status		Record Source <sup>3</sup>	Habitat Preferences	Likelihood to occur in the project area
	EPBC Act <sup>1</sup>	NC Act <sup>2</sup>			
				<p><b>Dispersal mode:</b> Gravity dispersed; some evidence of dispersal by vertebrates, but seeds are toxic (Queensland Herbarium, 2007).</p> <p><b>Nearest record:</b> This species has not been recorded within 25 km of the study area.</p>	
<i>Dichanthium queenslandicum</i> (King Blue-grass)	E	V	Wildlife Online, PMST, HERBRECS	<p><b>Distribution:</b> This species is known from three disjunct populations: 1) Hughenden district, 2) Nebo to Monto and west to Clermont and Rolleston, and 3) Dalby district.</p> <p><b>Habitat preferences:</b> This grass is confined to natural tussock grassland areas on heavy black cracking clay soils. It mainly occurs in association with other species of blue grasses (i.e. <i>Dichanthium</i> spp. and <i>Bothriochloa</i> spp.). It is strongly associated with the natural bluegrass grasslands of central and southern Queensland, including the EPBC Act listed natural grassland ecological communities (TSSC 2013c). Recorded only from well-managed and conservatively grazed properties (Fletcher 2001 Sharp and Simon 2002).</p> <p><b>Notable features:</b> A grass growing to 80 cm in height.</p> <p><b>Dispersal mode:</b> Wind and mammal dispersed – awned seeds assist with wind movement and attachment to mammals.</p> <p><b>Nearest record:</b> The nearest record is approximately 14 km south of the study area (Queensland Herbarium 2015c).</p>	<p><b>Low:</b> Non-statutory mapping by the Queensland Herbarium indicates that <i>Dichanthium sericeum</i> grassland (i.e. RE 11.8.11) may occur in the northern portion of the study area. This grassland RE has been known to also contain <i>Dichanthium queenslandicum</i>. However, field surveys found these areas to be heavily degraded and dominated by Buffel Grass (*<i>Pennisetum ciliaris</i>) and Parthenium Weed (*<i>Parthenium hysterophorus</i>).</p> <p><i>Dichanthium queenslandicum</i> was not recorded within the study area during the flora surveys, despite being targeted during appropriate seasonal conditions. It is therefore considered to have a low likelihood of being present due to the lack of habitat of suitable quality.</p>
<i>Dichanthium setosum</i> (no)	V	LC	Wildlife Online, PMST,	<p><b>Distribution:</b> This grass species is known from inland New South Wales and Queensland. In Queensland the</p>	<p><b>Low:</b> Non-statutory mapping by the Queensland Herbarium</p>

Common Name (Species Name)	Status		Record Source <sup>3</sup>	Habitat Preferences	Likelihood to occur in the project area
	EPBC Act <sup>1</sup>	NC Act <sup>2</sup>			
common name)			HERBRECS	<p>species has been recorded in the Leichardt, Morton, North Kennedy and Port Curtis regions.</p> <p><b>Habitat preferences:</b> It grows on heavy basaltic black soils and red-brown loams with clay subsoil. It is often found in moderately disturbed areas such as cleared woodland, grassy roadside remnant and highly disturbed pasture (DotE 2015d).</p> <p><b>Notable features:</b> This is a perennial grass that commences growing in spring, flowers in summer and becomes dormant in late autumn (DotE 2015d).</p> <p><b>Dispersal mode:</b> Wind and mammal dispersed – awned seeds assist with wind movement and attachment to mammals.</p> <p><b>Nearest record:</b> The nearest record is approximately 26 km north-west of the study area (Queensland Herbarium 2015c).</p>	<p>indicates that <i>Dichanthium sericeum</i> grassland (i.e. RE 11.8.11) may occur in the northern portion of the study area. This grassland RE has been known to also contain <i>Dichanthium setosum</i>. However, field surveys found these areas to be heavily degraded and dominated by Buffel Grass and Parthenium Weed.</p> <p><i>Dichanthium setosum</i> was not recorded within the study area during the flora surveys, despite being targeted during appropriate seasonal conditions. It is therefore considered to have a low likelihood of being present due to the lack of habitat of suitable quality.</p>
Black Ironbox ( <i>Eucalyptus raveretiana</i> )	V	LC	PMST	<p><b>Distribution:</b> This species occurs as scattered and disjunct populations in central coastal and sub-coastal Queensland, from Dipperu National Park southwest of Mackay, north to Charters Towers, Bowen and Ayr, in and 100 km around Rockhampton and near the Mackenzie River north of Daringa. It is known from 23 main locations and there are many more sub-populations (Brooker and Kleinig 2008 DotE 2015e)</p> <p><b>Habitat preferences:</b> This eucalypt occurs on the banks of rivers, creeks and moderate sized watercourses on</p>	<p><b>Low:</b> As this species hasn't been recorded in close proximity to the study area it is unlikely to be present. The watercourses in the project site were traversed in their entirety.</p> <p>This is a distinctive species that was not recorded within the study area during the flora</p>

Common Name (Species Name)	Status		Record Source <sup>3</sup>	Habitat Preferences	Likelihood to occur in the project area
	EPBC Act <sup>1</sup>	NC Act <sup>2</sup>			
				<p>clayey or sandy loam and is often associated with White Paperbark (<i>Melaleuca leucadendra</i>) and/or Weeping Paperbark (<i>M. fluviatilis</i>) fringing open forest in coastal streams where it tends to displace Queensland Blue Gum (<i>E. tereticornis</i>) as the emergent eucalypt species (TSSC 2008c). It is known to occur at an altitudinal range between 1-300 m in areas with annual rainfall between 650-1100 m (DotE 2015e).</p> <p><b>Notable features:</b> This is a large eucalypt with the smallest fruit of any eucalypt (DotE 2015e).</p> <p><b>Dispersal mode:</b> Gravity, wind and/or water dispersed – no specific morphological features that aid secondary dispersal. Ants may also disperse seeds.</p> <p><b>Nearest record:</b> This species has not been recorded within 25 km of the study area.</p>	surveys.
<i>Kelita uncinella</i> (no common name)	NL	E	Wildlife Online, HERBRECS	<p><b>Distribution:</b> This species is known from central Queensland.</p> <p><b>Habitat preferences:</b> This species has been recorded growing in red gravelly skeletal soils, on steep slopes in semi-evergreen vine thicket, also in <i>Acacia shirleyi</i> woodland with a sparse semi-evergreen vine thicket understorey on a stony ridge (CSIRO 2015b).</p> <p><b>Dispersal mode:</b> Fruit approximately 1.5 mm diameter excluding style, 1-seeded, thick-walled, and indehiscent. The sepals and the fruit capsule remain firmly attached to each other in the aging flower and together form the propagule, which readily detaches from the bract and bracteoles. Gravity, wind and/or water dispersed but also potentially transported on animal fur (Bean, 2010)</p> <p><b>Nearest record:</b> The nearest record of this species is approximately 18 km to the north-east of the study area</p>	<b>Low:</b> Although potential Lancewood woodland habitat is present in the study area, this vegetatively distinct species was not recorded despite extensive targeted searches during both flora survey periods.

Common Name (Species Name)	Status		Record Source <sup>3</sup>	Habitat Preferences	Likelihood to occur in the project area
	EPBC Act <sup>1</sup>	NC Act <sup>2</sup>			
				(Queensland Herbarium 2015c).	
<i>Samadera bidwillii</i> (no common name)	V	V	PMST	<p><b>Distribution:</b> This species is known from a number of locations between Scawfell Island, near Mackay and Goomborian, north of Gympie. It occurs in the Burnett Mary, Fitzroy, Mackay Whitsunday and Burdekin Natural Resource Management regions.</p> <p><b>Habitat preferences:</b> It occurs in lowland rainforest or on rainforest margins as well as open forest and woodland communities. It is often found adjacent to temporary or permanent watercourses up to 510 m in altitude. A number of eucalypts are commonly associated with this species (TSSC 2008d). It grows on lithosols, skeletal soils, loam soils, sands, silts and sands with clay subsoils (DotE 2015f).</p> <p><b>Notable features:</b> It bears red fruits and flowers from November to March (TSSC 2008d).</p> <p><b>Dispersal mode:</b> Gravity, wind and/or water dispersed – no specific morphological features that aid secondary dispersal. Ants may also disperse seeds.</p> <p><b>Nearest record:</b> This species has not been recorded within 25 km of the study area.</p>	<p><b>Low:</b> There are no known records in close proximity to the study area. Habitat is unlikely to be suitable for this species.</p> <p>This is a distinctive species that was not recorded within the study area during the flora surveys.</p>
<i>Solanum adenophorum</i> (no common name)	NL	E	Wildlife Online, HERBRECS	<p><b>Distribution:</b> This species is known from the Dingo-Nebo-Clermont area in Queensland (CSIRO 2015c).</p> <p><b>Habitat preferences:</b> It occurs in deep cracking clay soils in Brigalow (<i>Acacia harpophylla</i>) and Gidgee (<i>Acacia cambageana</i>) communities (CSIRO 2015c EHP 2015a).</p> <p><b>Notable features:</b> It flowers in October and fruits in May, September and October.</p> <p><b>Dispersal mode:</b> Vertebrate dispersed, particularly birds – multi-seeded fleshy fruit.</p>	<p><b>Low:</b> Non-statutory mapping by the Queensland Herbarium indicates that Brigalow communities may occur in the study area.</p> <p>This species was not recorded within the various patches of non-remnant Brigalow scrub to low woodland during the flora surveys. Cattle grazing and</p>

Common Name (Species Name)	Status		Record Source <sup>3</sup>	Habitat Preferences	Likelihood to occur in the project area
	EPBC Act <sup>1</sup>	NC Act <sup>2</sup>			
				<b>Nearest record:</b> The nearest record is approximately 20 km to the north-west of the study area (Queensland Herbarium 2015c).	trampling, habitat fragmentation and the dominance of Buffel Grass in the groundcover is likely to outcompete this species. Therefore, it is considered unlikely to occur within the study area.

<sup>1</sup> – EPBC Act Status: E = Endangered, V = Vulnerable, NL = Not listed

<sup>2</sup> – NC Act Status: E = Endangered, V = Vulnerable, NT = Near threatened, LC = Least concern

<sup>3</sup> - ALA – Atlas of Living Australia

- PMST – Protected Matters Search Tool (refer to PMST database results contained in Appendix A)
- Wildlife Online – Wildlife Online database (refer to Wildlife Online database search results contained in Appendix B)
- HERBRECS – Queensland Herbarium database (refer to HERBRECS database results contained in Appendix C)



## **Appendix J**

Assessment of likelihood for significant fauna species  
to occur in the study area

**Table J1: Significant fauna identified from database searches for the search area**

Common Name (Species Name)	Status		Record Source <sup>3</sup>	Habitat Preferences	Likelihood to occur in the project area
	EPBC Act <sup>1</sup>	NC Act <sup>2</sup>			
<b>Birds</b>					
Australian Painted Snipe ( <i>Rostratula australis</i> )	E	V	PMST, Birds Australia Atlas	<p><b>Distribution:</b> The Australian Painted Snipe has been recorded at wetlands in all states of Australia. It is most common in eastern Australia, where it has been recorded at scattered locations throughout much of Queensland, New South Wales, Victoria and south-eastern South Australia. This population is considered to occur as a single, contiguous breeding population (DotE 2015g).</p> <p><b>General habitat preferences:</b> This secretive, cryptic, crepuscular (active at dawn, dusk and during the night) species occurs in terrestrial shallow wetlands, both ephemeral and permanent, usually freshwater but occasionally brackish. They also use inundated grasslands, salt-marsh, dams, rice crops, sewage farms and bore drains with rank emergent tussocks of grass, sedges, rushes or reeds or samphire, and often with scattered clumps of Lignum (<i>Muehlenbeckia florulenta</i>), canegrass or sometimes tea trees. It has been known to use areas lined with trees, or that have some scattered fallen or washed-up timber (DotE 2015g).</p> <p><b>Foraging habitat:</b> The species feeds on vegetation, seeds, and invertebrates including crustaceans and molluscs as well as insects, worms and other invertebrates (DotE 2015g Marchant and Higgins 1994). Foraging habitats are not well understood (DotE 2015g).</p> <p><b>Breeding habitat:</b> Requirements are specific and include shallow wetlands with areas of bare wet mud and both upper and canopy cover nearby. Almost all records of nests occur on or near small islands in freshwater wetlands characterised by a combination of very shallow</p>	<p><b>Low:</b> Suitable wetland habitat for this species is not present in the study area. This species was not recorded within the study area during the fauna surveys.</p>

Common Name (Species Name)	Status		Record Source <sup>3</sup>	Habitat Preferences	Likelihood to occur in the project area
	EPBC Act <sup>1</sup>	NC Act <sup>2</sup>			
				<p>water, exposed mud, dense low cover and sometimes some tall dense cover. Although this species uses modified habitat, it doesn't necessarily breed in these habitats. It most likely breeds in response to wetland conditions rather than during a particular season (DotE 2015g).</p> <p><b>Notable features:</b> This is a distinctive species.</p> <p><b>Nearest record:</b> The nearest record of this species is approximately 25 km north-north-west of the study area on Goonyella Creek near the confluence with the Isaac River (BirdLife Australia 2015b).</p>	
Curlew Sandpiper ( <i>Calidris ferruginea</i> )	CE	LC	PMST	<p><b>Distribution:</b> This species occurs along the coasts but is also widespread inland. In Queensland there are scattered records in the Gulf of Carpentaria, widespread records along the coast, south of Cairns, and sparsely scattered records inland.</p> <p><b>General habitat preferences:</b> Near the coast it inhabits intertidal mudflats in sheltered areas, such as estuaries, bays inlets and lagoons and non-tidal swamps, lakes, lagoons, ponds in saltworks and sewage farms. Inland they are occasionally recorded around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand. They will use fresh and brackish habitats and floodwaters.</p> <p><b>Foraging habitat:</b> This species usually wades and forages in waters 15-30 mm deep, but up to 60 mm deep at the edge of saltmarsh, emergent vegetation and inundated saltflats. It feeds on invertebrates, including worms, molluscs, crustaceans and insects, as well as seeds.</p> <p><b>Roosting habitat:</b> The species usually roosts on bare dry shingle, shell or sand beaches, sand spits and islets and sometimes in dunes.</p>	<p><b>Low:</b> Suitable wetland habitat for this species is not present in the study area. This species was not recorded within the study area during the fauna surveys.</p>

Common Name (Species Name)	Status		Record Source <sup>3</sup>	Habitat Preferences	Likelihood to occur in the project area
	EPBC Act <sup>1</sup>	NC Act <sup>2</sup>			
				<p><b>Notable features:</b> This species does not breed in Australia (DotE 2016m).</p> <p><b>Nearest record:</b> This species has not been recorded within 25 km of the study area.</p>	
Painted Honeyeater ( <i>Grantiella picta</i> )	V	V	PMST	<p><b>Distribution:</b> This species is sparsely distributed from south-eastern Australia to north-western Queensland and eastern Northern Territory. Greatest concentrations, including all breeding records, come from south of 26°, on inland slopes of the Great Dividing Range between the Grampians in Victoria and Roma in Queensland. After breeding, many birds move to semi-arid regions such as north-eastern South Australia, central and western Queensland and central Northern Territory. This species is considered to have a single population.</p> <p><b>General habitat preferences:</b> This species occurs in mistletoes in eucalypt forests, woodlands, riparian woodlands of black box and river red gum, box-ironbark-yellow gum woodlands, acacia-dominated woodlands, paperbarks, casuarinas, Callitris, and trees on farmland or gardens. Prefers woodlands with a higher number of mature trees, as these generally support more mistletoes. More common in larger remnant tracts, rather than narrow remnant strips.</p> <p><b>Breeding preferences:</b> Breeding season is closely aligned with fruiting of mistletoe, therefore north-south movements have been observed (TSSC 2015). It has been known to breed in narrow roadside strips if ample mistletoe fruit is present. The species appears to prefer mistletoe as a nest substrate and is likely to be attracted to habitats where mistletoe is prevalent and parasitism rates are high (TSSC 2015).</p> <p><b>Nearest record:</b> This species has not been recorded within 25 km of the study area.</p>	<p><b>Low:</b> This species has not been recorded within 25 km of the study area. Available species records and habitat modelling (CSIRO, 2015d) indicate that the study area is outside of the known range of this species. The woodland vegetation on the study area does not support a high abundance of mistletoe to provide suitable habitat for this species.</p> <p>This species was not recorded within the study area during the fauna surveys.</p>

Common Name (Species Name)	Status		Record Source <sup>3</sup>	Habitat Preferences	Likelihood to occur in the project area
	EPBC Act <sup>1</sup>	NC Act <sup>2</sup>			
Red Goshawk ( <i>Erythrotriorchis radiatus</i> )	V	E	PMST	<p><b>Distribution:</b> This species is sparsely dispersed across coastal and sub-coastal Australia from western Kimberly Division to north-eastern New South Wales and occasionally on continental islands.</p> <p><b>General habitat preferences:</b> This species occurs in woodlands and forests, ideally with a mosaic of vegetation types and permanent water, particularly riverine forests. The species avoids both very dense and very open habitats. They are solitary and secretive birds and hunt mainly from ambush. Their prey is mostly birds, but also mammals, reptiles and insects (Marchant and Higgins 1994).</p> <p><b>Breeding habitat:</b> Nests are restricted to trees taller than 20 m and within 1 km of a watercourse or wetland. It is thought to rarely breed in areas with fragmented native vegetation (Garnett et al. 2011). Home ranges of 120 km<sup>2</sup> and 200 km<sup>2</sup> for females and males, respectively have been recorded (Marchant and Higgins 1994).</p> <p><b>Nearest record:</b> This species has not been recorded within 25 km of the study area.</p>	<p><b>Low:</b> There are no known records of this species within 25 km of the study area. While there is potential marginal habitat in the form of remnant vegetation and small watercourses in the study area, this species is more likely to occur in remnant areas associated with the larger Isaac River approximately 5 km to the west of the study area.</p> <p>This species was not recorded within the study area during the fauna surveys.</p>
Squatter Pigeon (southern subspecies) ( <i>Geophaps scripta scripta</i> )	V	V	Wildlife Online, PMST, Birds Australia Atlas	<p><b>Distribution:</b> The southern sub-species for the Squatter Pigeon (southern subspecies) is described as occurring south of the Burdekin River-Lynd divide in the southern region of Cape York Peninsula to the Border Rivers region of northern New South Wales, and from the east coast to Hughenden, Longreach and Charleville (Higgins and Davies 1996). The known distribution of the southern sub-species overlaps with the known distribution of the northern subspecies (DotE 2016k).</p> <p><b>General habitat preferences:</b> This species is known from tropical dry, open sclerophyll woodlands and sometimes savannah with <i>Eucalyptus</i>, <i>Corymbia</i>, <i>Acacia</i> or</p>	<p><b>Present:</b> This species was recorded at several locations during the survey within remnant woodland vegetation and in cleared areas close to water (Figure 14).</p>

Common Name (Species Name)	Status		Record Source <sup>3</sup>	Habitat Preferences	Likelihood to occur in the project area
	EPBC Act <sup>1</sup>	NC Act <sup>2</sup>			
				<p><i>Callitris</i> species in the overstorey. The groundcover layer is patchy consisting of native, perennial tussock grasses or a mix of grasses and low shrubs or forbs. However, the groundcover layer rarely exceeds 33% of the ground area. It appears to favour sandy soil dissected with low gravelly ridges and is less common on heavier soils with dense grass cover. It is nearly always found in close association i.e. within 3 km, with permanent water. While the species is unlikely to move far from woodland trees, where scattered trees still occur and the distance of cleared land between remnant trees or patches of habitat does not exceed 100 m, individuals may be found foraging in, or moving across modified or degraded environments (DotE 2016k).</p> <p><b>Foraging habitat:</b> This occurs in any remnant or regrowth open-forest to sparse, open woodland or scrub dominated by <i>Eucalyptus</i>, <i>Corymbia</i>, <i>Acacia</i> or <i>Callitris</i> species, on sandy or gravelly soils. It feeds primarily on seeds of grasses, herbs and shrubs.</p> <p><b>Breeding habitat:</b> This occurs on well-draining, stony rises occurring on sandy or gravelly soils or on low 'jump-ups' and escarpments (i.e. land zones 5 and 7), within 1 km of a suitable, permanent waterbody.</p> <p><b>Dispersal habitat:</b> This can be any forest or woodland occurring between patches of foraging or breeding habitat, and suitable waterbodies and may include denser patches of vegetation not suitable for foraging or breeding.</p> <p><b>Notable features:</b> This species can breed throughout most of the year, however, peak breeding is generally April to October when the primary source of food, grass seed, is most abundant (DotE 2016k).</p> <p><b>Nearest record:</b> This species was recorded in the study area during the fauna surveys.</p>	

Common Name (Species Name)	Status		Record Source <sup>3</sup>	Habitat Preferences	Likelihood to occur in the project area
	EPBC Act <sup>1</sup>	NC Act <sup>2</sup>			
Star Finch ( <i>Neochmia ruficauda ruficauda</i> )	E	E	PMST	<p><b>Distribution:</b> In Queensland, this species' range has largely contracted to southern Cape York. There have not been any confirmed records from the Cairns to Townsville region for some time and none were recorded during the Birds Australia Atlas project. Recent records around Rockhampton are thought likely to be aviary escapees (Higgins et al. 2006).</p> <p><b>General habitat preferences:</b> This species usually inhabits low dense damp grasslands bordering wetlands and waterways and also open savannah woodlands near water or subject to inundation but is absent from expanses of open country and uplands usually occurring in valleys (Higgins et. al. 2006). Woodland communities in which it occurs include <i>Eucalyptus coolabah</i>, <i>E. tereticornis</i>, <i>E. tessellaris</i>, <i>Melaleuca leucadendra</i>, <i>E. camaldulensis</i> and <i>Casuarina cunninghamii</i>.</p> <p><b>Foraging habitat:</b> It feeds on grass and shrub seeds, most likely from <i>Arundinella</i>, <i>Brachyachne</i>, <i>Chloris</i>, <i>Chrysopogon</i>, <i>Digitaria</i>, <i>Echinochloa</i>, <i>Heterachne</i>, <i>Iselema</i>, <i>Oryza</i>, <i>Panicum</i>, <i>Setaria</i>, <i>Sorghum</i>, <i>Themeda</i>, <i>Urochloa</i>, <i>Casuarina</i>, <i>Fimbristylis</i> and <i>Tridax</i> species. It also feeds on insects. It has been recorded foraging, in the shade of eucalypt species, on the ground.</p> <p><b>Breeding habitat:</b> Nests are thought to be bottle-shaped and placed in trees, amongst grass, sedges or reeds, at heights of approximately 3-9 m above the ground.</p> <p><b>Notable features:</b> Nesting occurs in November, with eggs recorded from February to May and in September.</p> <p><b>Nearest record:</b> This species has not been recorded within 25 km of the study area.</p>	<p><b>Low:</b> Suitable wetland, grassland and savannah woodland habitat for this species is not present in the study area and it has not been recorded within 25 km of the study area despite numerous surveys in the region.</p> <p>This species was not recorded within the study area during the fauna surveys.</p>

Common Name (Species Name)	Status		Record Source <sup>3</sup>	Habitat Preferences	Likelihood to occur in the project area
	EPBC Act <sup>1</sup>	NC Act <sup>2</sup>			
<b>Mammals</b>					
Corben's Long-eared Bat ( <i>Nyctophilus corbeni</i> )	V	V	PMST	<p><b>Distribution:</b> In Queensland, this species is mainly recorded in the Brigalow Belt South Bioregion, extending eastwards to the Bunya Mountains National Park, as far north as the Expedition Range and Dawson River areas and west into the Mulga Lands Bioregion and west of Bollon.</p> <p><b>General habitat preferences:</b> Corben's Long-eared Bat occurs in a range of inland woodland vegetation types, including box, ironbark and cypress pine woodlands as well as Buloke woodland, Brigalow woodland, Belah woodland, Smooth-barked Apple (<i>Angophora leiocarpa</i>) woodland, River Red Gum (<i>Eucalyptus camaldulensis</i>) woodland and dry sclerophyll forest. It is known from habitat dominated by various eucalypt and bloodwood species and various types of tree mallee, being most abundant in vegetation with a distinct canopy and a dense cluttered shrub layer (DotE 2015h).</p> <p><b>Foraging habitat:</b> This insectivorous bat feeds in flight, by gleaning vegetation and during ground foraging. It feeds on beetles, bugs, moths, grasshoppers, crickets, ants, spiders and mosquitoes. Foraging tends to be concentrated around patches of trees and is important for managing foliage feeding insects on eucalypt trees.</p> <p><b>Roosting habitat:</b> Occurs solitarily under exfoliated bark an in the crevices on trees.</p> <p><b>Breeding habitat:</b> Maternity roosts are likely to occur in colonies in larger tree cavities. Breeding is thought to occur around November, although there is little information about this (DotE 2015h).</p> <p><b>Nearest record:</b> This species has not been recorded within 25 km of the study area.</p>	<p><b>Low:</b> There are no known records within 25 km of the study area and the Moranbah region is beyond the known distribution of this species. Therefore, despite some potentially suitable woodland habitat with some dense shrub layer being present on the study area, this species is considered unlikely to occur.</p> <p>This species was not recorded within the study area during the fauna surveys.</p>



Common Name (Species Name)	Status		Record Source <sup>3</sup>	Habitat Preferences	Likelihood to occur in the project area
	EPBC Act <sup>1</sup>	NC Act <sup>2</sup>			
Ghost Bat ( <i>Macroderma gigas</i> )	V	V	PMST	<p><b>Distribution:</b> It is predicted, based on analysis of historic climatic data, fossils, and modelling that the Ghost Bat is a geographically relictual species in southern, arid landscapes, present only because caves provide suitable roost microclimates (TSSC 2016b). Although this species is thought to once occupy much of Australia, its current range is discontinuous across northern Australia, with colonies known in the Pilbara, Kimberly, northern Northern Territory, the Gulf of Carpentaria, coastal and near coastal eastern Queensland from Cape York to near Rockhampton and the Riversleigh and Cammoweal districts in western Queensland and occupying both arid and lush rainforest habitats (TSSC 2016b van Dyck and Strahan 2008a).</p> <p><b>General habitat preferences:</b> Habitat is comprised of thicket, open woodland, and spinifex and black soil grasslands (van Dyck et al. 2013 van Dyck and Strahan 2008a). Monsoon forests, open savannah woodland, tall open forest, deciduous vine forest and tropical rainforest is also used (Churchill 2009). Cave habitat is important for roosting and breeding (van Dyck and Strahan 2008a). Ghost bats usually require a number caves to move between seasonally (TSSC 2016b).</p> <p><b>Foraging habitat:</b> This species feeds on frogs, lizards, birds, small mammals and sometimes other bats (TSSC 2016b van Dyck and Strahan 2008a). It captures prey on the ground and then returns to an established feeding site, e.g. rock overhang or small cave, to feed (van Dyck and Strahan 2008a). It is known to forage up to 2 km from the roost cave and will use the same foraging area each night. Foraging areas are approximately 60 ha in size (Churchill 2009 TSSC 2016b).</p> <p><b>Roosting habitat:</b> Caves provide suitable roost</p>	<p><b>Low:</b> Mountainous cave and escarpment habitat does not occur in close proximity to the study area. The closest potential mountainous habitat is in the Denham Range or approximately 20 km to the north-east of the study area in the Carborough and Kerlong Ranges. There are no records of this species in close proximity to the study area. The closest known population is at least 60 km to the north-east near Mackay.</p>

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				<p>microclimates and it is known to rest during the day in large sandstone or limestone caves, boulder piles, shallow escarpments or deep rock fissures and mines (Churchill 2009 TSSC 2016b van Dyck and Strahan 2008a). This species appears to require caves with specific temperature and humidity ranges (DSITIA 2012 TSSC 2016b). Groups of greater than 100 individuals is unusual (van Dyck and Strahan 2008a).</p> <p><b>Breeding habitat:</b> Breeding is likely to occur in July or August with young being born between September and November. Nursery colonies are formed separately to males (van Dyck and Strahan 2008a). Only 14 breeding sites are currently known (TSSC 2016b). Young are fully weaned by about March each year but may be left in nurseries or forage with the mother up until this age (Churchill 2009). There is a tendency for breeding caves to have multiple entrances (TSSC 2016b).</p> <p><b>Nearest record:</b> This species has not been recorded within 25 km of the study area (EHP 2015b). The nearest record in the Atlas of Living Australia from 1978, is more than 60 km to the north-east near Mackay (CSIRO 2016b).</p>	
Greater Glider ( <i>Petauroides volans</i> )	V	LC	Wildlife Online, PMST	<p><b>Distribution:</b> This species is restricted to eastern Australia, between Windsor Tableland in north Queensland and Wombat State Forest in central Victoria. It occurs from sea level up to 1,200 m above sea level. Two isolated subpopulations exist in Queensland, one in the Gregory Range west of Townsville and another in the Einasleigh Uplands (TSSC 2016a).</p> <p><b>General habitat preferences:</b> The Greater Glider occurs in a range of eucalypt-dominated habitats, including low open forests on the coast to tall forests in the ranges and</p>	<b>Present:</b> This species was recorded at five locations in the study area along Smoky Creek and Billy's Gully (Figure 15).

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				<p>low woodland westwards of the Dividing Range. It does not use rainforest habitats (van Dyck et al. 2013 van Dyck and Strahan 2008a). This species favours taller, montane, moist eucalypt forests with relatively old trees and abundant hollows and a diversity of eucalypt species (TSSC 2016a).</p> <p><b>Foraging habitat:</b> The Greater Glider has an almost exclusive diet of eucalypt leaves and occasionally flowers or buds (TSSC 2016a van Dyck and Strahan 2008a). Although the species is known to feed on a range of eucalypt species, in any particular area it is likely to only forage on one or two species (van Dyck and Strahan 2008a).</p> <p><b>Breeding habitat:</b> Breeding occurs between March and June and a single young is born each year (TSSC 2016a van Dyck and Strahan 2008a). The young stays with the mother or is left in the nest and becomes independent at about 9 months (Menkhorst and Knight 2011).</p> <p><b>Notable features:</b> This species appears to have low dispersal ability and typically small home ranges of 1-4 ha. In lower productivity forests, home ranges may be as large as 16 ha for males. Male home ranges generally do not overlap (TSSC 2016a). It may glide over distances of up to 100 m. It is a nocturnal species and uses tree hollows during the day to rest (van Dyck and Strahan 2008a).</p> <p><b>Nearest record:</b> This species was recorded within the study area.</p>	
Koala ( <i>Phascolarctos cinereus</i> )	V	V	Wildlife Online, PMST	<b>Distribution:</b> This species is widespread in sclerophyll forest and woodlands on foothills and plains on both sides of the Great Dividing Range from about Chillagoe, Queensland to Mt Lofty Ranges in South Australia	<b>High:</b> The Koala was listed as occurring in the region in database searches, and in other recent EIS field surveys

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				<p>(Menkhorst and Knight 2011).</p> <p><b>General habitat preferences:</b> Koalas use a range of habitats, including temperate, sub-tropical and tropical forest, woodland and semi-arid communities dominated by Eucalyptus species. Essentially any forest or woodland, particularly in riparian areas, containing species that are known Koala food trees, or shrubland with emergent food trees provides potential Koala habitat. Koala are known to occur in modified or regenerating native vegetation communities (DotE 2015i).</p> <p><b>Foraging habitat:</b> The EPBC Act referral guidelines for the vulnerable Koala defines Koala food trees as those of the following genus: <i>Angophora</i>, <i>Corymbia</i>, <i>Eucalyptus</i>, <i>Lophostemon</i> and <i>Melaleuca</i> (DotE 2014).</p> <p><b>Refuge habitat:</b> Habitat that allows for the persistence of the Koala during droughts and periods of extreme heat, especially in riparian environments and other areas with reliable soil moisture and fertility. Such habitats occur on permanent aquifers, in riparian zones, on upper or mid-slopes, on fertile alluvial plains or where soil moisture/rainfall is reliable (DotE 2014).</p> <p><b>Nearest record:</b> Wildlife Online search results indicate that the nearest record of this species is between 7-10 km of the study area (EHP 2015b). This species or evidence of this species has been recorded within 10 km in recent EIS field surveys undertaken in close proximity to the study area (refer Section 6.4.1).</p>	<p>in proximity to the study area.</p> <p>The Koala was not identified in the study area during surveys. The EPBC Act referral guidelines for the vulnerable Koala (DotE 2014) explain, however, that “Koalas do not necessarily have to be present” for Koala habitat to be present. The definition of Koala habitat in the referral guidelines is based on the vegetation community present and the vegetation structure. Based on the habitat definitions contained in these guidelines and the records of the species from the region, the Koala has been assessed as having a high probability of occurrence. This rating is based on:</p> <ul style="list-style-type: none"> <li>- The presence of suitable habitat within the study area in the form of woodland vegetation that contains Koala food trees;</li> <li>- A connection between this habitat and habitat in the region where the Koala has been recorded.</li> <li>- The Koala’s ability to move between habitat areas,</li> </ul>

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					including its willingness to traverse rural landscapes, modified and disturbed areas in search of habitat (DotE 2016f).
Northern Quoll ( <i>Dasyurus hallucatus</i> )	E	LC	PMST	<p><b>Distribution:</b> The Northern Quoll was once widespread in Queensland but has undergone a severe range contraction and is now absent from much of its former range.</p> <p><b>General habitat preferences:</b> This species is usually associated with dissected rocky escarpments but also known from Eucalypt forest and woodlands, around human settlement and occasionally rainforest. In the Northern Territory Northern Quoll populations are becoming extinct within one year of the arrival of the Cane Toad (<i>Rhinella marina</i>), although in Queensland some remnant quoll populations persist in areas where Cane Toads have long been present (van Dyck and Strahan 2008a). The areas where the quoll persists in Queensland tend to be steep, rocky areas, close to water that have not been recently burnt. They appear to have become extinct in many lowland habitats formerly occupied (Woinarski et al. 2008).</p> <p><b>Breeding habitat:</b> Dens are made in rock crevices, tree holes or occasionally termite mounds (TSSC, 2005). Breeding success is higher in animals that have a den near a creek line (Braithwaite &amp; Begg 1995).</p> <p><b>Nearest record:</b> This species has not been recorded within 25 km of the study area.</p>	<p><b>Low:</b> Suitable habitat (i.e. rocky escarpments) is not present in the study area and the species has not been recorded within 25 km of the study area despite numerous surveys in the region.</p> <p>This species was not recorded within the study area during the fauna surveys.</p>
Short-beaked Echidna ( <i>Tachyglossus aculeatus</i> )	NL	SLC	Wildlife Online	<p><b>Distribution:</b> This species occurs throughout mainland Australia and Tasmania, as well as King, Flinders and Kangaroo Islands (Menkhorst &amp; Knight 2011).</p> <p><b>General habitat preferences:</b> This species occurs in</p>	<p><b>Present:</b> This species was recorded from Poplar Box woodland and scats were also recorded at a number of other locations. This species occurs</p>

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				<p>almost all terrestrial habitats except intensively managed farmland. It shelters in logs, crevices, burrows or piles of litter and feeds on ants, termites and other soil invertebrates, particularly beetle larvae (Menkhorst and Knight 2011).</p> <p><b>Nearest record:</b> This species was recorded in the study area during the field surveys.</p>	<p>in a wide range of habitats including grazing land and is likely to occur throughout the study area. However, areas of remnant vegetation are likely to be of greater habitat value for this species due to the presence of logs.</p>
<b>Reptiles</b>					
<p>Common Death Adder (<i>Acanthophis antarcticus</i>)</p>	NL	V	Wildlife Online	<p><b>Distribution:</b> This species is known from the Gulf region, central Queensland, New South Wales and southern parts of South Australia and Western Australia (Hines 2014).</p> <p><b>General habitat preferences:</b> Occurs in a variety of habitats containing deep leaf litter, including, rainforests, wet sclerophyll forests, woodland, grasslands, chenopod dominated shrublands, and coastal heathlands (Hines 2014). Habitat with deep intact leaf litter is preferred (Hines 2014 Wilson and Swann 2013).</p> <p><b>Foraging habitat:</b> The Common Death Adder feeds on insects, frogs, small mammals, lizards and birds (Hines 2014).</p> <p><b>Notable features:</b> During the day this snake buries itself in sand, soil or leaf litter often at the base of trees or shrubs and ambushes its prey using its tail as a lure (Cogger 2000 Hines 2014 Wilson and Swann 2013).</p> <p><b>Nearest record:</b> This species has been recorded approximately 25 km from the study area (DSITI 2016).</p>	<p><b>Low:</b> There are no areas of suitable habitat (i.e. areas that contain deep leaf litter) present in the study area, and this species has not been recorded within 25 km of the study area despite numerous surveys in the region.</p> <p>This species was not recorded within the study area during the fauna surveys.</p>
<p>Allan's Lerista (<i>Lerista allanae</i>)</p>	E	E	PMST	<p><b>Distribution:</b> This species is restricted to the area around Clermont and Capella (Borsboom et al. 2010) based on six records of this species in 2010. Prior to these records the species was thought to be potentially extinct.</p>	<p><b>Low:</b> There are some small areas of land zone 8 (i.e. areas that contain suitable chocolate to dark chocolate-</p>

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				<p><b>General habitat preferences:</b> Historically this species was known only from black soil downs (undulating plains formed on basalt, shale, sandstone and unconsolidated sediments) of the Oxford land system in the Brigalow Belt North Bioregion. Early specimens were found several centimetres under the surface of black-red soil, under tussocks of grass on farmland. Habitats include: Mountain Coolabah (<i>Eucalyptus orgadophila</i>)/Red Bloodwood (<i>E. erythrophloia</i>) open woodlands and Black Tea-tree (<i>Melaleuca bracteata</i>) closed scrub to low closed-forest gravelly hills, ridges and gullies; and scattered <i>Bauhinia</i> spp. on plains (DotE 2015j). Recent records of this species are from loose friable, weakly alkaline to alkaline surface soils or leaf litter beneath trees and shrubs. Soils are described as chocolate to dark chocolate-coloured, non-cracking clay-based soils (30-65% clay content) in REs 11.8.5 and 11.8.11/11.8.5 (Borsboom et al. 2010). This species has been recorded in disturbed areas and adjacent Buffel Grass areas (Borsboom et al. 2010).</p> <p><b>Foraging habitat:</b> This species feeds on termites.</p> <p><b>Breeding habitat:</b> There is no life cycle information available for this species.</p> <p><b>Notable features:</b> The absence of forelimbs and presence of a hindlimb with a single clawed digit differentiates this species from other reduced limb skinks in the region.</p> <p><b>Nearest record:</b> This species has not been recorded within 25 km of the study area.</p>	<p>coloured, non-cracking clay-based soils) within the study area. However, there are no local records of this species and it is thought to be entirely restricted to an area between Clermont and Capella. The study area is approximately 110 km to the north-east of the most recent 2010 records. Prior to this the species had not been recorded since 1960 (Borsboom et al. 2010).</p> <p>This species was not recorded within the study area during the fauna surveys.</p>
Dunmall's Snake ( <i>Furina dunmalli</i> )	V	V	PMST	<p><b>Distribution:</b> This snake occurs in the Brigalow Belt South and Nandewar bioregions from near the Queensland border south to Ashford in New South Wales.</p> <p><b>General habitat preferences:</b> Dunmall's Snake has been found in a broad range of habitats between 200-500 m</p>	<p><b>Low:</b> The study area largely lacks areas of woodland on clay or clay loam soils. In addition this species has not been recorded within 25 km</p>

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				<p>above sea level. Habitats including forests and woodlands on clay or clay loam soils dominated by Brigalow (<i>Acacia harpophylla</i>), other wattles such as <i>A. burrowii</i>, <i>A. deanii</i>, <i>A. leiocalyx</i>, native Cypress (<i>Callitris spp.</i>) or Bull Oak and various Spotted Gum (<i>Corymbia citriodora ssp. variegata</i>), Ironbark (<i>Eucalyptus crebra</i> and <i>E. melanophloia</i>), White Cypress Pine (<i>Callitris glaucophylla</i>) and Bull Oak open forest and woodland associations on sandstone derived soils. It has rarely been found on the edge of dry vine scrub and in hard ironstone country. It shelters under fallen timber and ground litter and may use cracks in alluvial clay soils. The Dunmall's Snake feeds on small skinks and geckos (DotE 2015k).</p> <p><b>Notable features:</b> This is a very secretive snake with few known records. The high number of mid-body scales (21) and small yellow flecks over the temporal region and lips will generally distinguish this snake from other similar species.</p> <p><b>Nearest record:</b> This species has not been recorded within 25 km of the study area.</p>	<p>of the study area.</p> <p>This species was not recorded within the study area during the surveys.</p>
Ornamental Snake ( <i>Denisonia maculata</i> )	V	V	Wildlife Online, PMST, Queensland Museum	<p><b>Distribution:</b> This snake species is known from the Brigalow Belt North and parts of the Brigalow Belt South Bioregions, with the main occurrences in the drainage system of the Fitzroy and Dawson Rivers.</p> <p><b>General habitat preferences:</b> This snake is found in close association with frogs which form the majority of its prey. It is known to prefer woodlands and open forests associated with moist areas, particularly gilgai (melon-hole) mounds and depressions with clay soils but is also known from lake margins, wetlands and waterways. This species has been recorded mostly in Brigalow (<i>Acacia harpophylla</i>), Gidgee (<i>Acacia cambagei</i>), Blackwood (<i>Acacia argyrodendron</i>) or Coolabah (<i>Eucalyptus coolabah</i>)</p>	<p><b>Present:</b> This species was identified at one location in the study area (Figure 16). However, the study area lacks gilgai or wetland areas that form the preferred habitat for this species. The level of disturbance to vegetation fringing the waterways reduces the potential of these areas to provide suitable habitat for this species.</p>



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				<p>- dominated vegetation communities or pure grassland associated with gilgais. REs in which it has been recorded include; 11.4.3, 11.4.6, 11.4.8 and 11.4.9 and 11.3.3 and 11.5.16. It shelters in logs, under coarse woody debris and in ground litter. It appears to prefer a diversity of gilgai size and depth and with some fringing groundcover vegetation and ground timber and where soils are of a high clay content with deep-cracking characteristics. Habitat patches greater than 10 ha and connected to larger areas of remnant vegetation are preferred (DotE 2015I). The Draft Referral guidelines for the nationally listed Brigalow Belt reptiles describes gilgai depressions and mounds as being important habitat with habitat connectivity between gilgais and other suitable habitats also being important (SEWPaC 2011c).</p> <p><b>Foraging habitat:</b> It prefers habitats where there is an abundance of burrowing frog species (DotE 2015I).</p> <p><b>Refuge habitat:</b> This species seeks refuge in soil cracks on gilgai mounds within habitat areas.</p> <p><b>Notable features:</b> This species is generally inactive during the day sheltering under microhabitat features. It is active and forages at night.</p> <p><b>Nearest record:</b> One individual was recorded in the study area during field surveys. The next nearest record of this species is approximately 5 km west of the study area (BirdLife Australia 2015b).</p>	It is expected that the individual recorded during the surveys was dispersing through the landscape between preferred habitat areas outside the study area.
Yakka Skink ( <i>Egernia rugosa</i> )	V	V	PMST	<p><b>Distribution:</b> The distribution of this species is highly fragmented. It extends from the coast to the hinterland of sub-humid to semi-arid eastern Queensland. It has been recorded between the Queensland/New South Wales border to Mungkan Kandju National Park on Cape York Peninsula, and from Bundaberg and the region west of</p>	<b>Low:</b> There are some areas of rocky habitat within the study area but the site lacks log piles and large hollow logs are generally sparse within the study area. There

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				<p>Gympie to Mariala National Park west of Charleville (DotE 2015m).</p> <p><b>General habitat preferences:</b> This species occurs in woodland and open forest habitats, wet/dry sclerophyll forest and ecotonal rainforest habitats. This species is commonly found in cavities under and between partly buried rocks, logs or tree stumps, root cavities and abandoned animal burrows. The species often takes refuge in large hollow logs and has been known to excavate deep burrow systems, sometimes under dense ground vegetation (Cogger 2000 Wilson 2005). In cleared habitat, this species can persist where there are shelter sites such as raked log piles, deep gullies, tunnel erosion/sinkholes and rabbit warrens. The species has also been found sheltering under sheds and loading ramps. This species is not generally found in trees or rocky habitats (Chapple 2003).</p> <p><b>Feeding habitat:</b> This species burrows and feeds on soft plant material and fruits as well as a variety of invertebrates that venture into or near the burrow entrance.</p> <p><b>Notable features:</b> This species defecates in a pile outside burrow entrances.</p> <p><b>Nearest record:</b> This species has not been recorded within 25 km of the study area.</p>	<p>are no records of this species within 25 km of the study area despite numerous fauna surveys being conducted in the Moranbah area.</p> <p>This species was not recorded within the study area during the fauna surveys.</p>
<b>Migratory</b>					
Black-faced Monarch ( <i>Monarcha melanopsis</i> )	M	SLC	PMST	<p><b>Distribution/Habitat preferences:</b> Rainforest, eucalypt woodlands and forest (mainly wet sclerophyll), coastal scrubs, rainforest gullies with a dense understorey of ferns and/or shrubs (DotE 2016g, 2015b Pizzey et al. 2012). This is important habitat under the EPBC Act (DotE 2015b). In Queensland this species occurs on the eastern</p>	<p><b>Present:</b> This species was recorded from riparian vegetation fringing Smoky creek.</p>

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				slopes of the Great Divide. Also occasionally occurs further inland (DotE 2016g). <b>Nearest record:</b> This was recorded within the study area.	
Common Greenshank ( <i>Tringa nebularia</i> )	M	SLC	BirdLife Australia Atlas	<b>Distribution/Habitat preferences:</b> This species occurs mainly in coastal regions with some scattered records south of a line from near Dalby to Mt Guide. It occurs in a variety of inland wetlands and sheltered coastal habitats of varying salinity. This species uses permanent and ephemeral terrestrial wetlands, including swamps, lakes, dams, rivers, creeks, billabongs, waterholes and inundated floodplains, claypans, saltflats mudflats, saltmarsh, mangroves, seagrass, embayments, harbours, river estuaries, deltas and lagoons. It will also use artificial wetlands and impoundments. It generally does not occur in dry grassland (DotE 2015n). <b>Nearest record:</b> The nearest record of this species is approximately 12 km south-west of the study area (CSIRO 2016a).	<b>Low:</b> The study areas lacks wetlands to provide habitat for this species. This species was not recorded within the study area during the fauna surveys.
Fork-tailed Swift ( <i>Apus pacificus</i> )	M	SLC	PMST, Birds Australia Atlas	<b>Distribution/Habitat preferences:</b> Aerial species that flies over open habitat sometimes over forests and cities (Pizzey et al. 2012). Sometimes occurs above rainforests, wet sclerophyll forest or pine plantations (DotE 2016h). It occurs in a range of habitat from inland open plains to wooded areas, where it is exclusively aerial (DotE 2015b). <b>Nearest record:</b> The nearest record of this species is approximately 20 km west of the north-western corner of the study area (BirdLife Australia 2015a).	<b>Moderate:</b> This species may overfly the study area as part of a larger foraging range. This species was not recorded within the study area during the fauna surveys.
Latham's Snipe ( <i>Gallinago hardwickii</i> )	M	SLC	PMST	<b>Distribution/Habitat preferences:</b> Soft wet ground or shallow water with tussocks, wet paddocks, seepage below dams, irrigated areas, scrub or open woodland (Pizzey et al. 2012).	<b>Low:</b> The study area does not contain wetland areas to provide habitat for this species. This species has not been recorded in close

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				<b>Nearest record:</b> This species has not been recorded within 25 km of the study area.	proximity to the study area. This species was not recorded within the study area during the fauna surveys.
Oriental Cuckoo ( <i>Cuculus optatus</i> )	M	SLC	PMST	<b>Distribution/Habitat preferences:</b> Non-breeding habitat occurs in Australia and is characterised by monsoonal rainforest, vine thickets, wet sclerophyll forest or open <i>Casuarina</i> , <i>Acacia</i> or <i>Eucalyptus</i> woodlands. Frequently in ecotones between habitats. This habitat is considered important under the EPBC Act (DotE 2015b). <b>Nearest record:</b> This species has not been recorded within 25 km of the study area.	<b>Low:</b> This species is not known from within 25 km of the study area. This species prefers dense forest habitats, which are not present in the study area. This species was not recorded within the study area during the fauna surveys.
Osprey ( <i>Pandion haliaetus</i> )	M	SLC	PMST	<b>Distribution/Habitat preferences:</b> This species occurs in littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands (DotE 2016l). The Osprey has been occasionally observed further inland along major rivers (DotE 2016l). This species requires extensive areas of fresh, brackish or saline waters for foraging (DotE 2016l). Important habitat under the EPBC Act is considered to be bays, estuaries, along tidal stretches of large coastal rivers, mangrove swamps, coral and rock reefs, terrestrial wetlands and coastal lands of tropical and temperate Australia and offshore islands. They are generally found on or near the coast but also range inland along large rivers, mainly in northern Australia. They nest in trees that are usually dead or with dead tops, rocky coastlines and on artificial structures (DotE 2015b). <b>Nearest record:</b> This species has not been recorded within 25 km of the study area.	<b>Low:</b> The study area does not contain wetland areas or riverine areas to provide habitat for this species. This species has not been recorded in close proximity to the study area. This species was not recorded within the study area during the fauna surveys.

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Rufous Fantail ( <i>Rhipidura rufifrons</i> )	M	SLC	BirdLife Australia Atlas	<b>Distribution/Habitat preferences:</b> Rainforest, wet eucalypt forests, monsoon forests, paperbarks, sub-inland and coastal scrubs, mangroves, watercourses, parks (Pizzey et al. 2012). <b>Nearest record:</b> This species was recorded within the study area.	<b>Present:</b> This species was recorded in the study area in Narrow-leaved Red Ironbark and Queensland Blue Gum woodland.
Satin Flycatcher ( <i>Myiagra cyanoleuca</i> )	M	SLC	PMST	<b>Distribution/Habitat preferences:</b> Heavily vegetated gullies in forests and taller woodlands. During migration, this species prefers coastal forests, woodlands, mangroves, gardens and open country (Pizzey et al. 2012). More common in tall wet sclerophyll forest, often in gullies or along water courses. In woodlands this species prefers open, grassy habitats. Habitat becomes more varied during migration and includes most wooded habitats except rainforests, although wintering birds may use rainforests in northern Queensland. All habitats are considered important under the EPBC Act (DotE 2015b). <b>Nearest record:</b> This species has not been recorded within 25 km of the study area.	<b>Low:</b> Vegetative structure is unlikely to be suitable for this species in the study area. It prefers a more densely structured closed or riparian forest habitat. This species was not recorded within the study area during the fauna surveys.
Whimbrel ( <i>Numenius phaeopus</i> )	M	SLC	BirdLife Australia Atlas	<b>Distribution/Habitat preferences:</b> This species has a primarily coastal distribution, with scattered inland records. It is found in all states. Habitats include intertidal mudflats of sheltered coasts, harbours, lagoons, estuaries and river deltas, often those with mangroves, but also open, unvegetated mudflats, saltflats with saltmarsh, saline grasslands with standing water and man-made wetland environments. Inland records are from saline lakes and Canegrass swamps (DotE 2015o). <b>Nearest record:</b> The nearest record of this species is approximately 7 km north-west of the study area (BirdLife Australia 2015a).	<b>Low:</b> Although this species has been recorded approximately 7 km to the north-west of the study area, inland occurrences are uncommon and preferred wetland habitat is not present in the study area. This species was not recorded within the study area during the fauna surveys.

Common Name (Species Name)	Status		Record Source <sup>3</sup>	Habitat Preferences	Likelihood to occur in the project area
	EPBC Act <sup>1</sup>	NC Act <sup>2</sup>			
White-throated Needletail ( <i>Hirundapus caudacutus</i> )	M	SLC	BirdLife Australia Atlas	<p><b>Distribution/Habitat preferences:</b> Aerial species that occurs over forests, woodlands, farmlands, plains, lakes and towns (Pizzey et al. 2012). It is known from above mainly wooded areas, and larger tracts of vegetation, particularly forest. The species roosts in tree hollows in tall trees on ridge-tops, on bark or rock faces and it is thought to have traditional roost sites (DotE 2015b). Large tracts of forest vegetation and breeding habitat is considered important in Australia (DotE 2015b).</p> <p><b>Nearest record:</b> The nearest record of this species is approximately 22 km east of the north-eastern corner of the study area (BirdLife Australia 2015a).</p>	<p><b>Moderate:</b> This species may overfly the study area as part of a larger foraging range. This species was not recorded within the study area during the fauna surveys.</p>
Yellow Wagtail ( <i>Motacilla flava</i> )	M	SLC	PMST	<p><b>Distribution/Habitat preferences:</b> This species prefers well-watered open grasslands and the fringes of wetlands. It roosts in mangroves and other dense vegetation.</p> <p><b>Nearest record:</b> This species has not been recorded within 25 km of the study area.</p>	<p><b>Low:</b> Wetland habitat is not present in the study area and the species has not been recorded within 25 km of the study area. This species was not recorded within the study area during the fauna surveys.</p>

<sup>1</sup> – EPBC Act Status: E = Endangered, V = Vulnerable, M = Migratory, NL = Not listed

<sup>2</sup> – NC Act Status: E = Endangered, V = Vulnerable, NT = Near threatened, LC = Least concern, SLC = Special least concern



<sup>3</sup> - ALA – Atlas of Living Australia

- PMST – Protected Matters Search Tool (refer to PMST database results contained in Appendix A)
- Wildlife Online (refer to Wildlife Online database results contained in Appendix B)
- Queensland Museum (refer to Queensland Museum database results contained in Appendix D)
- BirdLife Australia Atlas (refer to BirdLife Australia Atlas database results contained in Appendix E)



## **Appendix K**



Regional Ecosystems recorded within the study area



**Table K1: Descriptions of field-validated vegetation communities in the study area**



Regional Ecosystem	Species and Structural Composition	Condition	Location	Representative Photograph
<p><b>11.3.2</b></p> <p>Poplar Box (<i>Eucalyptus populnea</i>) woodland on alluvial plains (Poplar Box alluvial woodland).</p> <p>VM Act Status – Of concern</p> <p>Biodiversity status – Of concern</p> <p>EPBC Act status – <i>not applicable</i></p>	<p>The canopy layer comprised Poplar Box and associated Sally Wattle (<i>Acacia salicina</i>) and Carbeen (<i>Corymbia tessellaris</i>). The canopy layer had a median height of 15 m and canopy cover intercept ranging from 5 to 10%.</p> <p>The sub-canopy layer comprised mid-mature Poplar Box and was more representative of the EDL. Sally Wattle was also prevalent in this layer. The sub-canopy had a median height of 10 m and cover intercept ranging from 5 to 20%</p> <p>The shrub layer comprised Pegunny (<i>Lysiphyllum hookeri</i>), Poplar Box and Sally Wattle.</p> <p>The groundcover layer almost exclusively comprised Buffel Grass (<i>*Pennisetum ciliare</i>).</p>	<p>Situated on a narrow terrace between the main channel and the broad clay plains to the east. The community is moderately to markedly fragmented, supporting only scattered mature trees with residual mid-mature regrowth or shrubs. A small, shallow overflow basin was recorded on the eastern edge of the community.</p> <p>Historic clearing and subsequent thinning have affected the community, wherein the community only marginally satisfies the criteria for remnant status (i.e. the 70/50 rule).</p>	<p>This community was restricted to a small floodplain terrace on the western side of a tributary to Smoky Creek in the north-west portion of the study area.</p> <p>One assessment site was conducted within this community, i.e. Q32.</p>	 <p>Q32 – looking north and south (below)</p> 







Regional Ecosystem	Species and Structural Composition	Condition	Location	Representative Photograph
<p><b>Remnant 11.3.4</b></p> <p>Queensland Blue Gum (<i>Eucalyptus tereticornis</i> subsp. <i>tereticornis</i>) and/or <i>Eucalyptus</i> spp. on alluvial plains (Queensland Blue Gum alluvial woodland).</p> <p>VM Act Status – Of concern</p> <p>Biodiversity Status – Of concern</p> <p>EPBC Act Status – <i>not applicable</i></p>	<p>This community typically supported a canopy layer dominated by Poplar Box, Queensland Blue Gum, River Red Gum (<i>Eucalyptus camaldulensis</i> var. <i>obtusata</i>) and Carbeen. The canopy layer had a median height of 18 m and canopy cover intercept ranging from 25 to 30%.</p> <p>The sub-canopy layer comprised Sally Wattle. Less common species included juvenile canopy species, Pegunny and Ironwood (<i>Acacia excelsa</i> subsp. <i>excelsa</i>). The sub-canopy layer had a median height of 11 m (range 9 to 15 m) and a cover intercept ranging from 10 to 40%.</p> <p>The very sparse shrub layer comprised Pegunny, juvenile canopy species, Leichhardt Bean (<i>Cassia brewsteri</i>) and Whitewood (<i>Atalaya hemiglauca</i>).</p> <p>The groundcover variously comprised Buffel Grass, Green Panic (<i>Megathyrsus maximus</i> var. <i>pubiglumis</i>), Indian Blue Grass (<i>Bothriochloa pertusa</i>) and Golden Beard Grass (<i>Chrysopogon fallax</i>).</p>	<p>This community was moderately intact within its limited distribution but negatively impacted by a large edge to area ratio. The patch is heavily degraded within the groundcover layer and was found to be actively used by cattle due to the proximity of several permanent water points.</p> <p>Some large hollow bearing trees were observed.</p>	<p>This community was limited to a small patch fringing remnant riparian woodland (RE 11.3.25) in the far northern portion of the study area (Figure 10).</p> <p>One assessment site was conducted within this community, i.e. T35.</p>	 <p>T35 – looking north</p>  <p>T35 – looking north</p>



Regional Ecosystem	Species and Structural Composition	Condition	Location	Representative Photograph
<p><b>Remnant 11.3.25</b></p> <p>Queensland Blue Gum or River Red Gum woodland fringing drainage lines (mixed eucalypt riparian woodland).</p> <p>VM Act Status – Least concern</p> <p>Biodiversity Status – Of concern</p> <p>EPBC Act Status – <i>not applicable</i></p>	<p><u>Billy's Gully</u></p> <p>The canopy layer of the RE 11.3.25 community associated with Billy's Gully comprised Dallachy's Gum (<i>Corymbia dallachiana</i>), Carbeen, Narrow-leaved Red Ironbark (<i>Eucalyptus crebra</i>), Clarkson's Bloodwood (<i>Corymbia clarksoniana</i>), Queensland Blue Gum and Poplar Box. River Red Gum tended to be prevalent in and adjacent to the channel. The height of the canopy ranged from 15 to 20 m (median of 17 m) and had a cover intercept ranging from 10 to 30%. The sub-canopy layer comprised juvenile canopy species and Sally Wattle. The sub-canopy layer had a median height of 11 m (range 9 to 15 m) and a cover intercept ranging from 10 to 40%. The shrub layer was generally sparse and comprised juvenile canopy species and Sally Wattle. Other species included Pegunny, Leichhardt Bean and Ironwood. The groundcover variously comprised Buffel Grass, Green Panic, Indian Blue Grass, Golden Beard Grass, Kangaroo Grass (<i>Themeda triandra</i>) and Black Speargrass (<i>Heteropogon contortus</i>).</p> <p><u>Smoky Creek</u></p> <p>The canopy layer of the RE 11.3.25</p>	<p><u>Billy's Gully</u></p> <p>The RE 11.3.25 community associated with Billy's Gully appeared to be moderately intact with evidence of selective timber removal. The most likely species targeted for removal were Narrow-leaved Red Ironbark, Queensland Blue Gum and River Red Gum with the latter now largely restricted to the channel. The eastern side of the drainage line has been historically cleared up to the high bank with significant scouring evident in places. Mature hollow-bearing trees were infrequent and were generally restricted to the channel and bank areas. The groundcover of the community was moderately to significantly degraded by exotic grasses and herbs. Black Speargrass, Forest Bluegrass (<i>Bothriochloa bladhii</i>) along with Spiny-headed Mat Rush</p>	<p><u>Billy's Gully</u></p> <p>The RE 11.3.25 community associated with Billy's Gully was recorded as a single patch fringing both sides of Billy's Gully in the southern portion of the study area (Figure 10).</p> <p>Assessment sites within this community included S5 and S6 along with a number of tertiary and quaternary assessment sites.</p> <p><u>Smoky Creek</u></p> <p>The RE 11.3.25 community associated with Smoky Creek fringes Smoky Creek and its unnamed tributary in the northern portion of the study area (Figure 10). Assessment sites within this community included S9, S13, S14 and S24, and S24 along its tributary, and a number of tertiary</p>	 <p>S5 – looking north</p>  <p>T12 – channel, looking north (dry season survey)</p>



Regional Ecosystem	Species and Structural Composition	Condition	Location	Representative Photograph
	<p>community associated with Smoky Creek was dominated by River Red Gum and/or Queensland Blue Gum. Other species included Carbeen and River Oak (<i>Casuarina cunninghamiana</i>). Less frequently observed species included Dallachy's Gum, Sally Wattle and the occasional Brigalow (<i>Acacia harpophylla</i>) along the community's edge. The canopy height ranged from 15 to 25 m (median 21 m), with the occasional 27 m tree. The canopy cover intercept ranged from 15 to 40%. The sub-canopy layer was dominated by Black Tea Tree (<i>Melaleuca bracteata</i>), River Oak in and immediately adjacent to the channel, and juvenile canopy species. Other prevalent species included Yellowwood (<i>Terminalia oblongata</i>), taller Pegunny and Small-leaved Fig (<i>Ficus obliqua</i>). The sub-canopy layer had a median height of 14 m (range 10 to 16 m) and an average cover intercept of 10 to 30%. The shrub layer variously comprised Pegunny, Black Tea Tree, Sally Wattle, Sandpaper Fig (<i>Ficus opposita</i>), Yellowwood and Brigalow. Green Panic commonly dominated the groundcover layer. Other species included Buffel Grass, Indian Blue Grass, <i>Aristida personata</i> (no common name), Forest Bluegrass,</p>	<p>(<i>Lomandra longifolia</i>) and <i>Cyperus esculentus</i> were recorded from lower lying areas closer to the channel.</p> <p><u>Smoky Creek</u></p> <p>The RE 11.3.25 community associated with Smoky Creek was moderately intact with a relatively continuous distribution along both banks of Smoky Creek. However, the community has been cleared to the top of the high bank in places and the creek is heavily used by cattle. Sections show significant bank scouring, canopy dieback and evidence of over grazing. Mature, hollow-bearing trees were commonly recorded throughout this community. The ground cover on the banks and in the channel was heavily degraded with dense exotic grasses dominating. Parthenium weed (<i>*Parthenium hysterophorus</i>), a declared Category 3</p>	<p>and quaternary assessment sites. Recent high volume flow events had stripped some of the vegetative cover on much of the bank and low terraces, and in places flattened some shrubs.</p>	 <p>S6– looking east</p>  <p>S9 – looking south</p>

Regional Ecosystem	Species and Structural Composition	Condition	Location	Representative Photograph
	<p><i>Cyperus spp.</i> and Spiny-headed Mat-rush.</p>	<p>pest under the provisions of the Biosecurity Act, was scattered throughout the groundcover on both sides of the creek.</p>		 <p>S13 – looking east</p>  <p>S14 – looking north</p>



Regional Ecosystem	Species and Structural Composition	Condition	Location	Representative Photograph
<p><b>Remnant 11.5.3</b></p> <p>Poplar Box, +/- Silver-leaved Ironbark (<i>Eucalyptus melanophloia</i>), +/- Clarkson's Bloodwood woodland on Cainozoic sand plains and/or remnant surfaces (Poplar Box woodland).</p> <p>VM Act Status – Least concern</p> <p>Biodiversity status – No concern at Present</p> <p>EPBC Act status – <i>not applicable</i></p>	<p>This community typically supported a canopy layer dominated by Poplar Box with the occasional Narrow-leaved Red Ironbark and Clarkson's Bloodwood (primarily infiltrating from adjacent vegetation types). The canopy layer had a broad height range due to the absence of large, mature trees in some patches. Commonly the canopy had a median height of 17 m and canopy cover intercept ranging from 15 to 30%.</p> <p>The sub-canopy, where present, also primarily comprised Poplar Box. Other species included Narrow-leaved Red Ironbark and Ironwood. The sub-canopy layer had a median height of 12 m (range 9 to 14 m) and a cover intercept ranging from less than 5 to 40%. In some instances the sub-canopy was representative of the EDL.</p> <p>The shrub layer variously comprised Ironwood, Early Flowering Black Wattle (<i>Acacia leiocalyx</i> subsp. <i>leiocalyx</i>), Pegunny, Leichhardt Bean, Poplar Box, Sally Wattle, Quinine Bush (<i>Petalostigma pubescens</i>) and/or Cocaine Bush (<i>Erythroxylum australe</i> s. str.).</p> <p>The ground layer variously comprised Buffel Grass,</p>	<p>This community was moderately intact across the study area. However, felled trees along with old and new tracks associated with exploration and drilling have created a discontinuous canopy in many areas.</p> <p>Some large hollow-bearing Poplar Box trees were still present particularly in the less disturbed parts of the larger patch of this community.</p> <p>Native groundcover was present in less disturbed areas of the community. However, dense patches of exotic grasses were also prevalent.</p>	<p>This community occurred in four distinct patches. The largest patch was situated across the western central portion of the study area, a second moderate sized patch was situated north-east of the central portion of the study area, while the remaining two smaller patches were situated to the south-east and south of the central portion of study area (Figure 10).</p> <p>Assessment sites within this community included S1, S4 and S17 along with a number of tertiary and quaternary assessment sites.</p>	 <p>S1 – looking north</p>  <p>S4 – looking south (dry season)</p>



Regional Ecosystem	Species and Structural Composition	Condition	Location	Representative Photograph
	Wiregrasses ( <i>Aristida spp.</i> ), Golden Beard Grass, <i>Waltheria indica</i> (no common name), Red Natal Grass ( <i>Melinis repens</i> ) and Black Speargrass.			 <p>S17 – looking north</p>
<p><b>Remnant 11.5.8b</b></p> <p>Clarkson's Bloodwood, Queensland Peppermint (<i>Eucalyptus exserta</i>), Narrow-leaved Red Ironbark, Queensland Blue Gum, Poplar Gum (<i>Eucalyptus platyphylla</i>) woodland on Cainozoic sand plains and/or remnant surfaces (Narrow-leaved Red Ironbark-Queensland Blue Gum woodland).</p> <p>VM Act Status –</p>	<p>The canopy of this community primarily comprised Narrow-leaved Red Ironbark and Queensland Blue Gum. Other prevalent species encountered included Clarkson's Bloodwood and Poplar Box. Less frequently encountered species included Poplar Gum and Carbeen. The canopy layer height ranged from 13 to 20 m (median 17 m). The canopy cover intercept ranged from 10 to 15%.</p> <p>The low sub-canopy comprised Black Wattle (<i>Acacia julifera</i> subsp. <i>julifera</i>), Clarkson's Bloodwood, Silver Oak (<i>Grevillea parallela</i>) and Narrow-leaved Red Ironbark. The sub-canopy layer had a median height of 8 m (range 6 to 10 m) and a cover intercept ranging from less than 5 to 20%.</p> <p>The generally very sparse shrub</p>	<p>This community was relatively intact except towards the northern portion of the patch inside the mining lease.</p> <p>The community tended towards a grassy woodland to the east, while the shrub layer tended to thicken towards the ecotone with adjoining communities.</p> <p>Exotic grasses dominated the groundcover. Native grass and herb species occurred in patches but only formed a minor component of the groundcover.</p>	<p>This community was restricted to a small patch along the eastern boundary of the study area, north of Billy's Gully (Figure 10).</p> <p>Two assessment sites were located within this community; including S18 and T9.</p>	 <p>S18 – looking north</p>



Regional Ecosystem	Species and Structural Composition	Condition	Location	Representative Photograph
<p>Least concern</p> <p>Biodiversity status – No concern at present</p> <p>EPBC Act status – <i>not applicable</i></p>	<p>layer variously comprised Quinine Bush, Black Wattle and Yellow-barked Paperbark (<i>Melaleuca nervosa</i>).</p> <p>The groundcover composition primarily comprised Buffel Grass. Other species included Red Natal Grass, Wiregrasses, Indian Blue Grass, <i>Urochloa piligera</i> (no common name) and <i>Waltheria indica</i>.</p>			 <p>S18 – looking east</p>
<p><b>Remnant 11.5.9</b></p> <p>Narrow-leaved Red Ironbark and other <i>Eucalyptus</i> and <i>Corymbia</i> species woodland on Cainozoic sand plains and/or remnant surfaces (Narrow-leaved Red Ironbark woodland).</p> <p>VM Act Status – Least concern</p> <p>Biodiversity status – No concern at present</p> <p>EPBC Act status –</p>	<p>The canopy of this community comprised Narrow-leaved Red Ironbark with Clarkson's Bloodwood, Dallachy's Gum, Carbeen and/or Poplar Box also present. The canopy layer height ranged from 16 to 21 m (median 17 m). The canopy cover intercept ranged from 15 to 20%.</p> <p>The sub canopy, where present, comprised mid-mature canopy species and the occasional Crows Ash (<i>Flindersia australis</i>), Ironwood and Lancewood (<i>Acacia shirleyi</i>). Early flowering Black Wattle and Red Ash (<i>Alphitonia excelsa</i>) were locally abundant. The sub-canopy layer had a median height of 13 m (range 9 to 15 m) and a cover intercept ranging from 5 to 10%.</p>	<p>The canopy in this community tended to be moderately to highly fragmented. There is evidence of historic timber removal, as stags and fallen logs are prevalent. Some patches were bisected by fence lines and tracks.</p> <p>Buffel Grass and Red Natal Grass were prevalent throughout this community.</p>	<p>This community was recorded in three small patches in the eastern and central portions of the study area (Figure 10).</p> <p>Assessment sites within this community included S19 and S21 along with three tertiary sites.</p>	 <p>S19 – looking east</p>



Regional Ecosystem	Species and Structural Composition	Condition	Location	Representative Photograph
<p><i>not applicable</i></p>	<p>The shrub layer was generally sparse and variously comprised Quinine Bush, Black Wattle, Red Ash, Ironwood and juvenile canopy species. Less frequently encountered species included Early Flowering Black Wattle, Prickly Pine (<i>Bursaria incana</i>), Vine Tree (<i>Ventilago viminalis</i>), Whitewood and Cocaine Bush.</p> <p>The groundcover primarily comprised Buffel Grass, Wiregrasses, <i>Waltheria indica</i> and Red Natal Grass. Native species such as Black Speargrass, Kangaroo Grass and Barbwire Grass (<i>Cymbopogon refractus</i>) were more prominent in the southern patches.</p>			 <p>S21 – looking north</p>  <p>T10 – looking north (dry season)</p>







Regional Ecosystem	Species and Structural Composition	Condition	Location	Representative Photograph
<p><b>Remnant 11.5.12</b></p> <p>Clarkson's Bloodwood woodland and other <i>Corymbia</i> and <i>Eucalyptus</i> species on Cainozoic sand plains and/or remnant surfaces (Clarkson's Bloodwood woodland).</p> <p>VM Act Status – Least concern</p> <p>Biodiversity status – No concern at present</p> <p>EPBC Act status – <i>not applicable</i></p>	<p>The canopy layer was dominated by Clarkson's Bloodwood with Carbeen also prevalent. The occasional Poplar Box was also recorded. The height of the canopy ranged from 14 to 21 m (median of 17 m). The canopy had a cover intercept ranging from 15 to 30%.</p> <p>The sub-canopy was dominated by juvenile canopy species as well as Lancewood, Yellow-barked Paperbark and Early Flowering Black Wattle. The sub-canopy had a median height of 10 m (range 7 to 12 m) and a cover intercept of less than 5 to 15%.</p> <p>The sparse to mid-dense shrub layer variously comprised Yellow-barked Paperbark, Quinine Bush, Black Wattle, Red Ash, Prickly Pine, Early Flowering Back Wattle and juvenile canopy species.</p> <p>The groundcover mostly comprised Red Natal Grass and Buffel Grass. Golden Beard Grass, <i>Aristida spp.</i>, <i>Waltheria indica</i> and Shrubby Stylo (*<i>Stylosanthes scabra</i>) were also prevalent.</p>	<p>The community was moderately fragmented despite being a naturally sparse vegetation type. There was evidence of pulled timber in the form of stags, logs and stumps throughout much of the community. The shrub layer tended to thicken in places where the canopy was missing.</p> <p>Large trees and stags were present throughout the community with many supporting hollows.</p> <p>The groundcover was highly degraded throughout the community being largely dominated by exotic grasses and herbs.</p>	<p>This community was the dominant vegetation type in the study area and occurred as one large patch running through the centre of the study area (Figure 10).</p> <p>Assessment sites within this community included S2, S7, and S16 along with a number of tertiary and quaternary assessment.</p>	 <p>S2 – looking north</p>  <p>S16 – looking east</p>


Regional Ecosystem	Species and Structural Composition	Condition	Location	Representative Photograph
<p><b>Remnant 11.7.2</b></p> <p><i>Acacia</i> species woodland on Cainozoic lateritic duricrust. Scarp retreat zone (Lancewood woodland).</p> <p>VM Act Status – Least concern</p> <p>Biodiversity status – No concern at present</p> <p>EPBC Act status – <i>not applicable</i></p>	<p>The canopy layer primarily comprised Lancewood with emergent Clarkson’s Bloodwood and Carbeen scattered throughout. The height of the canopy ranged from 10 to 17 m (median of 14 m), with the occasional 19 m tree recorded. The canopy had a highly variable cover intercept that ranged from less than 5 to 60%.</p> <p>The sub-canopy, where present, was dominated by Lancewood with Red Ash and Bendee-bendee (<i>Acacia catenulata</i>) being less frequently recorded. The sub-canopy had a median height of 9 m (range (6 to 10 m) and a cover intercept of 40 to 60%.</p> <p>The tall shrub layer, where present, variously comprised Lancewood, Red Ash, Bendee-bendee and Bitter Bark (<i>Alstonia constricta</i>). Less frequently encountered species include Broad-leaved Wilga (<i>Geijera salicifolia</i>), Northern Sandalwood (<i>Santalum lanceolatum</i>) and Yellowwood. The low shrub-layer, where present, variously comprised Cocaine Bush, Soft Acalypha (<i>Acalypha eremorum</i>) and Bitter Bark.</p> <p>The groundcover variously comprised Hooky Grass (<i>Ancistrachne uncinulata</i>), Jericho</p>	<p>The community generally had a discontinuous and fragmented canopy. Even-aged cohorts of regrowth are the likely result of historic clearing and/or high frequency of fires. Historic clearing may also be responsible for the colonisation of areas by <i>Corymbia</i> spp. Fencing and tracks also lend to the fragmentation.</p> <p>The community supported moderate species richness particularly in the gully and scarp retreat zone in the northern extent of the community distribution. Vine thicket generalists tended to be prevalent at these locations.</p> <p>The ground cover composition was variable but generally dominated by native species. However, some of the gullies were heavily degraded by Green Panic. The underlying laterite</p>	<p>This community was recorded along the eastern boundary of the study area. The community was recorded in five patches, one large and four small relic patches (Figure 10). The community was associated with a minor lateritic rise.</p> <p>Assessment sites within this community included S15 and S20 as well as a number of tertiary and quaternary assessment.</p>	 <p>S15 – looking east (dry season)</p>  <p>T3 – looking east (dry season)</p>

Regional Ecosystem	Species and Structural Composition	Condition	Location	Representative Photograph
	<p>Wiregrass (<i>Aristida jerichoensis</i>) and <i>Calyptochloa gracillima</i> (no common name). Green Panic, Sabi Grass (<i>*Urochloa mosambicensis</i>) and Red Natal Grass were locally prevalent in places.</p>	<p>(scalds) was exposed at the surface in a number of areas and generally lacked vegetative cover.</p>		 <p>S20 – looking north</p>
<p><b>Remnant 11.8.5</b> Mountain Coolabah (<i>Eucalyptus orgadophila</i>) open woodland on Cainozoic igneous rocks (Mountain Coolabah woodland). VM Act Status – Least concern Biodiversity status – No concern at present EPBC Act status – <i>not applicable</i></p>	<p>The canopy layer comprised Mountain Coolabah with occasional taller Variable-barked Bloodwood (<i>Corymbia erythrophloia</i>) also present. The height of the canopy ranged from 12 to 15 m (median of 14 m). The canopy had a cover intercept ranging from 15 to 20%. The sparse tall shrub layer comprised canopy species, Red-flowered Bauhinia (<i>Lysiphyllum carronii</i>), Quinine Bush and Prickly Pine. The sparse low shrub layer variously comprised Cocaine Bush, Quinine Bush, Currant Bush (<i>Carissa ovata</i>), Northern Sandalwood, Native Gardenia (<i>Larsenaikia ochreatea</i>) and Yellowberry (<i>Denhamia cunninghamii</i>).</p>	<p>The community was moderately fragmented due to canopy dieback. The adjacent plains and low rises have been cleared and recently blade-ploughed. The ground cover was generally dominated by exotic grasses however native species were prevalent in patches.</p>	<p>This community was recorded towards the north eastern portion of the study area and was associated with a residual basalt rise (Figure 10). Improved pasture and some minor woody regrowth vegetation surrounded the community.  Three assessment sites were located within this community; including S3, S23 and Q10.</p>	 <p>S3 – looking west</p>

Regional Ecosystem	Species and Structural Composition	Condition	Location	Representative Photograph
	<p>Several small patches of vine thicket generalists were recorded in the south-western portion of the patch. These areas were considered representative of RE 11.8.5a but were too small to map (i.e. less than 1 ha). Common species included Soft Acalypha, Narrow-leaved Croton (<i>Croton phebaloides</i>), Small-leaved Ebony (<i>Diospyros humilis</i>), Yellowwood and Pegunny.</p> <p>The groundcover comprised Buffel Grass, Red Natal Grass, Indian Blue Grass, Black Speargrass, Wiregrasses and <i>Scleria mackaviensis</i> (no common name). Hooky Grass was common in the small patch of vine thicket generalists.</p>			 <p>S23 – looking south</p>  <p>Small patch of vine thicket at south-west end of spur</p>

Regional Ecosystem	Species and Structural Composition	Condition	Location	Representative Photograph
<p><b>Remnant 11.9.7a</b></p> <p>Poplar Box, False Sandalwood (<i>Eremophila mitchellii</i>) shrubby woodland on fine-grained sedimentary rocks (Poplar Box and Dawson River Gum woodland).</p> <p>VM Act Status – Of concern</p> <p>Biodiversity status – Of concern</p> <p>EPBC Act status – <i>not applicable</i></p>	<p>The canopy layer comprised Poplar Box with the occasional Dawson River Gum (<i>Eucalyptus cambageana</i>) also present. The height of the canopy ranged from 10 to 15 m (median of 13 m) and had a cover intercept of 15 to 30%.</p> <p>The sub-canopy layer comprised Poplar Box with Ironwood, Sally Wattle, Western Rosewood (<i>Alectryon oleifolius</i> subsp. <i>elongatus</i>) and Brigalow less frequently encountered. The sub-canopy layer had a median height of 7 m (range 5 to 9 m) and a cover intercept of 5 to 20%.</p> <p>A sparse shrub layer variously comprised Dead Finish (<i>Archidendropsis basaltica</i>), Scrub Boonaree (<i>Alectryon diversifolius</i>), Pegunny, Leichhardt Bean and Currant Bush.</p> <p>Buffel Grass dominated the groundcover with *<i>Sida</i> spp. and Melhania (<i>Melhania oblongifolia</i>) also prevalent.</p>	<p>The southern patch and north-eastern distribution of this community was moderately intact but tended towards even-age regrowth in the west.</p> <p>Exotic grasses primarily dominated the ground cover. However a variety of native herbs were also prevalent.</p>	<p>This community was limited to two patches in the north-east of the study area either side of Smoky Creek (Figure 10).</p> <p>Four assessment sites were located within this community; including S10, S22, T24 and Q25.</p>	 <p>S10 – looking east</p>  <p>S22 – looking north</p>

Regional Ecosystem	Species and Structural Composition	Condition	Location	Representative Photograph
<p><b>Non-remnant Vegetation</b></p>	<p>The distribution of non-remnant woody regrowth vegetation was limited within the study area. Most areas that were representative of non-remnant vegetation had been historically cleared, routinely mechanically maintained and/or pasture improved, primarily with Buffel Grass and Shrubby Stylo.</p> <p>Woody regrowth was commonly recorded in the vicinity of Smoky Creek and its tributaries. These patches comprised Brigalow regrowth, Poplar Box regrowth or mixed eucalypt scrubby regrowth. The gently undulated plains and low rises beyond these systems were, in places, also found to support scrubby Brigalow regrowth. The EDL of all of these patches fail to satisfy the criteria for remnant status as defined under the VM Act.</p> <p>A large patch of scrubby regrowth was identified in the eastern extent of the study area. This patch is currently mapped as remnant Poplar Box woodland and Lancewood open forest (90/10%). This patch would have historically supported Narrow-leaved Red Ironbark (RE 11.5.9) but instead comprised Quinine Bush, Prickly Pine, Red Ash, Black Wattle and Early-flowering Black Wattle. The shrub layer was representative of</p>	<p>The composition of these communities was quite variable due to the historic composition of the vegetation communities that would have subsisted prior to clearing. In general the groundcover layer within these patches was heavily degraded by exotic grasses, particularly Buffel Grass and/or Red Natal Grass.</p>	<p>These communities were commonly recorded in the vicinity of Smoky Creek and its tributaries as well as adjacent plains and low rises. A large patch of scrubby regrowth was also recorded in the eastern extent of the study area.</p>	 <p>S12 (Brigalow regrowth) – looking east</p>  <p>Q30 (scrubby Brigalow regrowth) – looking north</p>

Regional Ecosystem	Species and Structural Composition	Condition	Location	Representative Photograph
	the EDL and had a median height of 4 m and cover intercept ranging from 25 to 40%.			 <p>T11 (scrubby Quinine Bush and wattle regrowth)</p>

- 1 EPBC Act status is only relevant if the RE meets the EPBC Act condition thresholds and key diagnostic criteria for the relevant TEC (TEC status current as at July 2016).
- 2 Queensland REs are not individually listed under the EPBC Act, but may form part of a TEC listed under the EPBC Act.

## **Appendix L**

Flora species recorded during seasonal surveys  
of the project site



**Table L1: Flora field species list for the project site**

Family Name	Botanical Name	Common Name <sup>1</sup>	NC Act Status (Biosecurity Act Status) <sup>2</sup>	11.3.2 <sup>3</sup>	11.3.4 <sup>4</sup>	11.3.25	11.5.3	11.5.8b	11.5.9	11.5.12	11.7.2	11.8.5	11.9.7a	Extras
Cyperaceae	<i>Abildgaardia obovata</i>	<i>ncn</i>	LC			+(t)						+		
Malvaceae	<i>Abutilon malvifolium</i>	Mallow-flowered Lantern Flower	LC											1
Malvaceae	<i>Abutilon micropetalum</i>	Small-flowered Lantern Bush	LC									1	+	
Malvaceae	<i>Abutilon oxycarpum</i> var. <i>subsagittatum</i>	Lantern Bush	LC								2(t)		+	
Mimosaceae	<i>Acacia catenulata</i>	Bendee-bendee	LC								+2(t)			
Mimosaceae	<i>Acacia excelsa</i> subsp. <i>excelsa</i>	Ironwood	LC	1	2	1-3	2		1	2(t)	1		3	
Mimosaceae	<i>Acacia harpophylla</i>	Brigalow	LC		+(e)	++4(e,t)						+2(e,t)		
Mimosaceae	<i>Acacia julifera</i> subsp. <i>julifera</i>	Black Wattle	LC			+(t)	1	3-4	2	1-4				
Mimosaceae	<i>Acacia leiocalyx</i> subsp. <i>leiocalyx</i>	Early-flowering Black Wattle	LC							+-3				
Mimosaceae	<i>Acacia salicina</i>	Sally Wattle	LC	3-4	3-4	1-4	1-2					+(t)	2	
Mimosaceae	<i>Acacia shirleyi</i>	Lancewood	LC						2		4(-6)			
Euphorbiaceae	<i>Acalypha eremorum</i>	Soft Acalypha	LC			+-4				3(t)	+-5(t)	+-3(t)		
Asteraceae	<i>Acanthospermum hispidum</i>	Star Burr	*			+(t)								
Amaranthaceae	<i>Achyranthes aspera</i>	Chaff Flower	LC			+				+-1		+	1	
Asteraceae	<i>Ageratum conyzoides</i>	Billygoat Weed	*			+								
Sapindaceae	<i>Alectryon connatus</i>	Grey Bird's Eye	LC				+(c,t)			2(t)				
Sapindaceae	<i>Alectryon diversifolius</i>	Scrub Boonaree	LC			+-1	+(t)			3(t)		1-(3)	1	
Sapindaceae	<i>Alectryon</i>	Western	LC	1		+(t)						+	1	

Family Name	Botanical Name	Common Name <sup>1</sup>	NC Act Status (Biosecurity Act Status) <sup>2</sup>	11.3.2 <sup>3</sup>	11.3.4 <sup>4</sup>	11.3.25	11.5.3	11.5.8b	11.5.9	11.5.12	11.7.2	11.8.5	11.9.7a	Extras
	<i>oleifolius</i> subsp. <i>elongatus</i>	Rosewood												
Poaceae	<i>Alloteropsis cimicina</i>	Small Cockatoo Grass	LC	1						+	3-4			
Rhamnaceae	<i>Alphitonia excelsa</i>	Red Ash	LC			+	1		3-4	1-4	2	+		
Apocynaceae	<i>Alstonia constricta</i>	Bitterbark	LC				2			2	2			
Amaranthaceae	<i>Alternanthera denticulata</i>	Lesser Joyweed	LC			+								
Amaranthaceae	<i>Alternanthera nana</i>	(a) Joyweed	LC	+			1-2		+	+	1		2	
Amaranthaceae	<i>Amaranthus viridis</i>	Green Amaranth	LC									+(t)	1	
Lythraceae	<i>Ammannia multiflora</i>	Jerry-jerry	LC											
Loranthaceae	<i>Amyema congener</i> subsp. <i>congener</i>	Variable Mistletoe	LC											
Loranthaceae	<i>Amyema quandang</i> var. <i>bancroftii</i>	Grey Mistletoe	LC											
Poaceae	<i>Ancistrachne uncinulata</i>	Hooky Grass	LC							1(t)	1-5	+-2(t)	1	
Capparaceae	<i>Apophyllum anomalum</i>	Warrior Bush	LC											+
Mimosaceae	<i>Archidendropsis basaltica</i>	Dead Finish	LC			+-2	+-4		2-3	2(t)			+-2(t)	
Poaceae	<i>Aristida calycina</i> subsp. <i>calycina</i>	Dark Wiregrass	LC	1		+(t)	+-1	2	2	2	2	1-2	2	
Poaceae	<i>Aristida calycina</i> subsp. <i>praealta</i>	Dark Wiregrass	LC								1(t)			
Poaceae	<i>Aristida caput-medusae</i>	Many-headed Wiregrass	LC								3			
Poaceae	<i>Aristida gracillipes</i>	<i>ncn</i>	LC									1-3		
Poaceae	<i>Aristida holathera</i>	Erect Kerosene Grass	LC							+				
Poaceae	<i>Aristida hygrometrica</i>	Northern Kerosene Grass	LC				1(t)			+-4				
Poaceae	<i>Aristida</i>	Jericho	LC			1	1(-4t)	2-4	2	1-4	+-		2	

Family Name	Botanical Name	Common Name <sup>1</sup>	NC Act Status (Biosecurity Act Status) <sup>2</sup>	11.3.2 <sup>3</sup>	11.3.4 <sup>4</sup>	11.3.25	11.5.3	11.5.8b	11.5.9	11.5.12	11.7.2	11.8.5	11.9.7a	Extras
	<i>jerichoensis</i>	Wiregrass									1(c,t)			
Poaceae	<i>Aristida latifolia</i>	Kerosene Grass	LC	1		+(t)	2	1-3	3	2-3		+		
Poaceae	<i>Aristida leptopoda</i>	White Speargrass	LC	+		+ -1						2	+	
Poaceae	<i>Aristida personata</i>	<i>ncn</i>	LC			+ -3								
Poaceae	<i>Aristida pruinosa</i>	Gulf Feathertop Grass	LC										1	
Poaceae	<i>Aristida ramosa</i>	Purple Wiregrass	LC		+		+(t)							
Poaceae	<i>Astrebla elymoides</i>	Hoop Mitchell Grass	LC											+
Poaceae	<i>Astrebla squarrosa</i>	Bull Mitchell Grass	LC											
Sapindaceae	<i>Atalaya hemiglauca</i>	Whitewood	LC	1	2	+ -2	+(t)					1	2	
Euphorbiaceae	<i>Bertya pedicellata</i>	<i>ncn</i>	NT								1(t)			
Asteraceae	<i>Bidens bipinnata</i>	Cobbler's Pegs	*	1							+	+		
Nyctaginaceae	<i>Boerhavia burbidgeana</i>	(a) Tarvine	LC							+ -1	+	+	+	
Nyctaginaceae	<i>Boerhavia dominii</i>	Tarvine	LC				1(e,t)						1-2	
Convolvulaceae	<i>Bonamia media</i>	<i>ncn</i>	LC				1	+ -1	2	1-2(t)	2			
Poaceae	<i>Bothriochloa bladhii</i>	Forest Bluegrass	LC				+ -4					1		
Poaceae	<i>Bothriochloa decipiens</i> var. <i>decipiens</i>	Pitted Bluegrass	LC	1			+						+	
Poaceae	<i>Bothriochloa pertusa</i>	Indian Bluegrass	*	2	1	1-2	1	1-2		+		+ -3	+ -3(t)	
Poaceae	<i>Brachyachne convergens</i>	Native Couch	LC											+ -2(t)
Sterculiaceae	<i>Brachychiton australis</i>	Large-leaved Bottle Tree	LC				+				+(t)	+(t)	+	
Sterculiaceae	<i>Brachychiton rupestris</i>	Narrow-leaved Bottle Tree	LC				+(t)							
Phyllanthaceae	<i>Breynia</i>	Coffee Bush	LC				1-2	1	2	2	2	1(t)		

Family Name	Botanical Name	Common Name <sup>1</sup>	NC Act Status (Biosecurity Act Status) <sup>2</sup>	11.3.2 <sup>3</sup>	11.3.4 <sup>4</sup>	11.3.25	11.5.3	11.5.8b	11.5.9	11.5.12	11.7.2	11.8.5	11.9.7a	Extras
	<i>oblongifolia</i>													
Phyllanthaceae	<i>Bridelia leichhardtii</i>	Small-leaved Scrub Ironbark	LC				+			+(t)	+(t)			
Acanthaceae	<i>Brunoniella australis</i>	Blue Trumpet	LC	+		+-1						2		
Cyperaceae	<i>Bulbostylis barbata</i>	<i>ncn</i>	LC							1				
Pittosporaceae	<i>Bursaria incana</i>	Prickly Pine	LC						1	1-3		4		
Poaceae	<i>Calyptochloa gracillima</i>	<i>ncn</i>	LC								2-3			
Capparaceae	<i>Capparis canescens</i>	Wild Orange	LC								+(t)			
Capparaceae	<i>Capparis lasiantha</i>	Nipan	LC			1	+(t)				+	+		
Capparaceae	<i>Capparis loranthifolia</i>	Narrow-leaved Bumble Tree	LC										+	
Capparaceae	<i>Capparis mitchellii</i>	Wild Orange	LC										+	
Apocynaceae	<i>Carissa ovata</i>	Currant Bush	LC	2		1-3	+-2(t)		2	1		2-4	1-2	
Caesalpiniaceae	<i>Cassia brewsteri</i>	Leichardt Bean	LC	1	3	1-3	2		+		+	1	3	
Lauraceae	<i>Cassytha filiformis</i>	Dodder Laurel	LC							1(t)				
Casuarinaceae	<i>Casuarina cunninghamiana</i> var. <i>cunninghamiana</i>	River Oak	LC				1							
Fabaceae	<i>Chamaecrista absus</i>	<i>ncn</i>	LC			+-2	1	2	1	2	2	2		
Euphorbiaceae	<i>Chamaesyce dallachiana</i>	<i>ncn</i>	LC				+			+	+-2	1		
Euphorbiaceae	<i>Chamaesyce drummondii</i>	Caustic Weed	LC			+-2					+		1	
Adiantaceae	<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>	Mulga Fern	LC						+		1(t)			
Chenopodiaceae	<i>Chenopodium carinatum</i>	Green Crumbweed	LC							+	2		+	
Poaceae	<i>Chloris ventricosa</i>	Tall Chloris	LC				+(t)							
Asteraceae	<i>Chrysocephalum</i>	Golden	LC			1	1	2	1	1				

Family Name	Botanical Name	Common Name <sup>1</sup>	NC Act Status (Biosecurity Act Status) <sup>2</sup>	11.3.2 <sup>3</sup>	11.3.4 <sup>4</sup>	11.3.25	11.5.3	11.5.8b	11.5.9	11.5.12	11.7.2	11.8.5	11.9.7a	Extras
	<i>apiculatum</i>	Yellow Buttons												
Poaceae	<i>Chrysopogon fallax</i>	Golden Beard Grass	LC	1		+ -3	2-3		2-5	2-3	+ -3		1	
Rutaceae	<i>Citrus glauca</i>	Desert Lime	LC			+ -3(e,t)								
Vitaceae	<i>Clematocissus opaca</i>	Forest Grape	LC				+ (t)			1(t)	1(t)	+ (t)		
Cleomaceae	<i>Cleome viscosa</i>	Sticky Cleome	LC						1	+ -2		2		
Lamiaceae	<i>Clerodendron floribundum</i>	Lolly Bush	LC			2				1				
Lamiaceae	<i>Clerodendron tomentosum</i>	Lolly Bush	LC			+						1		
Fabaceae	<i>Clitoria ternatea</i>	Butterfly Pea	*			+ (t)	+							
Commelinaceae	<i>Commelina cyanea</i>	<i>ncn</i>	LC			1-2	+				1	2	2	
Convolvulaceae	<i>Convolvulus</i> sp. (n-r)	<i>ncn</i>	LC				+ (t)				+			
Sparrmanniaceae	<i>Corchorus</i> sp. (n-r)	<i>ncn</i>	LC								1(c,t)			
Sparrmanniaceae	<i>Corchorus trilocularis</i>	Native Jute	LC				+							
Myrtaceae	<i>Corymbia clarksoniana</i>	Long-fruited Bloodwood	LC				+ -4		2	3	5	1		
Myrtaceae	<i>Corymbia dallachiana</i>	Dallachy's Gum	LC				+ -4		2-3	3-4				
Myrtaceae	<i>Corymbia erythrophloia</i>	Variable-barked Bloodwood	LC									2		
Myrtaceae	<i>Corymbia tessellaris</i>	Carbeen	LC	2	3	1-3					3-4	1		
Amaryllidaceae	<i>Crinum flaccidum</i>	River Lily	LC				1							
Fabaceae	<i>Crotalaria incana</i>	Woolly Rattlepod	LC				+			+				
Fabaceae	<i>Crotalaria medicaginea</i>	Tre-foil Rattlepod	LC				+	1	2	1	1-2			
Fabaceae	<i>Crotalaria montana</i>	<i>ncn</i>	LC					1						
Fabaceae	<i>Crotalaria novae-hollandiae</i>	New Holland Rattlepod	LC				+				+ -2			

Family Name	Botanical Name	Common Name <sup>1</sup>	NC Act Status (Biosecurity Act Status) <sup>2</sup>	11.3.2 <sup>3</sup>	11.3.4 <sup>4</sup>	11.3.25	11.5.3	11.5.8b	11.5.9	11.5.12	11.7.2	11.8.5	11.9.7a	Extras
Euphorbiaceae	<i>Croton insularis</i>	Silver Croton	LC			+				1(t)	2(t)			
Euphorbiaceae	<i>Croton pheballoides</i>	Narrow-leaved Croton	LC									+-3(t)		
Apocynaceae	<i>Cryptostegia grandiflora</i>	Rubber Vine	* (C3)			+-1(t)								
Cucurbitaceae	<i>Cucumis anguria</i>	West Indian Gherkin	*			+-1(t)								
Cucurbitaceae	<i>Cucumis melo</i> subsp. <i>agrestis</i>	Native Cucumber	LC			+								
Asteraceae	<i>Cyanthillium cinereum</i>	Vernonia	*			+-2						1		
Asteraceae	<i>Cyclophyllum coprosmoides</i>	Coastal Canthium	LC						1					
Orchidaceae	<i>Cymbidium canaliculatum</i>	Black Orchid	LC			+-1(t)					+(t)	+		
Poaceae	<i>Cymbopogon refractus</i>	Barbed Wire Grass	LC				+(t)				+(e,c,t)	+-2	1	
Poaceae	<i>Cynodon dactylon</i>	Green Couch	LC			+								
Cyperaceae	<i>Cyperus esculentus</i>	<i>ncn</i>	LC			1-2(c,t)							+	
Cyperaceae	<i>Cyperus fulvus</i>	<i>ncn</i>	LC			1(t)	+-1(t)							
Cyperaceae	<i>Cyperus gracilis</i>	Whisker Grass	LC			1-3(t)				1(t)			+	
Cyperaceae	<i>Cyperus holoschoenus</i>	<i>ncn</i>	LC				1-2	+						
Cyperaceae	<i>Cyperus pygmaeus</i>	<i>ncn</i>	LC							1(c,t)				
Cyperaceae	<i>Cyperus rotundus</i>	Nutgrass	*			+-3(c,t)								
Cyperaceae	<i>Cyperus sp.</i>	<i>ncn</i>	LC				+				+			
Poaceae	<i>Dactyloctenium radulans</i>	Button Grass	LC			+	+				+-2			
Solanaceae	<i>Datura stramonium</i>	Common Thorn Apple	*											1
Celastraceae	<i>Denhamia cunninghamii</i>	Yellowberry	LC				1		1	2-3(t)		2		
Celastraceae	<i>Denhamia oleaster</i>	Stiff Denhamia	LC				++e(t)						1	
Fabaceae	<i>Desmodium brachypodium</i>	<i>ncn</i>	LC			+					1(t)		1	

Family Name	Botanical Name	Common Name <sup>1</sup>	NC Act Status (Biosecurity Act Status) <sup>2</sup>	11.3.2 <sup>3</sup>	11.3.4 <sup>4</sup>	11.3.25	11.5.3	11.5.8b	11.5.9	11.5.12	11.7.2	11.8.5	11.9.7a	Extras
Fabaceae	<i>Desmodium filiforme</i>	ncn	LC											1
Fabaceae	<i>Desmodium macrocarpum</i>	Large-fruited Tre-foil	LC								+(e,t)			
Fabaceae	<i>Desmodium varians</i>	Slender Tick-trefoil	LC			1(t)								+
Hemerocallidaceae	<i>Dianella caerulea</i>	Blueberry Flax Lily	LC									+(t)		
Poaceae	<i>Dichanthium aristatum</i>	Angleton Grass	*			+ -2								
Poaceae	<i>Dichanthium fecundum</i>	ncn	LC			+ -3								
Poaceae	<i>Dichanthium sericeum</i> subsp. <i>sericeum</i>	Queensland Bluegrass	LC											+(t)
Poaceae	<i>Digitaria ammophila</i>	Silky Umbrella Grass	LC				1	2	2	1-2				
Poaceae	<i>Digitaria brownii</i>	Cotton Panic Grass	LC							+-1	2		1	
Ebenaceae	<i>Diospyros humilis</i>	Small-leaved Ebony	LC			+ -2	+(t)			2(t)	1(t)	1-(3)		
Acanthaceae	<i>Dipteracanthus australasicus</i> subsp. <i>corynothecus</i>	ncn	LC											+
Sapindaceae	<i>Dodonaea stenophylla</i>	Yellow Hopbush	LC									+		
Poaceae	<i>Echinochloa colona</i>	Awnless Barnyard Grass	*			+(t)								
Boraginaceae	<i>Ehretia membranifolia</i>	Peach Bush	LC			+ -3	+ -1(t)	+	+(t)	1	1(t)	1-(2)	2	
Chenopodiaceae	<i>Einadia polygonoides</i>	Climbing Saltbush	LC											+
Celastraceae	<i>Elaeodendron australe</i> var. <i>integrifolium</i>	Narrow-leaved Red Olive Plum	LC			+(c,t)				1(t)				
Asteraceae	<i>Emilia sonchifolia</i>	Emilia	*			+								
Chenopodiaceae	<i>Enchylaena tomentosa</i>	Ruby Saltbush	LC											1

Family Name	Botanical Name	Common Name <sup>1</sup>	NC Act Status (Biosecurity Act Status) <sup>2</sup>	11.3.2 <sup>3</sup>	11.3.4 <sup>4</sup>	11.3.25	11.5.3	11.5.8b	11.5.9	11.5.12	11.7.2	11.8.5	11.9.7a	Extras
Poaceae	<i>Enneapogon gracilis</i>	Slender Nine-awn	LC				+(t)					2		
Poaceae	<i>Enneapogon lindleyanus</i>	Cone-top Nineawn	LC				1(t)		1(t)				1	
Poaceae	<i>Enneapogon polyphyllus</i>	Leafy Nine-awn	LC							+		+-1		
Poaceae	<i>Enneapogon virens</i>	(a) Nine-awn	LC						+	1(t)		1		
Poaceae	<i>Enteropogon acicularis</i>	Twirly Windmill Grass	LC	+										
Poaceae	<i>Enteropogon ramosus</i>	Curly Windmill Grass	LC			1	+(t)							
Poaceae	<i>Eragrostis lacunaria</i>	Purple Lovegrass	LC								2			
Poaceae	<i>Eragrostis pubescens</i>	<i>ncn</i>	LC						+					
Poaceae	<i>Eragrostis sororia</i>	<i>ncn</i>	LC						+					
Poaceae	<i>Eragrostis speciosa</i>	<i>ncn</i>	LC						+					
Poaceae	<i>Eremochloa bimaculata</i>	Poverty Grass	LC				1(t)							
Myoporaceae	<i>Eremophila mitchellii</i>	False Sandalwood	LC				+(t)			1(t)		1(e,t)		
Poaceae	<i>Eriachne mucronata</i>	Wanderrie Grass	LC						1					
Poaceae	<i>Eriochloa crebra</i>	Early Spring Grass	LC											+(t)
Erythroxylaceae	<i>Erythroxylum australe</i>	Cocaine Bush	LC			1	+(t)		2-3	3-4	3	2		
Myrtaceae	<i>Eucalyptus camaldulensis</i> var. <i>obtusata</i>	River Red Gum	LC			1-5								
Myrtaceae	<i>Eucalyptus crebra</i>	Narrow-leaved Red Ironbark	LC			+-4	2(e)	4-5	4-5		(1)			
Myrtaceae	<i>Eucalyptus orgadophila</i>	Mountain Coolabah	LC									5-6		
Myrtaceae	<i>Eucalyptus platyphylla</i>	Poplar Gum	LC					2						



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Myrtaceae	<i>Eucalyptus populnea</i>	Poplar Box	LC	6		+ -3	6	1		1(e,t)			6	
Myrtaceae	<i>Eucalyptus tereticornis</i> subsp. <i>tereticornis</i>	Queensland Blue Gum	LC			+ -5		3-4						
Poaceae	<i>Eulalia aurea</i>	Silky Browntop	LC			+ -2								
Euphorbiaceae	<i>Euphorbia tannensis</i> subsp. <i>deserti</i>	Desert Spurge	LC				+		+ -1	+		1	+	
Laxmanniaceae	<i>Eustrephus latifolius</i>	Wombat Berry	LC			1-2	+(t)			1(t)		+ -2		
Rubiaceae	<i>Everistia vacciniifolia</i> var. <i>nervosa</i>	Small-leaved Canthium	LC											1
Rubiaceae	<i>Everistia vacciniifolia</i> var. <i>vaccinifolia</i>	Small-leaved Canthium	LC								2(t)			
Convolvulaceae	<i>Evolvulus alsinoides</i>	Dwarf Morning Glory	LC							1	1	+ -1	1	2
Santalaceae	<i>Exocarpos latifolius</i>	Broad-leaved Cherry	LC							1(t)				
Moraceae	<i>Ficus obliqua</i>	Small-leaved Fig	LC				+							
Moraceae	<i>Ficus opposita</i>	Sandpaper Fig	LC				+ -4							
Cyperaceae	<i>Fimbristylis bisumbellata</i>	<i>ncn</i>	LC				1			1				
Cyperaceae	<i>Fimbristylis dichotoma</i>	<i>ncn</i>	LC				2		2	1-2	+			
Cyperaceae	<i>Fimbristylis</i> sp.	<i>ncn</i>	LC							1				
Rutaceae	<i>Flindersia australis</i>	Crow's Ash	LC						1	2(t)	1(t)			
Rutaceae	<i>Flindersia dissosperma</i>	Scrub Leopardwood	LC											1
Fabaceae	<i>Galactia tenuiflora</i>	<i>ncn</i>	LC				+	1	+	1	1	+	2	2
Rutaceae	<i>Geijera parvifolia</i>	Wilga	LC				+					+(t)		
Rutaceae	<i>Geijera salicifolia</i>	Broad-leaved Wilga	LC								2(t)			
Fabaceae	<i>Glycine falcata</i>	<i>ncn</i>	LC											+

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Fabaceae	<i>Glycine tabacina</i>	Glycine Pea	LC				+-2	+				1		
Fabaceae	<i>Glycine tomentella</i>	Woolly Glycine	LC				+-2		2					
Goodeniaceae	<i>Goodenia glabra</i>	ncn	LC							2				
Goodeniaceae	<i>Goodenia gracilis</i>	ncn	LC											1
Proteaceae	<i>Grevillea parallela</i>	Silver Oak	LC						+(t)					
Tiliaceae	<i>Grewia latifolia</i>	Dysentery Bush	LC				+-3	1-2	2	1-2	2	+(t)	1	1
Cactaceae	<i>Harrisia martinii</i>	Harrisia Cactus	* (C3)				+-1				+(t)	1	1	
Boraginaceae	<i>Heliotropium</i> sp. (n-r)	ncn	LC						+	+				
Poaceae	<i>Heteropogon contortus</i>	Black Speargrass	LC				+	+(t)		+	+		3-4	2
Poaceae	<i>Heteropogon triticeus</i>	Giant Speargrass	LC				+-2		+		+			
Malvaceae	<i>Hibiscus meraukensis</i>	Merauke Hibiscus	LC											+
Malvaceae	<i>Hibiscus sturti</i> var. <i>sturti</i>	Hill's Hibiscus	LC					+(t)		1		2		
Malvaceae	<i>Hibiscus verdcourtii</i>	Bladder Ketmia	LC											1
Poaceae	<i>Holcolemma dispar</i>	ncn	LC				+-3							
Fabaceae	<i>Hovea longipes</i>	Scrub Hovea	LC											
Fabaceae	<i>Hovea tholiformis</i>	ncn	LC				+-3			1	1	+ 2(c,t)	2-3(t)	
Violaceae	<i>Hybanthus enneaspermus</i>	Purple Spade Flower	LC				+-2	+	1	2	2	2(t)	2	1
Violaceae	<i>Hybanthus stellarioides</i>	Spade Flower	LC							2		2		
Fabaceae	<i>Indigofera colutea</i>	ncn	LC					1	2	1	+-2			+
Fabaceae	<i>Indigofera linifolia</i>	ncn	LC				+-2(t)						+(t)	
Fabaceae	<i>Indigofera linnaei</i>	ncn	LC	+			+							
Colchicaceae	<i>Iphigenia indica</i>	Grass Lily	LC						+	1				
Fabaceae	<i>Ipomoea plebeia</i>	Bell Vine	LC				1-2					+	+	
Poaceae	<i>Iseilema vaginiflorum</i>	Red Flinders Grass	LC											1
Convolvulaceae	<i>Jacquemontia paniculata</i>	ncn	LC						+(t)				+(t)	

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Oleaceae	<i>Jasminum didymum</i> subsp. <i>racemosum</i>	Native Jasmine	LC				+-2		+			1(t)	+	
Oleaceae	<i>Jasminum lineare</i>	Desert Jasmine	LC								+(t)			
Euphorbiaceae	<i>Jatropha gossypifolia</i>	Bellyache Bush	* (C3)				+-1							
Rubiaceae	<i>Larsenaikia ochreatea</i>	Native Gardenia	LC								+(-2t)	1	2	
Poaceae	<i>Leptochloa digitata</i>	Umbrella Canegrass	LC				+-1							
Laxmanniaceae	<i>Lomandra confertifolia</i> subsp. <i>pallida</i>	<i>ncn</i>	LC				+							
Laxmanniaceae	<i>Lomandra leucocephala</i>	Woolly-headed Mat Rush	LC								+			
Laxmanniaceae	<i>Lomandra longifolia</i>	Spiny-headed Mat Rush	LC				+-2				+			
Laxmanniaceae	<i>Lomandra multiflora</i>	Many-flowered Mat Rush	LC							+				
Laxmanniaceae	<i>Lomandra</i> sp. (n-r)	<i>ncn</i>	LC				+					+		
Loranthaceae	<i>Lysiana exocarpi</i>	Harlequin Mistletoe	LC											1
Caesalpinaceae	<i>Lysiphyllum carronii</i>	Red-flowered Bauhinia	LC				1(e,t)							
Caesalpinaceae	<i>Lysiphyllum hookeri</i>	Pegunny	LC		4-5	2-5	+(e,t)				+(-2t)	3-4	3-4	
Fabaceae	<i>Macroptilium atropurpureum</i>	Siratro	*				+-2							
Fabaceae	<i>Macroptilium lathyroides</i>	Phasey Bean	*				+-2							
Chenopodiaceae	<i>Maireana microphylla</i>	Blue Saltbush	LC											+
Malvaceae	<i>Malvastrum americanum</i>	Spiked Malvastrum	*				+-2							
Malvaceae	<i>Malvastrum coromandelianum</i>	False Mallow	*				1-2							

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Apocynaceae	<i>Marsdenia australis</i>	Native Pear	LC								2(t)	+		
Apocynaceae	<i>Marsdenia microlepis</i>	<i>ncn</i>	LC								1			
Apocynaceae	<i>Marsdenia pleiadenia</i>	Downy Milk Vine	LC							+(t)				
Apocynaceae	<i>Marsdenia viridiflora</i>	Native Pear	LC							+(t)	+	+(t)		
Poaceae	<i>Megathyrsus maximus</i> var. <i>pubiglumis</i>	Green Panic	*		4-5	3-5	1		1		1-5	2(t)	1	
Myrtaceae	<i>Melaleuca bracteata</i>	Black Tea Tree	LC			3-6								
Myrtaceae	<i>Melaleuca nervosa</i>	Yellow-barked Paperbark	LC						+ -2(t)		2(t)			
Malvaceae	<i>Melhania oblongifolia</i>	Melhania	LC			+ -1(t)	2		1-2	1		+	2-3	
Meliaceae	<i>Melia azedarach</i>	White Cedar	LC			+								
Poaceae	<i>Melinis repens</i>	Red Natal Grass	*			+ -2	1(-4t)	2-3	2-4	2-5	2-4	3-4		
Commelinaceae	<i>Murdannia graminea</i>	Slug Herb	LC				1(t)		+					
Rutaceae	<i>Murraya ovalifolia</i>	Native Mock Orange	LC							+(t)	1(t)			
Myoporaceae	<i>Myoporum acuminatum</i>	Boobialla	LC			+ -1			+					
Myoporaceae	<i>Myoporum debile</i>	Winter Apple	LC									+(t)		
Fabaceae	<i>Neptunia gracilis</i>	Native Sensitive Plant	LC				+(t)							
Fabaceae	<i>Neptunia monosperma</i>	<i>ncn</i>	LC											+
Oleaceae	<i>Notelaea microcarpa</i>	Small-fruited Mock Olive	LC			+ -2						+		
Amaranthaceae	<i>Nyssanthes erecta</i>	<i>ncn</i>	LC											1
Cactaceae	<i>Opuntia aurantiaca</i>	Tiger Pear	*(C3)										+	
Cactaceae	<i>Opuntia stricta</i>	Common Prickly Pear	*(C3)				+(t)							

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Cactaceae	<i>Opuntia tomentosa</i>	Velvety Tree Pear	*(C3)			+-1	+(t)		+	+(t)	1	1		
Meliaceae	<i>Owenia acidula</i>	Emu Apple	LC			+	1(t)							
Oxalidaceae	<i>Oxalis perennans</i>	<i>ncn</i>	LC								+			
Bignoniaceae	<i>Pandorea pandorana</i>	Wonga Vine	LC			+						+(t)		
Poaceae	<i>Panicum buncei</i>	<i>ncn</i>	LC						1	2				
Poaceae	<i>Panicum effusum</i>	Hairy Panic	LC			+(t)	+(t)			+				
Apocynaceae	<i>Parsonsia lanceolata</i>	Rough Silkpod	LC			+-2	1(t)		+		1(t)	1(t)		
Asteraceae	<i>Parthenium hysterophorus</i>	Parthenium Weed	*(C3)			+-3					+(t)	+		
Poaceae	<i>Paspalidium caespitosum</i>	Brigalow Grass	LC											+-2
Poaceae	<i>Paspalidium constrictum</i>	<i>ncn</i>	LC				1(t)				1		+	
Poaceae	<i>Paspalidium globoideum</i>	Sago Grass	LC											+-2(t)
Poaceae	<i>Pennisetum ciliare</i>	Buffel Grass	*		3-4	1-5	5-6	5	4-5	4-5	+-4(t)	3-5	5	
Poaceae	<i>Perotis rara</i>	Comet Grass	LC				1	1		2(t)				
Proteaceae	<i>Persoonia falcata</i>	Wild Pear	LC				+							
Picrodendraceae	<i>Petalostigma pubescens</i>	Quinine Bush	LC				1	4-5	4-5	4-5	+-2(t)	4		
Phyllanthaceae	<i>Phyllanthus maderaspatensis</i>	<i>ncn</i>	LC			+-1						2		
Phyllanthaceae	<i>Phyllanthus</i> sp. (n-r)	<i>ncn</i>	LC			+-2(t)	1	2	+-1	+-2		2		
Phyllanthaceae	<i>Phyllanthus virgatus</i>	<i>ncn</i>	LC			+-2(t)	+-1(t)			2	1(t)			
Pittosporaceae	<i>Pittosporum angustifolia</i>	Weeping Pittosporum	LC											+
Pittosporaceae	<i>Pittosporum spinescens</i>	Wallaby Apple	LC									2-3		
Anacardiaceae	<i>Pleiogynium timorense</i>	Burdekin Plum	LC			+(t)			2	+(t)		1		
Plumbaginaceae	<i>Plumbago zeylanica</i>	<i>ncn</i>	LC											
Caryophyllaceae	<i>Polycarpaea corymbosa</i>	<i>ncn</i>	LC											
Polygalaceae	<i>Polygala</i>	<i>ncn</i>	LC				1	+	+	1				

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	<i>linearifolia</i>													
Convolvulaceae	<i>Polymeria ambigua</i>	<i>ncn</i>	LC			+ -2								
Convolvulaceae	<i>Polymeria longifolia</i>	Peak Downs Curse	LC			+ -2	2	2	1	2				
Portulacaceae	<i>Portulaca bicolor</i>	<i>ncn</i>	LC						+	+ -1				
Portulacaceae	<i>Portulaca filifolia</i>	Native Pigweed	LC				1-2	+	2	1	1	1	1	
Portulacaceae	<i>Portulaca oleracea</i>	Pigweed	*			+	+				+	1	1	
Campanulaceae	<i>Pratia concolor</i>	<i>ncn</i>	LC			+ -2								
Acanthaceae	<i>Pseuderanthemum tenellum</i>	<i>ncn</i>	LC								+ -2		2	
Rubiaceae	<i>Psydrax attenuatum</i>	Narrow-leaved Canthium	LC				+			+				
Rubiaceae	<i>Psydrax johnsonii</i>	Brigalow Canthium	LC							+ (-2t)				
Rubiaceae	<i>Psydrax odoratum</i> forma. <i>buxifolium</i>	Stiff Canthium	LC								+			
Rubiaceae	<i>Psydrax oleifolium</i>	Myrtle Tree	LC											
Fabaceae	<i>Rhynchosia minima</i> var. <i>australis</i>	Rhyncho	LC			1-2	+(t)					1	2	
Acanthaceae	<i>Rostellularia adscendens</i>	Pink Tongues	LC			+ -1(t)	1					1-2		
Chenopodiaceae	<i>Salsola kali</i>	Soft Roly Poly	LC								+(t)		+	
Santalaceae	<i>Santalum lanceolatum</i>	Northern Sandalwood	LC			+				+ (-2t)	+(t)	2		
Apocynaceae	<i>Sarcostemma viminalis</i> subsp. <i>brunonianum</i>	Caustic Vine	LC								+(t)			
Goodeniaceae	<i>Scaevola spinescens</i>	Prickly Fan Flower	LC											
Poaceae	<i>Schizachyrium fragile</i>	Fire Grass	LC							+				
Cyperaceae	<i>Scleria mackaviensis</i>	<i>ncn</i>	LC			+						2		
Chenopodiaceae	<i>Sclerolaena tricuspis</i>	<i>ncn</i>	LC			+								

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Scrophulariaceae	<i>Scoparia dulcis</i>	Scoparia	*			+ -2(t)	1-3							
Caesalpiniaceae	<i>Senna artemisioides</i> subsp. <i>coriacea</i>	<i>ncn</i>	LC											+
Caesalpiniaceae	<i>Senna corallinoides</i>	Brigalow Senna	LC			+(t)								
Fabaceae	<i>Sesbania cannabina</i>	Sesbania Pea	LC			+								
Poaceae	<i>Setaria surgens</i>	(a) Pigeon Grass	LC				1	2	2	2-3	1(t)			
Malvaceae	<i>Sida cordifolia</i>	Flannel Weed	LC			+ -2	2							
Malvaceae	<i>Sida corrugata</i>	Corrugated Sida	LC											1
Malvaceae	<i>Sida cunninghamii</i>	<i>ncn</i>	LC											
Malvaceae	<i>Sida fibulifera</i>	<i>ncn</i>	LC								2			
Malvaceae	<i>Sida rhombifolia</i>	Paddy's Lucerne	*			+ -2								
Malvaceae	<i>Sida rohlenae</i>	<i>ncn</i>	LC			+ -1(t)	+ -2	+	2	2	1(t)		2	
Malvaceae	<i>Sida sp. (n-r)</i>	<i>ncn</i>	LC						+		+(t)			
Malvaceae	<i>Sida spinosa</i>	Spiny Sida	*			+								
Malvaceae	<i>Sida subspicata</i>	Shrub Sida	LC			1	+							
Solanaceae	<i>Solanum esuriale</i>	Quena	LC											1(t)
Solanaceae	<i>Solanum parvifolium</i>	<i>ncn</i>	LC			1(c,t)								
Rubiaceae	<i>Spermacoce brachystema</i>	<i>ncn</i>	LC			1			+ -2	1		1		
Poaceae	<i>Sporobolus creber</i>	Slender Rat's Tail Grass	LC											+
Verbenaceae	<i>Stachytarpheta jamaicensis</i>	Snakeweed	*			+ -1(c,t)								
Fabaceae	<i>Stylosanthes scabra</i>	Shrubby Stylo	*			2-6	2	2	1	2	1	2	2	
Fabaceae	<i>Tephrosia sp. (n-r)</i>	<i>ncn</i>	LC			+ -2(c,t)						2		
Combretaceae	<i>Terminalia oblongata</i>	Yellowwood	LC			1-3						2(e,t)		
Poaceae	<i>Themeda avenacea</i>	Native Oatgrass	LC			1-3								
Poaceae	<i>Themeda triandra</i>	Kangaroo Grass	LC			1-2						2		

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Poaceae	<i>Thyridolepis xerophila</i>	ncn	LC								3			
Menispermaceae	<i>Tinospora smilacina</i>	Snake Vine	LC								+(t)	+(t)		
Poaceae	<i>Tragus australianus</i>	Burr Grass	LC			+(e,t)								
Aizoaceae	<i>Trianthema portulacastrum</i>	Black Pigweed	*			+							2	
Aizoaceae	<i>Trianthema triquetra</i>	Red Spinach	LC										1	
Zygophyllaceae	<i>Tribulopsis angustifolia</i>	ncn	LC				1	2	+ -2	+ -1				
Zygophyllaceae	<i>Tribulus micrococcus</i>	ncn	LC											1
Jonhsoniaceae	<i>Tricoryne elatior</i>	ncn	LC						2					
Poaceae	<i>Tripogon loliiformis</i>	Five Minute Grass	LC				2		1					
Poaceae	<i>Urochloa mosambicensis</i>	Sabi Grass	*			1-2	1(t)				1		+	
Poaceae	<i>Urochloa panicoides</i>	ncn	*											+
Poaceae	<i>Urochloa piligera</i>	ncn	LC				2	2	2	2-3	+ -2	1		
Poaceae	<i>Urochloa subquadripara</i>	ncn	*											1
Mimosaceae	<i>Vachellia farnesiana</i>	Prickly Acacia	*			+ -1								
Rhamnaceae	<i>Ventilago viminalis</i>	Vine Tree	LC				+(t)					+(t)	1	
Fabaceae	<i>Vigna lanceolata</i>	ncn	LC			+ -2	+							
Asteraceae	<i>Vittadinia pustulata</i>	ncn	LC			+ -1(t)								
Asteraceae	<i>Vittadinia sulcata</i>	ncn	LC			+						+		
Campanulaceae	<i>Wahlenbergia queenslandica</i>	ncn	LC			+								
Campanulaceae	<i>Wahlenbergia stricta</i>	ncn	LC			+(c,t)								
Tiliaceae	<i>Waltheria indica</i>	ncn	LC			+ -2	2	2	2	2-3	1	+		
Asteraceae	<i>Wedelia spilantheidoides</i>	ncn	LC			1(t)	+(t)							
Asteraceae	<i>Xanthium pungens</i>	Noogera burr	*			+								



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Fabaceae	<i>Zornia dyctiocarpa</i>	<i>ncn</i>	LC							+(t)				
Fabaceae	<i>Zornia muriculata</i>	<i>ncn</i>	LC			+(t)			+ -2	1				

1. *ncn* denotes no common name
  2. NC Act Status indicates the Queensland conservation status of each taxon under the NC Regulation: Least concern (LC), Near Threatened (NT), Naturalized Exotic (\*).  
[No species that are listed under the EPBC Act were recorded in the Study Area]  
Biosecurity Act Status indicates the Queensland restricted status of some taxon under the Biosecurity Act: Category 3 (C3)
  3. A detailed species was not undertaken in the single locations of these two REs due to the small size and poor condition of the patches
  - # Relative abundance species was based on the Braun-Blanquet technique cover-abundance scale (Hurst and Allen 2007, Whittaker 1975, Mueller-Dombois 1974) as follows:
    - + = one or two individuals only
    - 1 = sparse, <5%;
    - 2 = any number, <5%;
    - 3 = 5 – 24%;
    - 4 = 25 – 49%;
    - 5 = 50 – 74%;
    - 6 = 75 – 100%.
- [**Note:** the relative abundance may be annotated with a "(d)", "(t)" or "(w)". This indicates that the species was recorded:
- (e) - at edge of community
  - (ch) - in channel
  - (t) - during a traverse within the same RE
  - (w) - in a wetland (note: small depression on high flow terrace on Smoky Creek)

## **Appendix M**

Fauna species recorded during seasonal surveys  
of the project site

**Table M1: Fauna field species list - trap sites and infrared camera sites (excluding bats)**

Common Name	Scientific Name	Status		Incidental	Trap Sites								Creek	Dam	Infrared Camera Sites				
		NC Act (Biosecurity Act) <sup>1</sup>	EPBC Act <sup>2</sup>		T1	T2	T3	T4	T5	T6	T7	T8			C1	C2	C3	C4	C5
<b>Amphibians</b>																			
Broad-palmed Rocket Frog	<i>Litoria latopalmata</i>	LC	NL																
Cane Toad	<i>Rhinella marina</i>	*	-	XX															
Green Tree Frog	<i>Litoria caerulea</i>	LC	NL									Fu							
Green-striped Burrowing Frog	<i>Cyclorana alboguttata</i>	LC	NL						Fu, As										
Knife-footed Frog	<i>Cyclorana cultripes</i>	LC	NL						Fu, Sp	Pf, Fu	Pf, Fu	Pf							
Ornate Burrowing Frog	<i>Platyplectrum ornatum</i>	LC	NL							Pf, Fu	Pf, Fu	Pf, Fu							
Short-footed Frog	<i>Cyclorana brevipes</i>	LC	NL				X												
Spotted Marsh Frog	<i>Limnodynastes tasmaniensis</i>	LC	NL							Pf									
<b>Birds</b>																			
Apostlebird	<i>Struthidea cinerea</i>	LC	NL	X			X												
Australasian Darter	<i>Anhinga novaehollandiae</i>	LC	NL	X															
Australasian Grebe	<i>Tachybaptus novaehollandiae</i>	LC	NL																
Australasian Pipit	<i>Anthus novaeseelandiae</i>	LC	NL	XX															
Australian Bustard	<i>Tachybaptus novaehollandiae</i>	LC	NL	X															
Australian Hobby	<i>Falco longipennis</i>	LC	NL	X															
Australian Magpie	<i>Cracticus tibicen</i>	LC	NL	XX		X			X			X			IR				
Australian Wood Duck	<i>Chenonetta jubata</i>	LC	NL	X															
Black Kite	<i>Milvus migrans</i>	LC	NL	X															
Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>	LC	NL	X							X								
Black-faced Monarch	<i>Monarcha melanopsis</i>	SLC	Mi									X							

Common Name	Scientific Name	Status		Incidental	Trap Sites								Creek	Dam	Infrared Camera Sites					
		NC Act (Biosecurity Act) <sup>1</sup>	EPBC Act <sup>2</sup>		T1	T2	T3	T4	T5	T6	T7	T8			C1	C2	C3	C4	C5	
Black-faced Woodswallow	<i>Artamus cinereus</i>	LC	NL	X			X													
Black-fronted Dotterel	<i>Euseyornis melanops</i>	LC	NL										X							
Blue-faced Honeyeater	<i>Entomyzon cyanotis</i>	LC	NL				X			X			X							
Blue-winged Kookaburra	<i>Dacelo leachii</i>	LC	NL							X	X									
Brolga	<i>Grus rubicunda</i>	LC	NL																	
Brown Falcon	<i>Falco berigora</i>	LC	NL	XX																
Brown Goshawk	<i>Accipiter fasciatus</i>	LC	NL									X								
Brown Honeyeater	<i>Lichmera indistincta</i>	LC	NL										X							
Brown Quail	<i>Coturnix ypsilophora</i>	LC	NL								X									
Buff-rumped Thornbill	<i>Acanthiza reguloides</i>	LC	NL		X															
Channel-billed Cuckoo	<i>Scythrops novaehollandiae</i>	LC	NL	X																
Cockatiel	<i>Nymphicus hollandicus</i>	LC	NL	X																
Common Bronzewing	<i>Phaps chalcoptera</i>	LC	NL	X							X									
Crested Pigeon	<i>Ocyphaps lophotes</i>	LC	NL	XX		X	X			X										
Dollarbird	<i>Eurystomus orientalis</i>	LC	NL							X			X							
Double-barred Finch	<i>Taeniopygia bichenovii</i>	LC	NL	X																
Eastern Barn Owl	<i>Tyto javanica</i>	LC	NL	Sp, Sp																
Eastern Koel	<i>Eudynamys orientalis</i>	LC	NL		X				X											
Emu	<i>Dromaius novaehollandiae</i>	LC	NL	XX																
Fairy Martin	<i>Petrochelidon ariel</i>	LC	NL	X																
Galah	<i>Eolophus roseicapillus</i>	LC	NL	XX	X		X		X	X		X								
Golden-headed Cisticola	<i>Cisticola exilis</i>	LC	NL	X																
Grey Butcherbird	<i>Cracticus torquatus</i>	LC	NL							X	X									

Common Name	Scientific Name	Status		Incidental	Trap Sites								Creek	Dam	Infrared Camera Sites					
		NC Act (Biosecurity Act) <sup>1</sup>	EPBC Act <sup>2</sup>		T1	T2	T3	T4	T5	T6	T7	T8			C1	C2	C3	C4	C5	
Grey Fantail	<i>Rhipidura albiscapa</i>	LC	NL																	
Grey Shrike-thrush	<i>Colluricincla harmonica</i>	LC	NL	X	X															
Grey Teal	<i>Anas gracilis</i>	LC	NL	X									X							
Grey-crowned Babbler	<i>Pomatostomus temporalis</i>	LC	NL	XX			X		X	X										
Horsfield's Bushlark	<i>Mirafrja javanica</i>	LC	NL	X																
Laughing Kookaburra	<i>Dacelo novaeguineae</i>	LC	NL		X		X	Sp		X	X									
Leaden Flycatcher	<i>Myiagra rubecula</i>	LC	NL	X	X															
Little Button-quail	<i>Turnix velox</i>	LC	NL	Sp																
Little Crow	<i>Corvus bennetti</i>	LC	NL				X													
Little Friarbird	<i>Philemon citreogularis</i>	LC	NL		X		X				X	X								
Magpie-lark	<i>Grallina cyanoleuca</i>	LC	NL	XX						X										
Masked Lapwing	<i>Vanellus miles</i>	LC	NL	XX									X							
Mistletoebird	<i>Dicaeum hirundinaceum</i>	LC	NL	X					X		X		X							
Nankeen Kestrel	<i>Falco cenchroides</i>	LC	NL	X					X											
Noisy Friarbird	<i>Philemon corniculatus</i>	LC	NL		X	X	X		X	X	X	X								
Noisy Miner	<i>Manorina melanocephala</i>	LC	NL	XX		X		X												
Olive-backed Oriole	<i>Oriolus sagittatus</i>	LC	NL							X			X							
Pacific Black Duck	<i>Anas superciliosa</i>	LC	NL	X										X						
Pale-headed Rosella	<i>Platycercus adscitus</i>	LC	NL	X		X			X	X		X								
Peaceful Dove	<i>Geopelia striata</i>	LC	NL						X		X		X							
Pheasant Coucal	<i>Centropus phasianinus</i>	LC	NL								X		X							
Pied Butcherbird	<i>Cracticus nigrogularis</i>	LC	NL		X				X			X								
Pied Currawong	<i>Strepera graculina</i>	LC	NL		X															
Plumed Whistling-Duck	<i>Dendrocygna eytoni</i>	LC	NL	X																
Plum-headed Finch	<i>Neochmia modesta</i>	LC	NL																	
Rainbow Bee-eater	<i>Merops ornatus</i>	LC	NL	XX	X		X	X		X										
Rainbow Lorikeet	<i>Trichoglossus haematodus</i>	LC	NL				X	X		X	X									

Common Name	Scientific Name	Status		Incidental	Trap Sites								Creek	Dam	Infrared Camera Sites				
		NC Act (Biosecurity Act) <sup>1</sup>	EPBC Act <sup>2</sup>		T1	T2	T3	T4	T5	T6	T7	T8			C1	C2	C3	C4	C5
Red-backed Fairy-wren	<i>Malurus melanocephalus</i>	LC	NL	X									X						
Red-winged Parrot	<i>Aprosmictus erythropterus</i>	LC	NL				X	X	X			X							
Rufous Fantail	<i>Rhipidura rufifrons</i>	SLC	Mi																
Rufous Songlark	<i>Cincloramphus mathewsi</i>	LC	NL	X															
Rufous Whistler	<i>Pachycephala rufiventris</i>	LC	NL	X	X														
Sacred Kingfisher	<i>Todiramphus sanctus</i>	LC	NL	XX															
Singing Honeyeater	<i>Lichenostomus virescens</i>	LC	NL	X						X									
Southern Boobook	<i>Ninox novaeseelandiae</i>	LC	NL					Cp	Sp, Cp		Cp								
Spotted Bowerbird	<i>Ptilonorhynchus maculatus</i>	LC	NL									X							
Squatter Pigeon	<i>Geophaps scripta</i>	V	V	XX		X	X					X		X					
Straw-necked Ibis	<i>Threskiornis spinicollis</i>	LC	NL	X															
Striated Pardalote	<i>Pardalotus striatus</i>	LC	NL	X						X		X							
Striped Honeyeater	<i>Plectorhyncha lanceolata</i>	LC	NL	XX															
Sulphur-crested Cockatoo	<i>Cacatua galerita</i>	LC	NL	X			X			X			X						
Tawny Frogmouth	<i>Podargus strigoides</i>	LC	NL							Sp		Sp							
Torresian Crow	<i>Corvus orru</i>	LC	NL	XX	Ir	X	Ir		Ir	X		X							
Tree Martin	<i>Petrochelidon nigricans</i>	LC	NL	X															
Varied Sittella	<i>Daphoenositta chrysoptera</i>	LC	NL																
Wedge-tailed Eagle	<i>Aquila audax</i>	LC	NL	XX				X											
Weebill	<i>Smicrornis brevirostris</i>	LC	NL	X							X	X							
Whistling Kite	<i>Haliastur sphenurus</i>	LC	NL	X			X			X									
White-faced Heron	<i>Egretta novaehollandiae</i>	LC	NL	X															
White-throated Gerygone	<i>Gerygone albogularis</i>	LC	NL	X	X			X											

Common Name	Scientific Name	Status		Incidental	Trap Sites								Creek	Dam	Infrared Camera Sites				
		NC Act (Biosecurity Act) <sup>1</sup>	EPBC Act <sup>2</sup>		T1	T2	T3	T4	T5	T6	T7	T8			C1	C2	C3	C4	C5
White-throated Honeyeater	<i>Melithreptus albogularis</i>	LC	NL				X												
White-winged Chough	<i>Corcorax melanorhamphos</i>	LC	NL	X	X		X						X						
Willie Wagtail	<i>Rhipidura leucophrys</i>	LC	NL	X			X												
Yellow-throated Miner	<i>Manorina flavigula</i>	LC	NL	X						X		X							
Zebra Finch	<i>Taeniopygia guttata</i>	LC	NL	X															
<b>Mammals</b>																			
Feral Cat	<i>Felis catus</i>	* (C3, 4, 6)	-	Sp			Ir											IR	
Common Brushtail Possum	<i>Trichosurus vulpecula</i>	LC	NL		Sp, Ir	Sp	Ir, Sc	Sp	Ir	Sp		Ir	X		IR	IR			IR
Dingo, Domestic Dog	<i>Canis lupus</i>	* (C3, 4, 6)	-					TT											
Eastern Grey Kangaroo	<i>Macropus giganteus</i>	LC	NL	XX				Sp							IR	IR		IR	
Greater Glider	<i>Petauroides volans</i>	LC	V				Sp	Sp											
House Mouse	<i>Mus musculus</i>	*	-		Pf														
European Rabbit	<i>Oryctolagus cuniculus</i>	* (C3, 4, 5, 6)	-	XX		X, Sp	Sp, Ir							Sp, Sc					
Rufous Bettong	<i>Aepyprymnus rufescens</i>	LC	NL	Sp, Sp			Ir, Sp									IR			
Short-beaked Echidna	<i>Tachyglossus aculeatus</i>	SLC	NL																
Sugar Glider	<i>Petaurus breviceps</i>	LC	NL					TT											
Swamp Wallaby	<i>Wallabia bicolor</i>	LC	NL	X															
<b>Reptiles</b>																			
Black-headed Monitor	<i>Varanus tristis</i>	LC	NL					Fu											

Common Name	Scientific Name	Status		Incidental	Trap Sites								Creek	Dam	Infrared Camera Sites					
		NC Act (Biosecurity Act) <sup>1</sup>	EPBC Act <sup>2</sup>		T1	T2	T3	T4	T5	T6	T7	T8			C1	C2	C3	C4	C5	
Box-patterned Gecko	<i>Lucasium steindachneri</i>	LC	NL			Sp														
Brown Tree Snake	<i>Boiga irregularis</i>	LC	NL				Sp													
Burton's Legless Lizard	<i>Lialis burtonis</i>	LC	NL			Fu														
Bynoe's Gecko	<i>Heteronotia binoei</i>	LC	NL		Fu, Sp	Fu, As, Sp	Pf, Fu, As, Sp	Pf, As, Sp	As	As	Fu, Sp	As, Sp								
Carpentaria Snake	<i>Cryptophis boschmai</i>	LC	NL									Fu								
Chain-backed Dtetella	<i>Gehyra catenata</i>	LC	NL			Sp	Sp					Sp								
Common Tree Snake	<i>Dendrelaphis punctulatus</i>	LC	NL				TT													
Curly Snake	<i>Suta suta</i>	LC	NL				Sp													
Eastern Bearded Dragon	<i>Pogona barbata</i>	LC	NL	X																
Eastern Brown Snake	<i>Pseudonaja textilis</i>	LC	NL	X																
Eastern Fat-tailed Gecko	<i>Diplodactylus platyurus</i>	LC	NL			Fu														
Eastern Mulch-slider	<i>Lerista fragilis</i>	LC	NL						As		As									
Eastern Robust Slider	<i>Lerista punctatovittata</i>	LC	NL				Pf													
Eastern Striped Skink	<i>Ctenotus robustus</i>	LC	NL			Fu	Fu		Fu	As		Fu								
Fine-spotted Mulch-skink	<i>Glaphyromorphus punctulatus</i>	LC	NL						Fu											
Fire-tailed Skink	<i>Morethia taeniopleura</i>	LC	NL			Pf	Pf, As		As		As									
Iridescent Litter-skink	<i>Lygisaurus foliorum</i>	LC	NL					Fu			As									
Ocellated Velvet Gecko	<i>Oedura monilis</i>	LC	NL										X							



Common Name	Scientific Name	Status		Incidental	Trap Sites								Creek	Dam	Infrared Camera Sites				
		NC Act (Biosecurity Act) <sup>1</sup>	EPBC Act <sup>2</sup>		T1	T2	T3	T4	T5	T6	T7	T8			C1	C2	C3	C4	C5
Open-litter Rainbow-skink	<i>Carlia pectoralis</i>	LC	NL		As	Pf, As	Pf, As	Pf, As	As	<b>Pf, Fu, As</b>	As	<b>Pf, Fu, As</b>							
Ornamental Snake	<i>Denisonia maculata</i>	V	V	<b>X</b>															
Pale-headed Snake	<i>Hoplocephalus bitorquatus</i>	LC	NL										Sp						
Prickly Knob-tailed Gecko	<i>Nephrurus asper</i>	LC	NL				Fu		<b>Fu</b>		<b>EI</b>								
Ragged Snake-eyed Skink	<i>Cryptoblepharus pannosus</i>	LC	NL			Pf	Pf	As		<b>As</b>	<b>As</b>	<b>As</b>							
Red-naped Snake	<i>Furina diadema</i>	LC	NL						<b>Fu</b>										
Robust Rainbow-skink	<i>Carlia schmeltzii</i>	LC	NL						<b>As</b>										
South-eastern Morethia Skink	<i>Morethia boulengeri</i>	LC	NL			Pf, Fu, As	Pf, As			<b>As</b>	<b>Pf, As</b>	<b>As</b>							
Yellow-faced Whipsnake	<i>Demansia psammophis</i>	LC	NL			Pf, Fu, As	Pf, As					<b>Fu</b>							

<sup>1</sup> EPBC Act Status – E = Endangered, V = Vulnerable, Mi = Migratory, NL = Not listed

<sup>2</sup> NC Act Status – E = Endangered, V = Vulnerable, NT = Near threatened, LC = Least concern, SLC = Species least concern, NL = Not listed

Biosecurity Act Status - C = Categories 3, 4, 5 and/or 6

\* = Exotic species

Class 2 = declared class 2 pest under the Queensland LP Act

**As** = Active Search; **Bs** = Bird Survey; **Cp** = Call Playback; **EI** = Elliot Trap; **Fu** = Funnel; **H** = Heard; **Ir** = Infrared Camera; **Pf** = Pitfall; **Sc** = Scats; **Sp** = Spotlight; **Tt** = Track or Trace; **X** = Present

**Bold** text indicates record was obtained during post-wet season survey, standard text indicates record was obtained during dry season survey



Common Name	Scientific Name	Status		Supplementary Sites																									
		NC Act (Biosecurity Act) <sup>1</sup>	EPBC Act <sup>2</sup>	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	S21	S22	S23	S24	S25	
Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>	LC	NL	X										X			X	X									X	X	
Black-faced Monarch	<i>Monarcha melanopsis</i>	SLC	Mi																										
Black-faced Woodswallow	<i>Artamus cinereus</i>	LC	NL																										
Black-fronted Dotterel	<i>Euseyornis melanops</i>	LC	NL																										
Blue-faced Honeyeater	<i>Entomyzon cyanotis</i>	LC	NL																							X			
Blue-winged Kookaburra	<i>Dacelo leachii</i>	LC	NL																										
Brolga	<i>Grus rubicunda</i>	LC	NL														X												
Brown Falcon	<i>Falco berigora</i>	LC	NL																										
Brown Goshawk	<i>Accipiter fasciatus</i>	LC	NL																										
Brown Honeyeater	<i>Lichmera indistincta</i>	LC	NL																										
Brown Quail	<i>Coturnix ypsilophora</i>	LC	NL																										
Buff-rumped Thornbill	<i>Acanthiza reguloides</i>	LC	NL										X																
Channel-billed Cuckoo	<i>Scythrops novaehollandiae</i>	LC	NL																										
Cockatiel	<i>Nymphicus hollandicus</i>	LC	NL																										
Common Bronzewing	<i>Phaps chalcoptera</i>	LC	NL																							X			X
Crested Pigeon	<i>Ocyphaps lophotes</i>	LC	NL															X											
Dollarbird	<i>Eurystomus orientalis</i>	LC	NL																	X	X					X	X		
Double-barred Finch	<i>Taeniopygia bichenovii</i>	LC	NL														X												

Common Name	Scientific Name	Status		Supplementary Sites																									
		NC Act (Biosecurity Act) <sup>1</sup>	EPBC Act <sup>2</sup>	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	S21	S22	S23	S24	S25	
Eastern Barn Owl	<i>Tyto javanica</i>	LC	NL																										
Eastern Koel	<i>Eudynamys orientalis</i>	LC	NL																										
Emu	<i>Dromaius novaehollandiae</i>	LC	NL																										
Fairy Martin	<i>Petrochelidon ariel</i>	LC	NL																										
Galah	<i>Eolophus roseicapillus</i>	LC	NL	X							X	X						X				X				X			
Golden-headed Cisticola	<i>Cisticola exilis</i>	LC	NL																										
Grey Butcherbird	<i>Cracticus torquatus</i>	LC	NL	X									X					X				X							
Grey Fantail	<i>Rhipidura albiscapa</i>	LC	NL										X																
Grey Shrike-thrush	<i>Colluricincla harmonica</i>	LC	NL																		X								
Grey Teal	<i>Anas gracilis</i>	LC	NL																										
Grey-crowned Babbler	<i>Pomatostomus temporalis</i>	LC	NL															X											
Horsfield's Bushlark	<i>Mirafra javanica</i>	LC	NL															X											
Laughing Kookaburra	<i>Dacelo novaeguineae</i>	LC	NL					X					X									X					X		
Leaden Flycatcher	<i>Myiagra rubecula</i>	LC	NL																										
Little Button-quail	<i>Turnix velox</i>	LC	NL																										
Little Crow	<i>Corvus bennetti</i>	LC	NL																										
Little Friarbird	<i>Philemon citreogularis</i>	LC	NL	X							X							X							X				
Magpie-lark	<i>Grallina cyanoleuca</i>	LC	NL																			X							
Masked	<i>Vanellus miles</i>	LC	NL															X											

Common Name	Scientific Name	Status		Supplementary Sites																										
		NC Act (Biosecurity Act) <sup>1</sup>	EPBC Act <sup>2</sup>	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	S21	S22	S23	S24	S25		
Lapwing																														
Mistletoebird	<i>Dicaeum hirundinaceum</i>	LC	NL															X			X	X								
Nankeen Kestrel	<i>Falco cenchroides</i>	LC	NL																											
Noisy Friarbird	<i>Philemon corniculatus</i>	LC	NL									X	X					X			X	X			X	X	X	X		
Noisy Miner	<i>Manorina melanocephala</i>	LC	NL	X									X					X												
Olive-backed Oriole	<i>Oriolus sagittatus</i>	LC	NL																											
Pacific Black Duck	<i>Anas superciliosa</i>	LC	NL														X													
Pale-headed Rosella	<i>Platycercus adscitus</i>	LC	NL								X							X				X					X	X		
Peaceful Dove	<i>Geopelia striata</i>	LC	NL																		X				X		X			
Pheasant Coucal	<i>Centropus phasianinus</i>	LC	NL																											
Pied Butcherbird	<i>Cracticus nigrogularis</i>	LC	NL															X								X	X	X		
Pied Currawong	<i>Strepera graculina</i>	LC	NL					X				X																		
Plumed Whistling-Duck	<i>Dendrocygna eytoni</i>	LC	NL																											
Plum-headed Finch	<i>Neochmia modesta</i>	LC	NL														X													
Rainbow Bee-eater	<i>Merops ornatus</i>	LC	NL									X					X				X					X	X			
Rainbow Lorikeet	<i>Trichoglossus haematodus</i>	LC	NL																											
Red-backed Fairy-wren	<i>Malurus melanocephalus</i>	LC	NL																											
Red-winged Parrot	<i>Aprosmictus erythropterus</i>	LC	NL								X							X				X			X					



Common Name	Scientific Name	Status		Supplementary Sites																									
		NC Act (Biosecurity Act) <sup>1</sup>	EPBC Act <sup>2</sup>	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	S21	S22	S23	S24	S25	
	<i>brevirostris</i>																												
Whistling Kite	<i>Haliastur sphenurus</i>	LC	NL																										
White-faced Heron	<i>Egretta novaehollandiae</i>	LC	NL																										
White-throated Gerygone	<i>Gerygone albogularis</i>	LC	NL								X	X	X													X			
White-throated Honeyeater	<i>Melithreptus albogularis</i>	LC	NL										X								X								
White-winged Cough	<i>Corcorax melanorhamphos</i>	LC	NL																										
Willie Wagtail	<i>Rhipidura leucophrys</i>	LC	NL																										
Yellow-throated Miner	<i>Manorina flavigula</i>	LC	NL																		X	X			X	X			X
Zebra Finch	<i>Taeniopygia guttata</i>	LC	NL														X												
<b>Mammals</b>																													
Feral Cat	<i>Felis catus</i>	* (C3, 4, 6)	-																										
Common Brushtail Possum	<i>Trichosurus vulpecula</i>	LC	NL	Sc	Sp	Sp	Sp	Sc	Sc	Sp									Sp	Sp	Sp		Sp	Sp					
Dingo, Domestic Dog	<i>Canis lupus</i>	* (C3, 4, 6)	-																			Tt							
Eastern Grey Kangaroo	<i>Macropus giganteus</i>	LC	NL				Sp								Sp		As			As	As					As		As	
Greater Glider	<i>Petauroides volans</i>	LC	V															Sp				Sp	Sp						
House Mouse	<i>Mus musculus</i>	*	-																										
European Rabbit	<i>Oryctolagus cuniculus</i>	* (C3, 4, 5, 6)	-	As		Sp			As	Sp																			As





Common Name	Scientific Name	Status		Supplementary Sites																									
		NC Act (Biosecurity Act) <sup>1</sup>	EPBC Act <sup>2</sup>	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	S21	S22	S23	S24	S25	
Eastern Robust Slider	<i>Lerista punctatovittata</i>	LC	NL																										
Eastern Striped Skink	<i>Ctenotus robustus</i>	LC	NL					As			As		As								As								
Fine-spotted Mulch-skink	<i>Glaphyromorphus punctulatus</i>	LC	NL																										
Fire-tailed Skink	<i>Morethia taeniopleura</i>	LC	NL																										
Iridescent Litter-skink	<i>Lygisaurus foliorum</i>	LC	NL																										
Ocellated Velvet Gecko	<i>Oedura monilis</i>	LC	NL								As																		
Open-litter Rainbow-skink	<i>Carlia pectoralis</i>	LC	NL	As				As	As		As	As	As	As				As			As	As			As	As			
Ornamental Snake	<i>Denisonia maculata</i>	V	V																										
Pale-headed Snake	<i>Hoplocephalus bitorquatus</i>	LC	NL																										
Prickly Knob-tailed Gecko	<i>Nephrurus asper</i>	LC	NL																										
Ragged Snake-eyed Skink	<i>Cryptoblepharus pannosus</i>	LC	NL	As				As			As	As														As			
Red-naped Snake	<i>Furina diadema</i>	LC	NL																										
Robust Rainbow-skink	<i>Carlia schmeltzii</i>	LC	NL																										
South-eastern Morethia Skink	<i>Morethia boulengeri</i>	LC	NL	As				As					As	As							As	As			As	As			
Yellow-faced Whipsnake	<i>Demansia psammophis</i>	LC	NL	As				As					As	As															

<sup>1</sup> EPBC Act Status – E = Endangered, V = Vulnerable, Mi = Migratory, NL = Not listed

<sup>2</sup> NC Act Status – E = Endangered, V = Vulnerable, NT = Near threatened, LC = Least concern, SLC = Species least concern, NL = Not listed

Biosecurity Act Status - C = Categories 3, 4, 5 and/or 6

\* = Exotic species

Class 2 = declared class 2 pest under the Queensland LP Act

**As** = Active Search; **Bs** = Bird Survey; **Cp** = Call Playback; **EI** = Elliot Trap; **Fu** = Funnel; **H** = Heard; **Ir** = Infrared Camera; **Pf** = Pitfall; **Sc** = Scats; **Sp** = Spotlight; **Tt** = Track or Trace; **X** = Present

**Bold** text indicates record was obtained during post-wet season survey, standard text indicates record was obtained during dry season survey

**Table M3: Micro-bat field species list (trap sites)**

Common Name	Scientific Name	Status		Trap Site	Supplementary Sites			Harp Trap Sites							
		NC Act <sup>1</sup>	EPBC Act <sup>2</sup>		T2	S16	S17	S20	H1	H2	H3	H4	H5	H6	H7
Northern Freetail Bat	<i>Chaerephon jobensis</i>	LC	NL												
Gould's Wattled Bat	<i>Chalinolobus gouldii</i>	LC	NL								4				1
Chocolate Wattled Bat	<i>Chalinolobus morio</i>	LC	NL								1				
Hoary Wattled Bat	<i>Chalinolobus nigrogriseus</i>	LC	NL								1				
Little Pied Bat	<i>Chalinolobus picatus</i>	LC	NL						2		1			2	1
Eastern Bent-winged Bat	<i>Miniopterus orianae oceanensis</i>	LC	NL												
Northern Free-tailed Bat	<i>Mormopterus lumsdenae</i>	LC	NL												
Eastern Free-tailed Bat	<i>Mormopterus ridei</i>	LC	NL												
Long-eared Bat	<i>Nyctophilus sp.</i>	LC	NL												
Yellow-bellied Sheath-tailed Bat	<i>Saccolaimus flaviventris</i>	LC	NL	H	<b>Sp</b>	<b>H</b>	<b>H</b>								
Inland Broad-nosed Bat	<i>Scotorepens balstoni</i>	LC	NL												
Little Broad-nosed Bat	<i>Scotorepens greyii</i>	LC	NL												
Broad-nosed Bat	<i>Scotorepens greyii/sanborni</i>	LC	NL								8			6	
Troughton's Sheath-tailed Bat	<i>Taphozous troughtoni</i>	LC	NL												
Inland Forest Bat	<i>Vespadelus braverstocki</i>	LC	NL												
Eastern Cave Bat	<i>Vespadelus troughtoni</i>	LC	NL					1					1	3	

<sup>1</sup> EPBC Act Status – E = Endangered, V = Vulnerable, NL = Not listed

<sup>2</sup> NC Act Status – E = Endangered, V = Vulnerable, NT = Near threatened, LC = Least concern, NL = Not listed

**H** = Heard; **Sp** = Spotlight; **1-6** = Number recorded

**Bold** text indicates record was obtained during post-wet season survey, standard text indicates record was obtained during dry season survey

**Table M4: Micro-bat field species list (Anabat sites)**

Common Name	Scientific Name	Status		Anabat Sites																
		NC Act <sup>1</sup>	EPBC Act <sup>2</sup>	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	
Northern Freetail Bat	<i>Chaerephon jobensis</i>	LC	NL	A	-	A	-	A	A	A	A	A	A	A	-	A	-	A	B	A
Gould's Wattled Bat	<i>Chalinolobus gouldii</i>	LC	NL	A	A	A	A	A	A	A	A	A	A	A	B	A	-	A	B	A
Chocolate Wattled Bat	<i>Chalinolobus morio</i>	LC	NL	A	A	A	A	-	A	A	-									
Hoary Wattled Bat	<i>Chalinolobus nigrogriseus</i>	LC	NL	A	B	B	-	A	A	-	A	-	-	-	B	-	-	-	-	B
Little Pied Bat	<i>Chalinolobus picatus</i>	LC	NL	-	A	B	-	A	A	A	-	-	B	B	-	B	-	B	-	
Eastern Bent-winged Bat	<i>Miniopterus orianae oceanensis</i>	LC	NL	-	-	-	-	-	-	-	-	-	B	B	-	B	B	B	B	B
Northern Free-tailed Bat	<i>Mormopterus lumsdenae</i>	LC	NL	A	A	-	-	-	A	-	-	A	A	A	-	-	A	A	A	A
Eastern Free-tailed Bat	<i>Mormopterus ridei</i>	LC	NL	B	-	-	-	B	-	B	B	B	-	B	B	-	B	B	B	B
Long-eared Bat	<i>Nyctophilus sp.</i>	LC	NL	-	-	-	-	-	-	A	A	-	-	-	-	-	-	-	-	A
Yellow-bellied Sheath-tailed Bat	<i>Saccolaimus flaviventris</i>	LC	NL	A	-	A	A	-	A	A	A	B	-	B	B	-	B	B	B	B
Inland Broad-nosed Bat	<i>Scotorepens balstoni</i>	LC	NL	-	B	-	-	A	-	B	A	-	-	A	B	-	A	-	-	
Little Broad-nosed Bat	<i>Scotorepens greyii</i>	LC	NL	A	A	-	A	A	A	A	A	A	A	-	A	-	A	B	A	A
Broad-nosed Bat	<i>Scotorepens greyii/sanborni</i>	LC	NL	-	-	-	-	-	-	-	-	A	A	B	B	B	A	B	A	A
Troughton's Sheath-tailed Bat	<i>Taphozous troughtoni</i>	LC	NL	-	-	-	-	-	-	-	-	B	-	-	-	-	-	-	B	-
Inland Forest Bat	<i>Vespadelus braverstocki</i>	LC	NL	A	-	A	-	A	A	A	-	-	A	A	-	B	A	B	A	A
Eastern Cave Bat	<i>Vespadelus troughtoni</i>	LC	NL	A	-	A	-	-	A	A	-	A	-	-	B	-	-	-	-	A

<sup>1</sup> EPBC Act Status – E = Endangered, V = Vulnerable, NL = Not listed

<sup>2</sup> NC Act Status – E = Endangered, V = Vulnerable, NT = Near threatened, LC = Least concern, NL = Not listed

**A** = at least one call from the site was attributed unequivocally to the species; **B** = calls similar to those of the species were recorded, but could not be reliably identified; - = species not recorded

**Bold** text indicates record was obtained during post-wet season survey, standard text indicates record was obtained during dry season survey

## **Appendix N**

EPBC Act critical habitat assessment for the Koala

**Table N1: EPBC Act critical habitat assessment for the Koala**

Attributes and Scores from Koala Habitat Assessment Tool			Results of Desktop Analysis	
Attribute	Score	Inland	Proposed Score	Comment
Koala occurrence	+2 (high)	Evidence of one or more Koalas within the last 5 years.	0: No confirmed evidence of Koala within 2 km of the impact area within the last 10 years.	The Wildlife Online database indicates that the nearest known record of this species is between 7 and 10 km from the study area (EHP 2015b). The database provides no further information in relation to the location of this record. No evidence of this species was recorded in the study area during the fauna field surveys.
	+1 (medium)	Evidence of one or more Koalas within 2 km of the edge of the impact area within the last 10 years.		
	0 (low)	None of the above.		
Vegetation composition	+2 (high)	Has forest, woodland or shrubland with emerging trees with 2 or more known Koala food tree species, OR 1 food tree species that alone accounts for >50% of the vegetation in the relevant strata.	2: Has forest, woodland or shrubland with emerging trees with 2 or more known Koala food tree species	The study area contains the following 12 species of Koala feed trees: <ul style="list-style-type: none"> <li>▪ Long-fruited Bloodwood (<i>Corymbia clarksoniana</i>)</li> <li>▪ Dallachy's Gum (<i>Corymbia dallachiana</i>)</li> <li>▪ Variable-barked Bloodwood (<i>Corymbia erythrophloia</i>)</li> <li>▪ Carbeen (<i>Corymbia tessellaris</i>)</li> <li>▪ Narrow-leaved Red Ironbark (<i>Eucalyptus crebra</i>)</li> <li>▪ River Red Gum (<i>Eucalyptus camaldulensis</i>)</li> <li>▪ Mountain Coolabah (<i>Eucalyptus orgadophila</i>)</li> <li>▪ Poplar Gum (<i>Eucalyptus platyphylla</i>)</li> <li>▪ Poplar Box (<i>Eucalyptus populnea</i>)</li> <li>▪ Queensland Blue Gum (<i>Eucalyptus tereticornis</i> ssp. <i>tereticornis</i>)</li> <li>▪ Black Tea Tree (<i>Melaleuca bracteata</i>)</li> <li>▪ Yellow-barked Paperbark (<i>Melaleuca nervosa</i>).</li> </ul>
	+1 (medium)	Has forest, woodland or shrubland with emerging trees with only 1 species of known Koala food tree present.		
	0 (low)	None of the above.		

Attributes and Scores from Koala Habitat Assessment Tool			Results of Desktop Analysis	
Attribute	Score	Inland	Proposed Score	Comment
<b>Habitat connectivity</b>	+2 (high)	Area is part of a contiguous landscape ≥ 1000 ha.	<b>2:</b> Area is part of a contiguous landscape ≥ 1000 ha	Approximately 380.1 ha of potential Koala habitat occurs in the study area.
	+1 (medium)	Area is part of a contiguous landscape < 1000 ha, but ≥ 500 ha.		The study area is part of a contiguous landscape of remnant riparian corridors and provides connectivity to other large tracts of remnant vegetation to the west, associated with the Isaac River and to the north and east associated with the Kerlong Range. However, connected corridors are generally restricted to narrow watercourses.
	0 (low)	None of the above.		
<b>Key existing threats</b>	+2 (high)	Little or no evidence of Koala mortality from vehicle strike or dog attack at present in areas that score 1 or 2 for koala occurrence. Areas which score 0 for koala occurrence and have no dog or vehicle threat present	<b>1:</b> The study area is likely to have some degree of dog threat present.	Dogs were recorded in the study area during the field survey and may pose a degree of threat to Koalas. Vehicles are unlikely to pose a significant threat to Koalas within the study area
	+1 (medium)	Evidence of infrequent or irregular Koala mortality from vehicle strike or dog attack at present in areas that score 1 or 2 for Koala occurrence, OR Areas which score 0 for Koala occurrence and are likely to have some degree dog or vehicle threat present.		
	0 (low)	Evidence of frequent or regular Koala mortality from vehicle strike or dog attack in the study area at present, OR Areas which score 0 for Koala occurrence and have a significant dog or vehicle threat present.		

Attributes and Scores from Koala Habitat Assessment Tool			Results of Desktop Analysis	
Attribute	Score	Inland	Proposed Score	Comment
Recovery value <sup>‡</sup>	+2 (high)	Habitat is likely to be important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1.	1: Uncertain whether the habitat is important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1 of the EPBC Act referral guidelines for the Koala	The creek lines in the study area have the potential to provide refuge habitat for Koalas as described in the EPBC Act referral guidelines for the vulnerable Koala (DotE 2014). These habitats are connected with larger remnants in the landscape.
	+1 (medium)	Uncertain whether the habitat is important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1.		
	0 (low)	Habitat is unlikely to be important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1.		
<b>TOTAL</b>			<b>6</b>	<b>Decision: Habitat critical to the survival of the Koala—assessment of significance required.</b>



## **Appendix O**

Summary of impacts table

**Table O1: Vegetation and habitat proposed to be disturbed within the ecology study area<sup>+</sup>**

Vegetation / Species	Conservation status		Total area in the ecology study area (ha)	Total area to be cleared (ha)
	Cw'lth Status <sup>1</sup>	State Status <sup>2</sup>		
<b>Regional ecosystems</b>				
11.3.2 Poplar Box alluvial woodland	-	Of concern	1.2	0.0
11.3.4 Queensland Blue Gum alluvial woodland	-	Of concern	0.5	0.0
11.3.25 Mixed eucalypt riparian woodland	-	Least concern	48.1	1.4
11.5.3 Poplar Box woodland	-	Least concern	105.2	80.1
11.5.8b Narrow-leaved Red Ironbark - Queensland Blue Gum woodland	-	Least concern	3.4	0.0
11.5.9 Narrow-leaved Red Ironbark woodland	-	Least concern	9.7	0.0
11.5.12 Clarkson's Bloodwood woodland	-	Least concern	142.2	36.2
11.7.2 Lancewood woodland	-	Least concern	14.6	0.0
11.8.5 Mountain Coolabah woodland	-	Least concern	11.8	0.9
11.9.7a Poplar Box - Dawson River Gum woodland	-	Of concern	8.5	3.7
<b>Regional ecosystems within a defined distance of watercourses (50 m)</b>				
11.3.2 (Poplar Box alluvial woodland)	-	Of concern	1.1	0.0
11.3.4 Queensland Blue Gum alluvial woodland	-	Of concern	0.1	0.0
11.3.25 Mixed eucalypt riparian vegetation	-	Least concern	38.9	0.7
11.5.3 Poplar Box woodland	-	Least concern	0.1	0.0
11.5.8b Narrow-leaved Red Ironbark - Queensland Blue Gum woodland	-	Least concern	0.04	0.0
11.9.7a	-	Of concern	0.7	0.0

Vegetation / Species	Conservation status		Total area in the ecology study area (ha)	Total area to be cleared (ha)
	Cw'lth Status <sup>1</sup>	State Status <sup>2</sup>		
Poplar Box - Dawson River Gum woodland				
<b>Significant fauna habitat recorded in the study area</b>				
Squatter Pigeon (southern subspecies) ( <i>Geophaps scripta scripta</i> )	Vulnerable	Vulnerable	181.5	73.7
Greater Glider ( <i>Petauroides volans</i> )	Vulnerable	Least concern	49.8	1.4
Ornamental Snake ( <i>Denisonia maculata</i> )	Vulnerable	Vulnerable	0.0	0.0
Short-beaked Echidna ( <i>Tachyglossus aculeatus</i> )	Not listed	Special least concern	345.2	122.3
Migratory fauna	Migratory	Special least concern	345.2	122.3
<b>Significant fauna habitat likely to occur in the study area</b>				
Koala ( <i>Phascolarctos cinereus</i> )	Vulnerable	Vulnerable	380.1	124.8

<sup>+</sup> In some cases totals may not equal the appropriate total number due to rounding

- 1 EPBC Act status is only relevant if the RE meets the EPBC Act condition thresholds and key diagnostic criteria for the relevant TEC (TEC status current as at May 2016). Queensland REs are not individually listed under the EPBC Act, but may contribute to a TEC listed under the EPBC Act.
- 2 VM Act status for REs defined under the Regional Ecosystem Description Database (REDD) (Queensland Herbarium 2015b), NC Act status for threatened/near threatened species

## **Appendix P**

EPBC Act significance assessment

## ***Introduction***

This appendix provides an assessment of the significance of impacts of the project, to listed species. Note, no threatened communities were found in the project site, and none were considered likely to occur.

The assessments have been conducted for each species, as per the criteria presented in Table 7. The assessments consider both the direct and indirect impacts of the project, and were undertaken in accordance with the EPBC Act Significant Impact Guidelines (DotE 2013).

The following species were assessed:

### Threatened fauna

- Squatter Pigeon (vulnerable) –assessed in Section P1
- Greater Glider (vulnerable) –assessed in Section P2
- Koala (vulnerable) –assessed in Section P3

### Migratory

The following migratory species are assessed in Section P4:

- Black-faced Monarch
- Rufous Fantail
- White-throated Needletail
- Fork-tailed Swift

## ***Summary of proposed impacts***

Clearing of vegetation constitutes the most substantial direct impact associated with the project. Overall, the project will result in the removal of approximately 122.3 ha of remnant vegetation, with further clearing in areas of non-remnant vegetation, some of which provides suitable habitat for various threatened species. Figure 18 illustrates the extent of remnant vegetation clearing associated with the project.

Remnant vegetation encompassed by the proposed clearing footprint for the project also supports areas of habitat for fauna species of conservation significance under the EPBC Act and NC Act.

Edge effects or fragmentation relevant to this assessment are considered to be those associated with effects of clearing on the edge of a retained community or habitat. Edge effects and other potential indirect impacts have not been quantified as part of this assessment as they are influenced by many factors in any given location, e.g. the likelihood and type of weed invasion, the type and severity of disturbance, the type of vegetation being impacted, the ongoing land use adjacent to the cleared edge. Typically edge effects in the form of nearby noise, dust deposition, increased light, wind shear, and weed invasion, is of a width in the order of tens of metres, and lesser for open woodland communities compared with dense vegetation.

### ***Avoidance, mitigation and rehabilitation***

The location of the coal resources dictates the area of disturbance for coal mines and in areas where clearing cannot be avoided, control measures will be implemented to minimise impacts on vegetation and habitat as far as practical. These measures are contained in the various management plans and procedures that are in place for the existing Isaac Plains Mine, and will be implemented for the Isaac Plains East project (refer to Section 8).

The following sections provide a profile of each species proposed to be impacted, the likely impacts after mitigation and an assessment of the significance of these impacts against the EPBC Act Significant Impact Guidelines, set out in the form of specific criteria or questions.

Some key concepts are important in assessing significance of impacts under the EPBC Act Significant Impact Guidelines as follows:

Establishing whether an 'important population' of a species listed under the EPBC Act is necessary in addressing the significant impact criteria for vulnerable species. An important population is a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

- key source populations either for breeding or dispersal
- populations that are necessary for maintaining genetic diversity, and/or
- populations that are near the limit of the species range.

Identifying 'critical habitat' is important in the assessment of significance of impacts under the EPBC Act Significant Impact Guidelines. Habitat critical to the survival of a species refers to areas that are necessary:

- for activities such as foraging, breeding, roosting, or dispersal
- for the long-term maintenance of the species or ecological community (including the maintenance of other species essential to the survival of the species or ecological community, such as pollinators)
- to maintain genetic diversity and long term evolutionary development, or
- for the reintroduction of populations or recovery of the species or ecological community.

These concepts are addressed where relevant, for each of the species.

## **P1: SIGNIFICANCE ASSESSMENT – Squatter Pigeon**

The Squatter Pigeon (southern) (*Geophaps scripta scripta*) is listed as vulnerable under the Commonwealth EPBC Act and Queensland NC Act.

### ***Distribution and habitat***

This species is known to inhabit tropical dry, open sclerophyll woodlands and occasionally open savannah. It appears to favour sandy soil dissected with low gravelly ridges and is less common on heavy soils with dense grass cover. It is nearly always found in close association with permanent water (Higgins and Davies 1996). This species is also often recorded from areas that do not support remnant vegetation, but in these areas it seems to be associated with clear, disturbed sites such as tracks and stockyards (DotE 2016d); S. Marston Pers. obs.). These habitat areas are likely to provide breeding, foraging and dispersal habitat.

### ***Presence in the study area***

PRESENT

The Squatter Pigeon was recorded frequently throughout the study area during both survey periods (Figure 14). Recorded locations comprised both remnant and cleared areas, often along dirt vehicle tracks and usually within approximately 1 km of a dam. Water sources that still contained water at the time of the October 2015 (dry season) survey were considered permanent water points (typically farm dams) for the purpose of mapping Squatter Pigeon habitat.

Habitat mapping for the Squatter Pigeon (Figure 14) within the study area has been undertaken in accordance with the Red Hill Project EPBC Act approval definition. Habitat is categorised as follows:

- Suitable Habitat – grassy woodland habitat in REs on land zones 3, 5 or 7, which are either: within 1 km of a permanent water body; or within 1 km of a Queensland Government mapped wetland or  $\geq 3^{\text{rd}}$  order stream (DotE 2015a).
- Unsuitable Habitat – The Squatter Pigeon is considered unlikely to breed or forage elsewhere in the study area due to the proximity of water sources, the presence of unsuitable soils or groundcover. The Squatter Pigeon is noted as being less common in dense vegetation and vegetation with dense grass cover (Higgins and Davies 1996). This would largely preclude the cleared and disturbed areas due to the dominance of Buffel Grass in the groundcover layer. Therefore, all other areas of the study area are mapped as being generally unsuitable for this species except for dispersal purposes.

Based on this definition, there are 181.5 ha of suitable habitat for the Squatter Pigeon in the study area.

### ***Importance of the population***

The population of Squatter Pigeon that uses the study area is considered unlikely to be an important population for the following reasons:

- key source populations either for breeding or dispersal
  - This species is regularly recorded in the central Queensland region and remains common north of the Carnarvon Ranges. All sub-populations of this species occurring south of the Carnarvon Ranges in central Queensland are considered to be important sub-populations (DotE 2016k). The habitat types of the study area remain common throughout the region and the population of this species within the study area is therefore considered unlikely to be of particular significance for breeding or dispersal.
- populations that are necessary for maintaining genetic diversity
  - The population of the Squatter Pigeon within the Moranbah area is considered unlikely to be important in maintaining genetic diversity within the species. The inherent mobility of a bird species is likely to increase genetic exchange between individuals in comparison to less mobile species whose access to potential mates may be limited. Because of the relatively high rates of genetic exchange in more mobile species, it is less likely that any single population represents an important population for maintaining genetic diversity. The species is noted as being likely to comprise a single contiguous breeding population (DotE 2016k). It is therefore considered unlikely that the population of this species that occurs in the study area is important in maintaining genetic diversity of the species.
- populations that are near the limit of the species range.
  - The range of the Squatter Pigeon (southern) extends north to the Burdekin region and the species once occurred in southern New South Wales, although it has not been recorded in New South Wales for some time (DotE 2016k). The Moranbah area is well within the known distribution of this species. The northern limit of the Squatter Pigeon's (southern) range is considered to be the Burdekin region, approximately 200 km to the north of Moranbah. The species' range extends to the Border Rivers region of northern New South Wales. The area in which the study area is located is within the known distribution of this species.

### ***EPBC Act Plans***

- Conservation Advice: Approved Conservation Advice has been prepared for the Squatter Pigeon, which nominates conservation and management actions for the species. Conservation actions include survey and monitoring priorities, as well as research priorities.
- Recovery Plan: A recovery plan has not been prepared for the Squatter Pigeon, and the DotEE SPRAT Profile explains that one is not required as the Approved Conservation Advice provides sufficient direction to implement priority actions and mitigate against key threats.
- Threat Abatement Plan: Threat abatement plans are in place for the Squatter Pigeon for the threat of Cane Toads, tramp ants, rabbits and the European Red Fox.
- Referral Guideline: There are no referral guidelines for the Squatter Pigeon.



### **Known threats**

The main threats to the Squatter Pigeon (southern) are as follows:

- loss of habitat due to clearing for agricultural or industrial purposes.
- degradation of habitat by grazing herbivores (i.e. sheep, cattle, rabbits).
- degradation of habitat through infestation by Buffel Grass and other improved pasture species
- excessive predation. Known predators include Feral Cats, Red Foxes, birds of prey, Dingos and snakes, but Feral Cats and Red Foxes are likely to be having the greatest impact upon Squatter Pigeon (southern) populations (DotE 2016k).

It is, however, noted that this species is common in the region and is commonly recorded during field surveys in the region.

### **Proposed impacts**

The project would result in the removal of approximately 73.7 ha of habitat for the Squatter Pigeon (southern) mapped in the study area (Figure 19). Table P1 assesses the significance of this proposed impact.

**Table P1: Assessment of significance of impacts for the Squatter Pigeon**

<b>Significance Criteria</b>	<b>Assessment of significance</b>
<i>An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:</i>	
Lead to a long-term decrease in the size of an important population of a species	The population of Squatter Pigeon using the study area is not considered to be an important population. The extent of clearing is unlikely to decrease the size of the population present given the extent of similar habitat available in the region.
Reduce the area of occupancy of an important population	The population of Squatter Pigeon using the study area is not considered to be an important population. The vegetation within the study area is commonly found throughout the surrounding Moranbah area and is not considered to be unique or particularly significant for the Squatter Pigeon. The Squatter Pigeon is also known to commonly occur in disturbed habitats. Therefore, due to the availability of similar habitat within the broader Moranbah region and the mobility of this avian species, the project is considered unlikely to affect the Squatter Pigeon's area of occupancy.
Fragment an existing important population into two or more populations	The population of Squatter Pigeon using the study area is not considered to be an important population. A portion of habitat on the western side of the study area is likely to be fragmented as a result of the project (Figure 19). However, the Squatter Pigeon is a highly mobile species and is known to disperse across cleared and degraded landscapes between preferred habitat areas. Therefore, it is considered unlikely that the population that occurs in the study area would be fragmented into two or more populations.
Adversely affect habitat critical to the survival of a species	Squatter Pigeon habitat is relatively broad by definition, i.e. open-forests to sparse, open-woodland mostly dominated by <i>Eucalyptus</i> , <i>Corymbia</i> , <i>Acacia</i> or <i>Callitris</i> species and within

<b>Significance Criteria</b>	<b>Assessment of significance</b>
	<p>3 km of water bodies or watercourses (DotE 2016k). Therefore, very few areas, including the habitats in the study area, would be described as critical to the survival of the species.</p> <p>The habitat that is to be disturbed within the study area is not regarded as particularly significant or indicative of critical habitat due to the large amount of potential Squatter Pigeon habitat that exists in the surrounding Moranbah area. This habitat will continue to be available to the population of Squatter Pigeon that occurs within the study area.</p> <p>Given the mobility of avian species, access to habitat in the surrounding area should not be restricted.</p>
<p>Disrupt the breeding cycle of an important population</p>	<p>The population of Squatter Pigeon using the study area is not considered to be an important population. It is not known if the Squatter Pigeon breeds within the study area, however, given the relatively large number of birds recorded, it is considered likely.</p> <p>Standard industry recognised measures will be employed during the vegetation clearing stages of the project to minimise harm and disruption to animals and breeding places in accordance with the requirements of the Queensland Nature Conservation (Wildlife Management) Regulation 2006. This will reduce the risk and extent of disruption to the breeding cycle of the Squatter Pigeon in the study area.</p>
<p>Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline</p>	<p>Sub-populations in this region have not been identified as being of particular importance for the long-term survival or recovery of this species. This species is regularly recorded in the Moranbah area and is common in the region. The proposed clearing of 73.7 ha of suitable Squatter Pigeon habitat will not remove habitats, isolate habitats or degrade remaining habitats to the extent that the species is likely to decline. This is because clearing and disturbance is proposed to be gradual, habitat connectivity will be largely maintained and large tracts of similar suitable habitat occurs throughout the landscape.</p>
<p>Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat</p>	<p>The study area is located within a modified rural landscape where introduced plants and feral predators are present. Invasive and predatory species, including feral animals such as the Feral Cat and Domestic Dog have been identified as part of recent field surveys in the study area. Other species such as Foxes are likely to occur in the broader landscape and the study area is accessible to such species.</p> <p>However, this project will not result in invasive species becoming established in Squatter Pigeon habitat, as these species are already established throughout the wider landscape. Isaac Plains Mine has existing procedures in place for feral animal control, and these will be applied to the project (refer to Section 8).</p>
<p>Introduce disease that may cause the species to decline, or</p>	<p>Disease is not a known threat to this species. Therefore, the project is unlikely to introduce any disease that may cause the Squatter Pigeon to decline.</p>
<p>Interfere substantially with the recovery of the species.</p>	<p>This species is noted as 'remaining common north of the Carnarvon Ranges in central Queensland' (DotE 2016k) and is regularly recorded in the Moranbah area. Substantial areas of suitable habitat will remain within the local landscape. The</p>

<b>Significance Criteria</b>	<b>Assessment of significance</b>
	Squatter Pigeon is known to occur in disturbed areas and is likely to continue occupying the study area during the life of the project. Therefore, it is considered unlikely the project will interfere substantially with the recovery of the species.
<i>Conclusion</i>	<i>The project is considered unlikely to result in a significant residual impact to the Squatter Pigeon as the species remains common in its northern distribution, the study area is unlikely to support an important population, and extensive similar habitat occurs elsewhere in the region.</i>

## **P2: SIGNIFICANCE ASSESSMENT – Greater Glider**

The Greater Glider (*Petauroides volans*) is listed as vulnerable under the Commonwealth EPBC Act and least concern under the Queensland NC Act.

### ***Distribution and habitat***

The Greater Glider is a nocturnal species and uses tree hollows during the day to rest (van Dyck and Strahan 2008a). It may glide over distances of up to 100 m, however, it appears to have low dispersal ability and typically small home ranges of 1-4 ha. The species has an almost exclusive diet of eucalypt leaves and occasionally flowers or buds (TSSC 2016a van Dyck and Strahan 2008a). Although it is known to feed on a range of eucalypt species, in any particular area, it is likely to only forage on one or two species (van Dyck and Strahan 2008a).

The Greater Glider occurs in a range of eucalypt-dominated habitats, including low open forests on the coast to tall forests in the ranges and low woodland westwards of the Dividing Range. It does not use rainforest habitats (van Dyck et al. 2013 van Dyck and Strahan 2008a). This species favours taller, montane, moist eucalypt forests with relatively old trees and abundant hollows and a diversity of eucalypt species (TSSC 2016a).

### ***Presence in the study area***

PRESENT

This species was identified at five locations in the study area, along Smoky Creek and Billy's Gully in mixed eucalypt riparian woodland (RE 11.3.25) (Figure 15).

The approved conservation advice for this species (TSSC 2016a) indicates that taller, moist eucalypt forest with relatively old trees and abundant hollows and a diversity of eucalypt species is favoured by this species. Using this description and in consideration of the communities in which the Greater Glider was observed in the study area and in other surveys conducted throughout Central Queensland, the riparian and alluvial communities are considered to provide suitable habitat for this species. These communities are considered to provide the greatest availability of large old hollow-bearing trees and provide the greatest connectivity with larger patches of remnant vegetation in the landscape.

Habitat mapping for the Greater Glider (Figure 15) within the study area has been based on information contained in the TSSC conservation advice for the species, as well as the communities in which the Greater Glider was observed in the study area and in other surveys conducted throughout Central Queensland. Habitat is categorised as follows:

- Suitable Habitat – In line with TSSC conservation advice, remnant riparian and alluvial REs 11.3.2, 11.3.4 and 11.3.25 provide habitat.
- Unsuitable Habitat – The Greater Glider is considered unlikely to be present within other vegetation types in the study area as these lack

large, old hollow-bearing trees and a diversity of Eucalypt species. Therefore, these areas are mapped as being generally unsuitable for this species.

Based on this definition, there are 49.8 ha of suitable habitat for the Greater Glider in the study area.

#### *Importance of the population*

The population of Greater Gliders that uses the study area is considered unlikely to be an important population for the following reasons:

- key source populations either for breeding or dispersal
  - The habitat mapped for the Greater Glider within the study area is relatively small and narrow and is unlikely to support a large population. Larger watercourses and wider riparian corridors in the broader landscape are more likely to provide greater connectivity value and support larger populations, which would be more important for breeding and dispersal. Therefore, the study area is unlikely to support a key source population.
- populations that are necessary for maintaining genetic diversity
  - The population of Greater Gliders using the study area is not necessarily unique, large, isolated or genetically disjunct from any other Greater Gliders occurring in the region. Therefore, the population using the study area would not be considered necessary for maintaining genetic diversity.
- populations that are near the limit of the species range.
  - The study area is not at or near the limit of this species' range. The Greater Glider occurs throughout the eastern part of Australia and the study area is located more or less centrally within the known distribution of this species (TSSC 2016a).

#### **EPBC Act Plans**

- Conservation Advice: Approved Conservation Advice has been prepared for the Greater Glider, which recommends conservation and management actions for the species. The conservation advice also details threats to the species, and assigns consequence ratings to the threat.
- Recovery Plan: There is no Recovery Plan in place for the Greater Glider, however, the DotEE SPRAT Profile identifies that a Recovery Plan is required.
- Threat Abatement Plan: There are no threat abatement plans in place for the Greater Glider.
- Referral Guideline: There are no referral guidelines for the Greater Glider.

#### **Known threats**

The following key threats have been identified for the Greater Glider:

- habitat loss and fragmentation (through clearing and logging), causing loss of connectivity and large hollow-bearing habitat trees

- too intense or frequent fires causing population loss or declines
- climate change affecting habitat suitability and causing a range contraction
- increased predation by owls causing local extinctions (TSSC 2016a).

***Proposed Impacts***

The project would result in the clearing of approximately 1.4 ha of habitat for the Greater Glider in the study area (Figure 20). Table P2 assesses the significance of this proposed impact.

**Table P2: Assessment of significance of impacts for the Greater Glider**

Significance Criteria	Assessment of significance
<i>An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:</i>	
Lead to a long-term decrease in the size of an important population of a species	The population of Greater Gliders using the study area is not considered to be an important population. The limited extent of clearing is unlikely to decrease the size of the population present given the limited clearing that is proposed (i.e. 1.4 ha) and the extent of similar habitat available in the region.
Reduce the area of occupancy of an important population	The population of Greater Gliders using the study area is not considered to be an important population. The Greater Glider is known to be abundant in riparian vegetation along the Isaac River and other waterways in the Moranbah region (S. Marston pers. obs.). Therefore, the removal of 1.4 ha of suitable habitat is considered unlikely to reduce the area of occupancy of this species within the local Moranbah area.
Fragment an existing important population into two or more populations	The population of Greater Gliders using the study area is not considered to be an important population. Although the width of clearing for the construction of haul roads for the project across Billy's Gully and the unnamed tributary of Smoky Creek (i.e. approximately 40 m) may affect dispersal to some degree, this species is known to glide distances of up to 100 m. In addition, these waterways are not the only dispersal corridor for this species in the region. It is anticipated that the Greater Glider would also make use of other riparian corridors in the area, such as Smoky Creek, which will not be impacted by the project. Furthermore, this species typically has small home ranges of 1-4 ha. Therefore, altering connectivity along this corridor within the study area is unlikely to isolate or fragment any populations.
Adversely affect habitat critical to the survival of a species	There is no published literature that indicates what habitat may be considered critical to the survival of the Greater Glider. Riparian habitats are likely to be favoured by this species due to the typically higher abundance, height and age of eucalypt trees. It is noted that in any one area the Greater Glider tends to feed on one or two species of Eucalypt (van Dyck and Strahan 2008b). Given past observations of this species nearly always being associated with riparian vegetation over several years and during several fauna surveys (S. Marston pers. obs.) in the Central Queensland region, it appears that the species favours River Red Gum and Queensland Blue Gum as food trees in the region. These species are present along the Smoky Creek and Billy's Gully habitats (i.e. RE 11.3.25) where the Greater Glider was recorded. There is no information to suggest the habitat proposed to be cleared is critical to the survival of this species or any more important than any other similar riparian or wetland habitat in the study area or surrounding areas.
Disrupt the breeding cycle of an important population	The population of Greater Gliders using the study area is not considered to be an important population. Nonetheless, clearing of approximately 1.4 ha of habitat is unlikely to disrupt the breeding cycle of the local population. This is because it is a relatively small area of clearing compared with the availability of habitat in the broader landscape and standard industry recognised measures will be employed during the vegetation clearing stages of the project to minimise harm and disruption to animals and breeding places in accordance with the

Significance Criteria	Assessment of significance
	requirements of the Queensland Nature Conservation (Wildlife Management) Regulation 2006. These measures will reduce the risk and extent of disruption to the breeding cycle of Greater Gliders in the study area.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	<p>The proposed clearing and disturbance of 1.4 ha of Greater Glider habitat will not remove habitats, isolate habitats or degrade remaining habitats to the extent that the species is likely to decline. This is because large tracts of similar suitable habitat occurs throughout the landscape and the area proposed to be cleared is relatively small. Connectivity along Billy's Gully is unlikely to be affected by the project.</p> <p>A similar level of connectivity of the study area will be maintained with other large tracts of remnant vegetation to the north-east, associated with the Burton, Kerlong and Carborough Ranges. Riparian connectivity with the Isaac River is still evident to the east and south of the study area, south of the Peak Downs Highway. Therefore, it is considered unlikely that the species is likely to decline as a result of the impacts to connectivity along Billy's Gully.</p>
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	<p>The study area is located within a modified rural landscape where introduced plants and feral predators are present. Invasive species, including feral animals such as the Feral Cat and Domestic Dog have been identified as part of recent field surveys in the study area. Other species such as Foxes are also likely to occur in the broader landscape and the study area is accessible to such species. These existing threats will continue to be present throughout the study area during the life of the project. These types of predatory species are drawn to areas of disturbance to prey upon mammals and reptiles that are moving away from the disturbance area. Therefore, predation by feral animals is a risk to this species during and immediately after clearing activities. Predatory species are also attracted to the prey opportunities presented by cleared linear corridors, i.e. exposure of prey moving across cleared corridors.</p> <p>However, this project will not result in invasive species becoming established in habitat, as these species are already established throughout the wider landscape. Isaac Plains Mine has existing procedures in place for feral animal control, and these will be applied to the project (refer to Section 8).</p>
Introduce disease that may cause the species to decline, or	<p>There are no known pathogens or disease that may cause the Greater Glider to decline. However, the root rot fungus <i>Phytophthora</i> (<i>Phytophthora cinnamomi</i>) is known to affect the health of eucalypt species, which the Greater Glider is reliant upon as habitat. <i>Phytophthora</i> is known to occur in all states of Australia and is likely to be present in the landscape in which the study area is located. River Red Gum is thought to be tolerant of this fungus, although there is no published information for the Queensland Blue Gum. Vegetation most at risk to this fungus is thought to be in areas with average annual rainfall of &gt;600 mm (O'Gara et al. 2005). The Moranbah region falls beneath this threshold (BoM 2016). Given the fungus is likely to be already within the local area and the <i>Phytophthora</i> threat to the Greater Glider is considered to be minor at this stage by the TSSC (TSSC 2016a), it is considered unlikely that</p>



<b>Significance Criteria</b>	<b>Assessment of significance</b>
	the project will introduce disease that may cause the species to decline.
Interfere substantially with the recovery of the species.	The project will result in clearing or disturbance of 1.4 ha of habitat. The Greater Glider is known to be abundant in riparian vegetation along the Isaac River and other waterways in the Moranbah region (S. Marston pers. obs.). The limited extent of clearing is considered unlikely to interfere substantially with the recovery of the Greater Glider as extensive similar habitat areas occur elsewhere in the local and regional landscape.
<i>Conclusion</i>	<i>Given that only a small area of habitat is proposed to be cleared, and habitat will remain in the broader landscape, the project is considered unlikely to cause a significant residual impact to the Greater Glider.</i>

### **P3: SIGNIFICANCE ASSESSMENT – Koala**

The Koala (*Phascolarctos cinereus*) is listed as vulnerable under the Commonwealth EPBC Act and Queensland NC Act.

#### ***Distribution and habitat***

This species is widespread in sclerophyll forest and woodland on foothills and plains on both sides of the Great Dividing Range from about Chillagoe, Queensland to Mt Lofty Ranges in South Australia (Menkhorst and Knight 2011).

Any forest or woodland containing species that are known Koala food trees, or shrubland with emergent food trees provides potential Koala habitat. Koalas are known to occur in modified or regenerating native vegetation communities, and are not restricted to remnant vegetation (DotE 2016f). The EPBC Act referral guidelines for the vulnerable Koala (DotE 2016f) defines define Koala food trees as species of the *Angophora*, *Corymbia*, *Melaleuca*, *Lophostemon* or *Eucalyptus* genera.

#### ***Presence in the study area***

##### **HIGH LIKELIHOOD OF OCCURRENCE**

The Koala was listed as occurring in the region in database searches (Wildlife Online within 7 to 10 km of the study area). This species has been recorded in recent EIS field surveys undertaken in proximity to the study area, including:

- Integrated Isaac Plains Project EIS – the Integrated Isaac Plains study area was located approximately 8 km to the south of the study area (note this project has been withdrawn since the publication of the EIS)
- Moranbah South Project EIS – the Moranbah South study area is located approximately 4 km to the south of the study area
- Red Hill Project EIS – the Red Hill project site is located approximately 17 km to the north-west of the study area
- Caval Ridge Project EIS – the Caval Ridge ML is located approximately 11 km to the south-west of the study area.

The location of these mines and projects is shown on Figure 3.

The Koala was not identified in the study area during surveys. The EPBC Act referral guidelines for the vulnerable Koala (DotE 2014) explain, however, that "*Koalas do not necessarily have to be present*" for Koala habitat to be present. The definition of Koala habitat is based on the vegetation community present and the vegetation structure. Based on the habitat definitions contained in these guidelines and the records of the species from the region, the Koala has been assessed as having a high probability of occurrence. This rating is based on:

- The presence of suitable habitat within the study area, including riparian habitat, in the form of woodland vegetation that contains Koala food trees, as defined in the EPBC Act referral guidelines for the vulnerable Koala (DotE 2014).
- A connection between this habitat and habitat in the region, including through riparian corridors, where the Koala has been recorded. The Koala has

been recorded during field surveys undertaken for a number of other mining projects in proximity to the study area. The riparian vegetation within the study area provides a connection between these project sites and the Isaac Plains East Project.

- The Koala's ability to move between habitat areas, including its willingness to traverse cleared and disturbed areas in search of habitat (DotE 2016f).

Habitat mapping for the Koala (Figure 17) within the study area has been undertaken in accordance with the Red Hill Project EPBC Act approval definition. Habitat is categorised as follows:

- Suitable Habitat – any forest or woodland containing species that are Koala food trees, or any shrubland with emergent Koala food trees (i.e., trees of any of the following genera: *Angophora*, *Corymbia*, *Eucalyptus*, *Lophostemon*, *Melaleuca*).
- Unsuitable Habitat – Cleared areas, Brigalow and SEVT vegetation types are considered to be generally unsuitable habitat for the Koala.

All of the areas of remnant vegetation within the study area are considered to provide habitat for the Koala due to the presence of the Koala feed trees, namely:

- RE 11.3.2 – Carbeen (*Corymbia tessellaris*), Poplar Box (*Eucalyptus populnea*)
- RE 11.3.4 – Carbeen, Poplar Box, River Red Gum (*Eucalyptus camaldulensis* var. *obtusata*) and Queensland Blue Gum (*Eucalyptus tereticornis* subsp. *tereticornis*)
- RE 11.3.25 – Carbeen, Poplar Box, River Red Gum, Queensland Blue Gum, Long-fruited Bloodwood (*Corymbia clarksoniana*), Dallachy's Gum (*Corymbia dallachiana*), Narrow-leaved Red Ironbark (*Eucalyptus crebra*) and Black Tea Tree (*Melaleuca bracteata*)
- RE 11.5.3 – Poplar Box and Narrow-leaved Red Ironbark
- RE 11.5.8b – Poplar Box, Queensland Blue Gum, Long-fruited Bloodwood, Dallachy's Gum, Narrow-leaved Red Ironbark, Poplar Gum (*Eucalyptus platyphylla*) and Yellow-barked Paperbark (*Melaleuca nervosa*)
- RE 11.5.9 – Long-fruited Bloodwood, Dallachy's Gum and Narrow-leaved Red Ironbark
- RE 11.5.12 - Carbeen, Poplar Box, Long-fruited Bloodwood and Yellow-barked Paperbark
- RE 11.7.2 – Carbeen, Long-fruited Bloodwood and Narrow-leaved Red Ironbark
- RE 11.8.5 - Mountain Coolabah (*Eucalyptus orgadophila*) and Variable-barked Bloodwood (*Corymbia erythrophloia*)
- RE 11.9.7a – Poplar Box.

In addition, some areas of non-remnant habitat with emergent gums (such as Narrow-leaved Red Ironbark) are considered potential habitat for this species.

Figure 17 shows areas that have been mapped as suitable habitat. There are 380.1 ha of suitable habitat for the Koala in the study area.

The habitat within the study area has been assessed using the Koala Habitat Assessment Tool in the EPBC Act referral guidelines for the vulnerable Koala (DotE 2014). As outlined in Appendix N, the assessment of habitat in accordance with the tool indicates that the study area supports habitat critical to the survival of the Koala, with the main factors contributing to this assessment being:

- The habitat in the study area supports 12 potential feed tree species for the Koala
- The habitat in the study area is contiguous with more than 1,000 ha of habitat in the surrounding area
- The remnant vegetation along watercourses in the study area is likely to provide refuge habitat for the Koala, meaning that it may be important for achieving the interim recovery objectives for the Koala.

#### *Importance of the population*

The population of Koalas that may use the study area is considered unlikely to be an important population for the following reasons:

- key source populations either for breeding or dispersal
  - The Koala was not identified during field surveys, and no scats or scratches were observed. The study area is considered likely to support only a low density of Koalas. The suitable open woodland habitat is widespread throughout the broader landscape. Therefore, dispersal and breeding is likely to occur throughout the region and the study area is part of this broader regional habitat area.
- populations that are necessary for maintaining genetic diversity
  - Individual Koalas that may occur within the study area would be likely to belong to a larger meta-population of Koalas that would occur within areas of suitable habitat throughout the broader Moranbah region. Any population of Koalas using the study area would not necessarily be unique, large, isolated or genetically disjunct from any other Koalas occurring in the region. Therefore, any individuals using the study area would not be considered necessary for maintaining genetic diversity.
- populations that are near the limit of the species range.
  - The study area is not at or near the limit of this species' range. The Koala occurs throughout coastal and inland areas of eastern Australia and the study area is located more or less centrally within the known distribution of this species (DotE 2014).

#### **EPBC Act Plans**

- Conservation Advice: Approved Conservation Advice has been prepared for the Koala, which provides priority research and management actions for the species, as well as specifying key threats.

- Recovery Plan: There is no Recovery Plan in place for the Koala, however, the DotEE SPRAT Profile identifies that a Recovery Plan is required.
- Threat Abatement Plan: There are no threat abatement plans in place for the Koala.
- Referral Guideline: The EPBC Act Referral Guidelines for the Vulnerable Koala outline important habitat for the Koala, and a habitat assessment tool is provided to assess if the habitat within the impact area is critical to the survival of the species. The guidelines also enable the proponent to undertake an initial assessment to determine whether a significant impact is likely on the species.

### **Known threats**

Current known threats to the Koala include:

- agricultural land clearing, fragmentation and habitat degradation
- climate change altering temperatures, rainfall patterns and frequency of severe weather events
- ecosystem stresses affecting populations
- predation by the Domestic Dog
- disease and mortality caused by the Koala Retrovirus and Chlamydia
- localised overpopulation
- vehicle mortality (DotE 2016f).

### **Proposed impacts**

The project would result in the removal of approximately 124.8 ha of habitat for the Koala in the study area (Figure 21). Table P3 assesses the significance of this proposed impact.

**Table P3: Assessment of significance of impacts for the Koala**

<b>Significance Criteria</b>	<b>Assessment of significance</b>
<i>An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:</i>	
Lead to a long-term decrease in the size of an important population of a species	As discussed above, the population of Koalas that may use the study area is considered unlikely to be an important population. The extent of clearing is unlikely to decrease the size of the population present given the extent of similar habitat available in the region and likely low density of Koalas in the local area.
Reduce the area of occupancy of an important population	Any population of Koalas using the study area would not be considered to be an important population. The project would not significantly impact the area of occupancy of the population of Koalas that occurs in the region as substantial areas of similar habitat exist. For example, Queensland Government RE mapping indicates there is in the order of 55,000 ha of similar habitat (i.e. the same REs that are considered to form habitat for the Koala in the study area) in the surrounding region (i.e. within a 25 km radius of the study area).
Fragment an existing important	The Koalas that may use the study area are not considered to be a part of an important population. Connectivity of habitat will

<b>Significance Criteria</b>	<b>Assessment of significance</b>
population into two or more populations	not be compromised as a result of the project and any population within the study area will not be fragmented, as Koalas are known to readily cross cleared areas.
Adversely affect habitat critical to the survival of a species	<p>Based on advice in the EPBC Act referral guidelines for the vulnerable koala (DotE 2014), koala habitat in the study area is considered to be critical habitat (a score of 6) (refer Appendix N). It is proposed that 124.8 ha of critical habitat (with a score of 6) will be cleared or disturbed as a result of the project. Under the EPBC Act referral guidelines the significance of impacts to habitat with a score of 6 are assessed on a case by case basis, taking into account the factors listed in Figure 2 of the referral guidelines. The discussion below makes reference to these factors.</p> <p>The Koala is considered likely to occur at a low density within the study area, if it occurs at all. Line transects resulted in approximately 104.2 ha or approximately 27% of the 380.1 ha of suitable habitat within the study area being searched for Koalas without any animals or signs being recorded.</p> <p>The 124.8 ha of habitat proposed to be impacted is proposed to be completely cleared. However, connectivity of habitat will not be compromised as a result of the project and any population within the study area will not be fragmented, as Koalas are known to cross cleared areas and are not completely reliant on habitat corridors (DotE 2016f).</p> <p>Importantly, the project has been designed to avoid clearing of remnant vegetation where possible, and only involves very limited clearing of riparian vegetation which provides the highest value habitat for the koala on the study area. The riparian vegetation in the study area will therefore continue to provide connectivity to other areas of habitat beyond the study area.</p>
Disrupt the breeding cycle of an important population	The Koalas that may use the study area would not be considered to be a part of an important population. Nonetheless, clearing of approximately 124.8 ha of habitat over approximately 7 years is unlikely to disrupt the breeding cycle of the local population. This is because this is a relatively small area compared the availability of habitat in the broader landscape and standard industry recognised measures will be employed during the vegetation clearing to minimise harm and disruption to animals and breeding places in accordance with the requirements of the Queensland Nature Conservation (Wildlife Management) Regulation 2006.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The proposed clearing and disturbance of 124.8 ha of Koala habitat will not remove habitats, isolate habitats or degrade remaining habitats to the extent that the species is likely to decline. This is because the project will not sever connectivity with similar suitable habitat that occurs throughout the region and Koalas are known to disperse through cleared and modified landscapes. Connectivity with other large tracts of remnant vegetation to the north-north-east, associated with the Burton, Kerlong and Carborough Ranges and to the south-west with the Denham and Cherwell Ranges will not be substantially affected by the project. The project has been designed to avoid clearing of remnant vegetation were possible, and only involves very

<b>Significance Criteria</b>	<b>Assessment of significance</b>
	<p>limited clearing of riparian vegetation which provides the highest value habitat for the koala on the study area. The riparian vegetation in the study area will therefore continue to provide connectivity to other areas of habitat beyond the study area.</p> <p>Furthermore, the Koala is likely to occur at only a low density within the study area, if it occurs at all. Prior to any clearing, a spotter catcher will undertake pre-clearing inspections to ensure any impacts to this species is limited. Therefore any impact to habitat is not likely to impact the species to the extent that it is likely to decline.</p>
<p>Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat</p>	<p>The study area is located within a modified rural landscape where introduced plants and feral predators are present. Invasive species and feral animals such as the Feral Cat and Domestic Dog have been identified as part of field surveys in the study area. Other species such as Foxes are also likely to occur in the broader landscape. These predatory species already pose a risk to the Koala in the habitat areas present and the project is unlikely to increase this threat.</p>
<p>Introduce disease that may cause the species to decline, or</p>	<p>Three viruses are known to affect Koalas in the wild, Chlamydia and Koala Retrovirus (KoRV-A and KoRV-B). It is known that Chlamydia is a sexually transmitted disease in Koalas, however, how the Retrovirus is spread contagiously is unknown. Studies have shown that 100% of Koalas in the wild have the Retrovirus, and the majority of Queensland and New South Wales populations are infected with Chlamydia (Hanger and Loader 2009).</p> <p>Stress has been suggested to exacerbate the effects of disease on Koala populations in more populated areas. However, the project is not considered to present a significant mechanism, whereby the clearing of habitat would result in the introduction or increase the prevalence of these diseases in the local Koala population. This is because of the extensive area of habitat in the landscape and the likely low density of Koalas using the study area as evidenced by the lack of traces of this species (e.g. scats) recorded during the targeted field surveys. Therefore, the project is considered unlikely to introduce disease that may cause the species to decline.</p>
<p>Interfere substantially with the recovery of the species.</p>	<p>The project will result in clearing or disturbance of 124.8 ha of Koala habitat. However, if the Koala does occur within the study area it is considered to be present at low densities, if at all, as line transects resulted in the survey of approximately 27% of suitable habitat, without an animal being recorded. A large area of similar habitat will remain within the surrounding area with approximately 55,000 ha of similar habitat (i.e. the same REs that are considered to form habitat for the Koala in the study area) within a 25 km radius of the study area.</p> <p>As stated in the EPBC Act referral guidelines, riparian vegetation is considered to be important for the recovery of the species. The project has been designed to avoid clearing of remnant vegetation where possible, and involves only very limited clearing of some areas of riparian vegetation which provides the highest value habitat for the koala in the study area. The riparian vegetation in the study area will therefore continue to provide</p>

<b>Significance Criteria</b>	<b>Assessment of significance</b>
	<p>connectivity to other areas of habitat beyond the study area. As discussed above, the project is not likely to increase koala fatalities due to dog attacks or vehicle strike, nor will it facilitate the introduction or spread of disease. Further, the project will not create a barrier to movement to or between critical habitat, given the project has been designed to avoid clearing of remnant vegetation where possible, and only involves very limited clearing of riparian vegetation which provides the highest value habitat for the koala on the study area. Therefore the project is considered unlikely to substantially interfere with the recovery of the Koala in the broader Moranbah region.</p>
<i>Conclusion</i>	<p><i>As the population of Koalas that may occur within the study area is not considered to be an important population, and habitat will remain in the broader landscape, the project is considered unlikely to cause a significant impact to the Koala.</i></p>



#### **P4: SIGNIFICANCE ASSESSMENT – Migratory birds**

Habitat occurs throughout the study area for the four migratory birds identified or considered to potentially occur. The study area provides foraging habitat but is unlikely to provide breeding habitat for any migratory species. In the case of the Fork-tail Swift and White-throated Needletail, these species are more likely to overfly and forage above the study area rather than use on-ground habitats.

All remnant vegetation in the study area potentially provide habitat, to some extent, for these species and are preferred over cleared or heavily disturbed areas due to the structural diversity of habitats in remnant areas. However, cleared areas may provide foraging habitat for the White-throated Needle-tail and Fork-tailed Swift as these are predominantly aerial species. Remnant habitats comprise 345.2 ha within the study area.

Two key concepts are important in assessing the significance of impacts against the EPBC Act Significant Impact Guidelines. They are defined below.

##### ***Important habitat***

Determining if an area of 'important habitat' for a migratory species listed under the EPBC Act occurs within the impact area is necessary in addressing the significant impact criteria for migratory species. Important habitat for a migratory species is:

- habitat utilised by a migratory species occasionally or periodically within a region that supports an ecological significant proportion of the population of the species, and/or
- habitat that is of critical importance to the species at particular life-cycle stages, and/or
- habitat utilised by a migratory species which is at the limit of the species range, and/or
- habitat within an area where the species is declining (DotE 2013).

It is considered unlikely that the study area provides important habitat for any migratory species due to:

- there being a relatively small number of individuals observed, i.e. less than 0.1% of the population of each species (DotE 2015b)
- the extent of agricultural clearing on alluvial flats adjacent to watercourses, significantly narrowing these riparian habitats
- the woodland habitat in the study area lacking dense and wet habitat understory features preferred by the Black-faced Monarch and Rufous Fantail
- vegetation within and adjacent to the study area being relatively fragmented
- the availability of larger more intact remnant landscapes to the north-east and south-west of the study area associated with the Isaac River, Denham, Peak, Carborough and Kerlong Ranges, which are likely to be more important habitat for migratory species.

### **Ecologically significant proportion**

An ecologically significant proportion of a migratory species will differ between species, however, the species' population status, genetic distinctiveness and species specific behavioural patterns (for example, site fidelity and dispersal rates) should be considered in evaluating this (DotE 2013).

The study area is unlikely to provide important habitat for any migratory species. It is also unlikely to support an ecologically significant proportion of the population of a migratory species, as this would have been evident as a result of seasonal surveys undertaken for the project. There was no evidence of important habitat areas, roost sites or other wetland features that could be used by large numbers of birds.

### **Known threats**

There are no significant threats to the White-throated Needletail and Fork-tailed Swift in Australia, however the following are potential threats to the Black-faced Monarch and Rufous Fantail:

- invasive vines in riparian habitat, e.g. Rubber Vine.
- fragmentation and loss of core moist forest breeding habitat through land clearing and urbanisation
- predation or competition by the Feral Cat (*Felis catus*) and Black Rat (*Rattus rattus*) (DotE 2016h, 2015b).

### **Proposed impacts**

Approximately 122.3 ha of remnant vegetation is proposed to be cleared within the study area (Figure 18). Table P4 assesses the significance of this impact on migratory birds.

**Table P4: Assessment of significance of impacts for migratory birds**

<b>Significance Criteria</b>	<b>Assessment of significance</b>
<i>An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:</i>	
Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species;	The study area is unlikely to provide important habitat for a migratory species, therefore, important habitat will not be substantially modified, destroyed or isolated by the project. Additionally, the proposed clearing of 122.3 ha falls beneath the suggested thresholds for a significant impact for the relevant species in the Draft referral guidelines for 14 birds listed migratory under the EPBC Act (DotE 2015b).
Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species, or	The study area is unlikely to provide important habitat for a migratory species. Therefore, an invasive species, that is harmful to a migratory species, will not become established in important habitat as a result of the project.
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant	An ecologically significant proportion of the population of a migratory species is considered unlikely to occur in the study area. Therefore, the project will not seriously disrupt the lifecycle of an ecologically

<b>Significance Criteria</b>	<b>Assessment of significance</b>
proportion of the population of the migratory species.	significant proportion of the population of a migratory species.
<i>Conclusion</i>	<i>The project will not cause a significant residual impact to migratory species listed under the EPBC Act.</i>

## **Appendix Q**

Terrestrial MNES and MSES likely to require environmental offsets

**Table Q1: Terrestrial MNES and MSES likely to require environmental offsets**

Protected Matter	Presence in the study area	Potential project impacts	Offsets proposed under the EPBC Act	Offsets proposed under EO Act	Terrestrial Ecology Report section
<b>MNES Only</b>					
• None					
<b>Dual Listed MNES and MSES</b>					
• None					
<b>MSES Only</b>					
• Regulated vegetation - of concern REs					
RE 11.9.7a (sparse structure)	8.5 ha	Clearing 3.7 ha	Not an MNES	Yes – Offsets are required under the EO Act for significant residual impacts, i.e. clearing greater than 2.0 ha of remnant of concern RE with a sparse structure <sup>+</sup>	Sections: <ul style="list-style-type: none"> <li>▪ 5.2.3</li> <li>▪ 7.2.1</li> <li>▪ Appendix K</li> <li>▪ Appendix O</li> </ul>
• Watercourse REs – Within defined distance to VM Act watercourses					
11.3.25 (mid-dense structure)	38.9 ha	Clearing 0.7 ha for the construction of haul road connections (i.e. linear infrastructure)	Not an MNES	Yes – Offsets are required under the EO Act for significant residual impacts, i.e. clearing for linear infrastructure of greater than 10 m wide in a remnant RE with a mid-dense structure within the defining distance of a watercourse <sup>+</sup>	Sections: <ul style="list-style-type: none"> <li>▪ 5.2.3</li> <li>▪ 7.2.1</li> <li>▪ Appendix K</li> <li>▪ Appendix O</li> </ul>

+ As advised in the SRI Guideline (EHP 2014a)

## **Appendix R**

EO Act significance assessments

## ***Introduction***

Database searches and desktop review indicated the potential for various NC Act listed flora and fauna species to occur in the study area.

Two NC Act listed threatened fauna species are considered to have suitable habitat within the study area, namely the Squatter Pigeon (southern subspecies), and Koala. These species are also listed under the EPBC Act, and have been assessed against the EPBC Act Significant Impact Guidelines 1.1: Matters of National Environmental Significance (DotE 2013) in Appendix P.

The Short-beaked Echidna was the only special least concern fauna species (non-migratory) recorded in the study area that is not also listed under the provisions of the EPBC Act.

This appendix provides an assessment of the significance of impacts of the project to the Short-beaked Echidna against the Queensland Environmental Offset Policy Significant Residual Impact Guideline (EHP 2014a). The Short-beaked Echidna is a non-migratory, special least concern species listed under the NC Act.

Special least concern migratory species are not MSES under the EO Act and therefore have not been assessed against these Queensland guidelines.

## R1: SIGNIFICANCE ASSESSMENT – Short-beaked Echidna

The Short-beaked Echidna is listed as special least concern under the Queensland NC Act.

### ***Habitat and distribution***

The Short-beaked Echidna occurs in almost all terrestrial habitats except intensively managed farmland. It shelters in logs, crevices, burrows or piles of litter and feeds on ants, termites and other soil invertebrates, particularly beetle larvae (Menkhorst and Knight 2011).

### ***Presence in the study area***

The Short-beaked Echidna was recorded at three locations in cleared and vegetated areas in the study area. While this species is likely to use all areas of the study area for dispersal, remnant vegetation communities are considered to provide more favourable habitat due to the presence of foraging resources such as hollow logs and leaf litter.

Approximately 345.2 ha of foraging habitat is present in the study area (Figure 18).

### ***Known threats***

The likely predators of the Short-beaked Echidna area Feral Cats, Foxes, Domestic Dogs and Goannas (NPWS 1999).

### ***Proposed impacts***

The project will result in the removal of approximately 122.3 ha of Short-beaked Echidna habitat within the study area (Figure 18). Despite this reduction in habitat, connectivity to retained habitat and adjoining vegetation communities will not be substantially changed in the local landscape. Table R1 provides an assessment of the significance of these impacts against the Queensland Significant residual impact guidelines

**Table R1: Assessment of significance of impacts for the Short-beaked Echidna**

<b>Significance Criteria</b>	<b>Assessment of significance</b>
<i>An action is likely to have a significant impact on a special least concern (non-migratory) animal wildlife habitat if it is likely that it will result in:</i>	
A long-term decrease in the size of a local population; or	Approximately 122.3 ha of habitat formed by remnant vegetation is proposed to be cleared as part of the project. As Short-beaked Echidna habitat is widespread in the region and this species does not have specific habitat requirements, this clearing is unlikely to lead to a long-term decrease in the local population.
A reduced extent of occurrence of the species; or	Short-beaked Echidna habitat is proposed to be cleared as part of the project. However, the reduction of 122.3 ha of habitat is considered unlikely to affect the ability of the species to persist in the local area because of the extent of habitat that will remain and their broad habitat requirements. Therefore, the extent of occurrence of this species is unlikely to be reduced as



<b>Significance Criteria</b>	<b>Assessment of significance</b>
	a result of the project.
Fragmentation of an existing population; or	Connectivity of habitat will not be substantially altered as a result of the project as this species is known to use disturbed and cleared areas (Figure 18). As the Short-beaked Echidna is a mobile species the local population is unlikely to be fragmented due to the proposed clearing for the project.
Result in genetically distinct populations forming as a result of habitat isolation; or	As the local population is unlikely to be fragmented or become isolated, the gene flow within the local population is unlikely to be affected by the project.
Disruption to ecologically significant locations (breeding, feeding or nesting sites) of a species.	Standard industry recognised measures will be employed during the vegetation clearing stages of the project to minimise harm and disruption to animals and breeding places in accordance with the requirements of the Queensland Nature Conservation (Wildlife Management) Regulation 2006. This will reduce the risk and extent of disruption to the breeding cycle of the Short-beaked Echidna in the study area.
<i>Conclusion</i>	<i>Given the relatively small area of habitat proposed to be cleared as part of the project, the broad habitat requirements and mobility of the species, it is not likely that the project will have a significant residual impact on the Short-beaked Echidna.</i>

## **Appendix S**

Output of Landscape Fragmentation and Connectivity Tool

ipe CONNECTIVITY - LOGFILE - 20160727.txt

Department of Environment and Heritage Protection (DEHP)  
Landscape Fragmentation and Connectivity (LFC) Tool version 1.4 LOGFILE  
Process started at 26-07-2016 12:23:29 AM  
Python version: 2.7.10 (default, May 23 2015, 09:40:32) [MSC v.1500 32 bit (Intel)]  
Arcpy version: 10.4.1  
Username: Administrator

INPUT PARAMETERS

Output Workspace: C:\20160721 - CONNECTIVITY\07 OUTPUT\DP\_EHP\_LFC\_TOOL\Output  
Threshold lookup table: C:\G200 -  
CONNECTIVITY\SOFTWARE\LFC\_data.gdb\tbl\_Regional\_frag\_local\_threshold  
Remnant cover layer: C:\20160721 - CONNECTIVITY\06 FINAL VEG\IPE FINAL VEG -  
AMGZ55.shp  
Remnant cover layer edited: True  
Regional buffer extent: 20 kilometres  
Local buffer extent: 5 kilometres  
Impact layer: C:\20160721 - CONNECTIVITY\03 DISTURBANCE\IPE DISTURBANCE -  
AMG55.shp  
layer projection: AGD\_1984\_AMG\_Zone\_55  
Raster cell resolution for analysis: 10 metres  
Edge Width: 50 metres  
(The distance from non-remnant landscapes through to the core ecosystem - the edge of  
remnant ecosystems)  
Default projection: C:\G200 - CONNECTIVITY\SOFTWARE\scripts\QLD Albers Equal Area  
Conic.prj

00:23:29 Checking out the spatial analyst tool - required for LFC

00:23:29 \_\_\_\_\_BEGINNING LANDSCAPE FRAGMENTATION AND CONNECTIVITY  
ANALYSIS\_\_\_\_\_

00:23:29 This tool will categorise the landscape into:  
{0: 'non-rem', 1: 'patch', 2: 'edge', 3: 'perforated', 4: 'core (< 100 hectares)', 5: 'core (100-500  
hectares)', 6: 'core (> 500 hectares)'}

00:23:29 Deleted existing .img files  
00:23:50 Deleted existing files in output folder  
00:23:51 Deleted existing pre-impact file geodatabase  
00:23:55 Deleted existing post-impact file geodatabase  
00:23:58 Copying across impact site feature(s) and calculating area in hectares (AreaHA)  
00:23:58 Making a local copy of the impact site  
00:23:59 Preparing remnant cover layer for analysis  
00:24:01 Created regional scale buffer of 20 kilometres  
00:24:03 Created local scale buffer of 5 kilometres  
00:24:09 Clipped the remnant cover to the regional buffer extent  
00:24:10 Unioned the pre impact remnant layer with the impact site  
00:24:12 Attributed the impact area as non-remnant  
00:24:13 Categorized the cover attributes in clip\_remcover\_pre.shp ready for raster  
conversion  
00:24:21 Converted clip\_remcover\_pre.shp to raster  
  
00:24:22 Categorized the cover attributes in clip\_remcover\_post.shp ready for raster  
conversion

IFE CONNECTIVITY - LOGFILE - 20160727.txt

00:24:31 Converted clip\_remcover\_post.shp to raster

00:24:31 Run Landscape fragmentation analysis on the pre impact regional landscape

NATURALLY VEGETATED AND CLEARED LAND BEING EXTRACTED FROM LAND COVER  
IDENTIFICATION OF CORE, PATCH, EDGE AND PERFORATIONS  
COMBINING FRAGMENTATION CLASSES  
CLASSIFYING CORE FOREST PATCHES BY AREA  
COMPOSING FINAL FRAGMENTATION MAP  
COMPOSING FINAL FRAGMENTATION MAP  
(FRAGMENTATION CALCULATION TIME WAS 3.7 MINUTES)

00:28:14 Run Landscape fragmentation analysis on the post impact regional landscape

NATURALLY VEGETATED AND CLEARED LAND BEING EXTRACTED FROM LAND COVER  
IDENTIFICATION OF CORE, PATCH, EDGE AND PERFORATIONS  
COMBINING FRAGMENTATION CLASSES  
CLASSIFYING CORE FOREST PATCHES BY AREA  
COMPOSING FINAL FRAGMENTATION MAP  
COMPOSING FINAL FRAGMENTATION MAP  
(FRAGMENTATION CALCULATION TIME WAS 3.8 MINUTES)

Extracting a local subset of lfc\_regional\_pre\_impact  
Extracting a local subset of lfc\_regional\_post\_impact

Collating pre and post impact statistics and trigger assessment

00:32:17 Summarising area statistics for: lfc\_localmsk\_pre\_impact  
00:32:17 Summarising area statistics for: lfc\_localmsk\_post\_impact  
00:32:17 Summarising area statistics for: lfc\_regional\_pre\_impact  
00:32:17 Summarising patch count for lfc\_localmsk\_pre\_impact  
00:32:20 Summarising patch count for lfc\_localmsk\_post\_impact

Analysing impact on Connectivity Areas

SIGNIFICANCE TEST ONE

The regional total area is 161988.34  
The regional extent of core remnant is 56780.45  
The regional extent of core remnant is 35.05 percent  
This level of regional fragmentation sets a local impact threshold of: 10.0 percent

The table below lists the local impact thresholds for categories of regional core remnant extent:

REGIONAL CORE CATEGORY	LOCAL IMPACT THRESHOLD
< 10	2.0
10 - 30	5.0
30 - 50	10.0
50 - 70	20.0
70 - 90	30.0
>90	50.0

Area of core at the local scale (pre impact): 3773.88  
Area of core at the local scale (post impact): 3661.63  
Percent change of core at the local scale (post impact): 2.97

IFE CONNECTIVITY - LOGFILE - 20160727.txt

SIGNIFICANCE TEST TWO

The number of core remnant areas occurring on the site: 2  
The number of core remnant areas remaining on the site post impact: 2  
(Only core polygons greater than or equal to 1 hectare are included)

RESULT

00:32:27 This analysis has determined any impact on connectivity areas is NOT significant  
(A significant reduction in core remnant at the local scale is False OR a change from core to non-core remnant at the site scale is False)

The significance table has been written to: ..\main\_output\lfc\_significance\_assessment.csv  
The local scale summary table has been written to: ..\main\_output\lfc\_local\_scale\_summary.csv  
The site scale summary table has been written to: ..\main\_output\lfc\_site\_scale\_summary.csv  
GIS layer files copied into folder \lyr\_file within the project folder.  
View layers in ArcMAP using..\C:\20160721 - CONNECTIVITY\07  
OUTPUT\DP\_EHP\_LFC\_TOOL\Output\lyr\_file\lyr\_file\Connectivity Area Impact Assessment.lyr

Please scrutinise the output tables and spatial layers to confirm the desktop modelling of connectivity area impact

This analysis used an edited version of the Regulated Vegetation layer.

00:33:01 \_\_\_\_\_COMPLETED LANDSCAPE FRAGMENTATION AND  
CONNECTIVITY ANALYSIS\_\_\_\_\_

# Habitat Quality Plot Ecological Report



**ecosm.com.au**

## **ISAAC PLAINS EAST PROJECT HABITAT QUALITY ASSESSMENTS**

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**July 2018**

## Disclaimer

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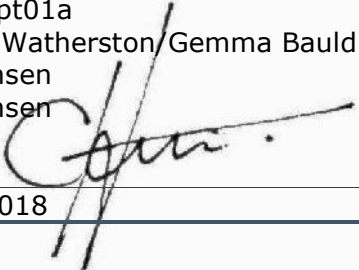
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## Document History and Status

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Document version:	18018_Rpt01a
Author(s):	Meredith Watherston/Gemma Bauld
Reviewed by:	Chris Hansen
Approved by:	Chris Hansen
Signed :	
Date issued:	12 July 2018

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## Contents

1	Introduction .....	1
1.1	Description of the project area.....	1
1.2	Objectives.....	2
2	Methodology.....	3
2.1	Field methods.....	3
2.1.1	Timing .....	3
2.1.2	Habitat quality assessment plots .....	4
2.1.3	Photo monitoring points .....	6
2.1.4	Co-ordinate system and map datum .....	6
2.1.5	Climatic conditions .....	6
3	Results .....	7
3.1	Site condition .....	7
3.2	Species habitat indices .....	7
4	References .....	11

## List of Tables

Table 1:	Regional ecosystems in the IPE project area .....	1
Table 2:	Habitat quality plots (HQPs) and corresponding RE .....	5
Table 3:	Additional attributes recorded within upgraded habitat quality plots.	5
Table 4:	Monthly rainfall (mm) for Moranbah prior to and following the survey .....	6

## List of Figures

Figure 1:	Location of the Isaac Plains East project area.....	14
Figure 2:	Location of habitat quality plots.....	15

## Appendices

- Appendix A: Breakdown of habitat quality data
- Appendix B: Photos in habitat quality plots

## Symbols and Abbreviations

*	(Preceding a plant species name) plant species not native to Australia
AU	Assessment units
BAMM	Biodiversity Assessment and Mapping Methodology
BoM	Bureau of Meteorology
BPA	Biodiversity Planning Assessment
DBH	Diameter at breast height
DES	(Queensland) Department of Environment and Science
DSITI	(Queensland) Department of Science, Information Technology and Innovation
EHP	Former (Queensland) Department of Environment and Heritage Protection
EMZ	Environmental management zone
GIS	Geospatial information systems
GPS	Global positioning system
ha	Hectares
HQ	Habitat Quality
km	Kilometres
QEOP	Queensland Environmental Offset Policy
RE	Regional Ecosystem as defined under the Queensland Vegetation Management Regulation 2000

## Glossary

Term	Definition
Benchmark condition	Benchmark condition describes the standard or typical condition of a particular RE in an undisturbed condition and is determined from an average value from mature and long undisturbed reference of 'Best on Offer' sites (Eyre et al. 2011). Benchmarks are developed by the EHP for various vegetation communities, but not all at this stage.
Bioregion	A geographically distinct biological region, which is a reporting unit for assessing the status of native ecosystems and their level of protection. Australia is divided into 89 bioregions. Bioregions form part of the regional ecosystem classification code system. The study area is located Northern Bowen Basin sub-region of the Brigalow Belt Bioregion.
Broad vegetation group	Broad vegetation groups were developed by the Queensland Herbarium to group vegetation communities at a high level, and are included in the regional ecosystem spatial dataset.
Project area	The mining lease boundary for the project as shown on Figure 1.
Region	The local area surrounding the study area, including the landscape within 25 km of the project area.
Regional ecosystem	A vegetation community within a bioregion that is consistently associated with a particular combination of geology, landform and soils.
Remnant vegetation	Defined under the Queensland <i>Vegetation Management Act 1999</i> as, woody vegetation that has not been cleared or vegetation that has been cleared but where the dominant canopy has >70 % of the height and >50 % of the cover relative to the undisturbed height and cover of that stratum and is dominated by species characteristic of the vegetation's undisturbed canopy.

## 1 Introduction

In 2018 the Isaac Plains East (IPE) mining leases and the Commonwealth Department of the Environment and Energy (DoEE) and the Queensland Department of Environment and Heritage Protection (EHP) approvals were granted allowing the extension of the life of the Isaac Plains Complex. As part of the approvals, offsets for impacts to state and Commonwealth matters of environmental significance are required to be secured, including for the Koala (*Phascolarctos cinereus*), Squatter Pigeon (southern) (*Geophaps scripta scripta*) and Greater Glider (*Petauroides volans*).

This habitat quality assessment was undertaken for the IPE project area to assist Stanmore Coal in determining the baseline habitat quality for the matters of state and Commonwealth environment significance against which to compare proposed offsets for these matters.

### 1.1 Description of the project area

The project area is located approximately 170 km south-west of Mackay in central Queensland (Figure 1). The Kerlong and Carborough Ranges are located to the north-east and the region is part of the Northern Bowen Basin sub-region within the Brigalow Belt (North) Bioregion. Smoky Creek, its northern tributary and Billy's Gully are located within the project area and are part of the Isaac River Catchment (Figure 2).

Terrestrial ecological studies were undertaken in late 2015 and early 2016 for the project area as part of the impact assessment for the project. As part of these studies regional ecosystems (REs) were validated and mapped throughout the project area and are shown on Figure 2. Eleven REs, comprising remnant and regrowth vegetation, have been mapped for the project area as outlined in Table 1.

**Table 1: Regional ecosystems in the IPE project area**

RE	Short Description		VM Act Status	Area (ha)
<b>Remnant</b>				
11.3.2	<i>Eucalyptus populnea</i> woodland on alluvial plains		Of concern	1.2
11.3.4	<i>Eucalyptus tereticornis</i> and/or <i>Eucalyptus spp.</i> woodland on alluvial plains		Of concern	0.5
11.3.25	<i>Eucalyptus camaldulensis</i> or <i>Eucalyptus tereticornis</i> riparian open forest to woodland		Least concern	48.1
11.5.3	<i>Eucalyptus populnea</i> +/- <i>E. melanophloia</i> +/- <i>Corymbia clarksoniana</i> woodland on Cainozoic sand plains and/or remnant surfaces		Least concern	105.2
11.5.8b	<i>Corymbia clarksoniana</i> , <i>Eucalyptus exserta</i> , <i>E. crebra</i> , <i>E. tereticornis</i> , <i>E. platyphylla</i> woodland on Cainozoic sand plains and/or remnant surfaces		Least concern	3.4

RE	Short Description		VM Act Status	Area (ha)
11.5.9	<i>Eucalyptus crebra</i> and other <i>Eucalyptus spp.</i> and <i>Corymbia spp.</i> woodland on Cainozoic sand plains and/or remnant surfaces		Least concern	9.7
11.5.12	<i>Corymbia clarksoniana</i> woodland and other <i>Corymbia spp.</i> and <i>Eucalyptus spp.</i> on Cainozoic sand plains and/or remnant surfaces		Least concern	142.2
11.7.2	<i>Acacia spp.</i> woodland on Cainozoic lateritic duricrust. Scarp retreat zones		Least concern	14.6
11.8.5	<i>Eucalyptus orgadophila</i> open woodland on Cainozoic igneous rocks		Least concern	11.8
11.9.7a	<i>Eucalyptus populnea</i> , <i>Eremophila mitchellii</i> shrubby woodland on fine-grained sedimentary rocks		Of concern	8.5
<b>Regrowth</b>				
11.9.5	<i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> open forest on fine-grained sedimentary rocks		Endangered	9.0
<b>Total Area</b>				<b>354.2</b>

Source: (Ecological Survey & Management 2016)

## 1.2 Objectives

The purpose of this habitat quality assessment is to measure 13 'site condition' attributes for each RE and 5 'species habitat index' attributes for each of the threatened species (i.e. Koala, Squatter Pigeon and Greater Glider) in the project area.

Collection of this data will allow for habitat quality scoring to be undertaken for these species in accordance with the Queensland Environmental Offset Policy (QEOP) *Guide to determining terrestrial habitat quality* (Version 1.2) (EHP 2017). Determining 'site context' attributes do not form part of this scope of works and will be developed by others as part of the separate habitat scoring process.

## **2 Methodology**

### **2.1 Field methods**

A series of habitat quality plots were undertaken in the IPE project area to capture site information. This field data can then be used in combination with geospatial information to determine a habitat quality score for species and communities in the project area, using the methodology outlined in the Habitat Quality Guide.

The methodology undertaken as part of this assessment was developed in order to capture information about 'site ecological condition' and 'habitat indices', which are two of the three components required to develop a habitat quality score. The third component, the 'site context' information is developed geospatially and does not form part of this assessment.

#### ***Site condition***

The site ecological condition attributes required to be assessed, include:

- recruitment of woody perennial species
- native plant species richness - trees
- tree canopy height
- tree canopy cover
- shrub canopy cover
- native perennial grass cover
- organic litter
- large trees
- coarse woody debris
- weed cover.

#### ***Habitat indices***

Habitat indices were recorded for each relevant species (i.e. Koala, Squatter Pigeon (southern) and Greater Glider) at each habitat quality plot. The following habitat attributes as they relate to each assessment unit or habitat quality plot if variable for each species were assessed:

- threats to species
- quality and availability of food and foraging habitat
- quality and availability of shelter
- species mobility capacity
- role of site location to species overall population in the state.

##### ***2.1.1 Timing***

Two ecologists undertook the ecological survey of the habitat quality plots over three days between and including 19 and 21 April 2018. This survey

supplemented a number of survey sites undertaken as part of the previous studies for the IPE project impact assessment over four days (22 - 24 September and 20 October) in 2015 and five days (24 - 28 February) in 2016.

### **2.1.2 Habitat quality assessment plots**

The 2016 field surveys were carried out in compliance with the *Methodology for Survey and Mapping of Regional Ecosystems and Vegetation communities in Queensland (Versions 3.2 and 4.0)* (Neldner et al. 2017, 2012). The subsequent vegetation validation and mapping, which was previously undertaken for the IPE project area (Figure 2), was used. Secondary survey sites undertaken as part of the IPE project impact assessment in late 2015 and early 2016 were used as a basis for the habitat quality plots. Data recorded at each secondary survey site included:

- date and precise location (with reference to handheld GPS)
- soils, slope, aspect and landform observations
- ground-layer, mid-stratum and canopy species composition and abundance
- structural characteristics
- condition and disturbance of existing vegetation communities (including distribution of weed species)
- quantitative and qualitative species composition within a 1,000 m<sup>2</sup> quadrat, and documentation of ancillary species identified within the immediate area or during foot traverse
- basal area of vegetation (Bitterlich Stick methodology)
- photographs of the community (north, east, south, west, groundcover and soils).

These survey sites were then upgraded with additional data collection in April 2018 into habitat quality plots. Habitat quality plots were performed throughout the project area so as to survey each RE. Some REs comprised more than one polygon within the project area and therefore, assessment units were established that represented each RE.

A total of 21 habitat quality plots were assessed in ten assessment units and are shown on Figure 2 and outlined in Table 2. The field-validated polygon of RE 11.3.4 was too small to install a habitat quality plot and therefore was not assigned an assessment unit. Instead this RE comprises the same broad vegetation group as RE 11.3.25 and therefore has been included in the same assessment unit in Table 2. The polygon of RE 11.3.2 associated with the northern tributary was also too small to install a habitat quality plot. A nearby polygon of RE 11.3.2, located upstream of the project area on Smoky Creek, was used as a representative surrogate for the polygon within the project area (Figure 2).

**Table 2: Habitat quality plots (HQPs) and corresponding RE**

Assessment Unit	RE	Area (ha)	Number HQPs
AU1	11.3.2	1.2	1
AU2	11.3.25/11.3.4	48.6	6
AU3	11.5.3	105.2	3
AU4	11.5.8b	3.4	1
AU5	11.5.9	9.7	2
AU6	11.5.12	142.2	3
AU7	11.7.2	14.6	1
AU8	11.8.5	11.8	1
AU9	11.9.7a	8.5	2
AU10	Regrowth 11.9.5	9.0	1
<b>Total</b>		<b>354.2</b>	<b>21</b>

Data recorded at these 21 sites complied with the *Guide to determining terrestrial habitat quality: A toolkit for assessing land based offsets under the Queensland Environmental Offsets Policy, Version 1.2* (EHP 2017) (hereafter referred to as the Habitat Quality Guide), which requires that one or more habitat quality plots be installed in each assessment unit. Each habitat quality plot involved a 100 m x 50 m plot in which a series of attributes were recorded in accordance with the Habitat Quality Guide. Attributes recorded are in addition to those recorded as part of the secondary survey methodology described above, and are outlined in Table 3.

The median vegetation height data was measured using a laser rangefinder (hypsoneter) and the diameter of trees measured at breast height (nominally 1.3 m above the ground) with a diameter at breast height (DBH) tape.

**Table 3: Additional attributes recorded within upgraded habitat quality plots**

Sub Plot	Attributes
100 m transect	<ul style="list-style-type: none"> <li>▪ Tree canopy cover (%)</li> <li>▪ Tree sub-canopy cover (%)</li> <li>▪ Native shrub cover (%)</li> </ul> <p>Measured as percentage of living foliage cover that intercepts the transect line.</p>
100 m x 50 m plot	<ul style="list-style-type: none"> <li>▪ Number of large eucalypt trees</li> <li>▪ Number of large non-eucalypt trees</li> <li>▪ Tree canopy height - median canopy height (m)</li> <li>▪ Recruitment of canopy species - proportion of dominant canopy species that are regenerating (%)</li> <li>▪ Native tree species richness - number of species present</li> </ul>
50 m x 20 m plot	<ul style="list-style-type: none"> <li>▪ Coarse woody debris - length of all logs &gt;10 cm diameter, 0.5 m in length</li> </ul>
50 m x 10 m plot	<ul style="list-style-type: none"> <li>▪ Native shrub, grass and forbs/other species richness</li> <li>▪ Non-native plant cover - cover of exotic species as a</li> </ul>



Sub Plot	Attributes
	component of the overall vegetation cover (%)
1 m x 1 m quadrats	<ul style="list-style-type: none"> <li>▪ Native perennial grass cover (%)</li> <li>▪ Organic litter cover (%)</li> <li>▪ Native forbs and other species (%)</li> <li>▪ Native shrubs (&lt;1 m in height) (%)</li> <li>▪ Non-native grass (%)</li> <li>▪ Non-native forbs and shrubs (%)</li> </ul> <p>[Note: Not all of the above attributes are used in the habitat quality score. Assessing all attributes improves the reliability of cover estimates for the assessable attributes, namely native perennial grass cover and organic litter cover.]</p>

### 2.1.3 Photo monitoring points

Photographs of the vegetation within the assessment plot were taken at the ends of the plot (i.e. the 0 and 100 m mark), and in the directions of north (0°), east (90°), south (180°) and west (270°) at the centre of the plot (i.e. the 50 m mark). Photos of the groundcover intersected by the centreline tape and soils were also taken at the 50 m mark along the plot.

### 2.1.4 Co-ordinate system and map datum

Locations were recorded using the UTM coordinate system. All locations presented in this report are within zone 55K. The map datum used was WGS84.

### 2.1.5 Climatic conditions

Weather conditions during and leading up to the survey period were relatively dry and warm, with maximum day time temperatures reaching in the high 20s to mid-30s and night time temperatures in the mid-teens to low 20s at Moranbah Airport Weather Station (BoM 2018). Total rainfall for the region leading up to the field survey was substantially less than average, except in October 2017 and February 2018, as shown in Table 4 below.

**Table 4: Monthly rainfall (mm) for Moranbah prior to and following the survey**

Month	2017							2018			
	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April
Average	22.1	18.0	25.0	9.1	35.7	69.3	103.9	103.8	100.7	55.4	36.4
Actual Rainfall Total 2017/2018	0.0	1.6	1.2	0.4	86.0	39.4	16.2	20.4	183.4	13.0	8.0

Source: (BoM 2018)

## 3 Results

### 3.1 Site condition

Data collected from each of the habitat quality plots is provided in Appendix A and field data sheets provided in Appendix B. Representative photos of each of the monitoring sites is provided in Appendix C.

### 3.2 Species habitat indices

The habitat assessed as part of this habitat quality assessment draws on the mapping and habitat criteria developed for the IPE project impact assessment to maintain consistency (Ecological Survey & Management 2016). The following sections describe the habitat for each of the species in relation to the habitat indices applied for the project area.

#### ***Squatter Pigeon (Southern)***

Suitable habitat for the Squatter Pigeon is categorised as 'grassy woodland habitat in REs on land zones 3, 5 or 7, which are either: within 1 km of a permanent water body; or within 1 km of a Queensland Government mapped wetland or  $\geq$ 3rd order stream'. This includes the majority of REs in the project area, including; REs 11.3.2, 11.3.4, 11.3.25, 11.5.3, 11.5.8b, 11.5.9, 11.5.12 and 11.7.2 (Ecological Survey & Management 2016). The following rationale was used in determining habitat indices for the Squatter Pigeon throughout the project area:

1. ***Threat to species*** - There are few local or main roads in the region and vehicle movements are irregular. Predators are present in the landscape, but there is no evidence to suggest they are high in numbers or putting considerable pressure on the Squatter Pigeon. Nonetheless, some areas, such as riparian areas, have a higher abundance of taller denser grasses, including exotic grasses, providing better cover and ambush areas for introduced predators (such as foxes and feral cats). Riparian areas are also targeted by native predators, such as raptors.
2. ***Quality and availability of food and foraging habitat*** - The local landscape has been largely cleared of native vegetation for cattle grazing, mining and exploration activities. Native habitat is often confined to watercourses and has been cleared or thinned throughout the landscape. However, this species is known to use disturbed or partly modified areas (DoEE 2018a). This indices varies throughout the project area and is dependent on abundance of weeds, particularly exotic pasture grasses, and presence of native grasses in the ground layer and proximity of these foraging resources in relation to water resources.
3. ***Quality and availability of shelter*** - Shelter habitat for the Squatter Pigeon is not well defined in the SPRAT Profile. This species shelters in nearby trees as described in the SPRAT Profile and requires a combination of open forest or woodland habitats within close proximity (i.e. up to 3 km) to water sources. The project area provides a fairly moderate

presence of this type of habitat. Water resources are scarce through the middle of the project area away from riparian areas.

4. **Species mobility capacity** - The Squatter Pigeon is a mobile bird, however, it is considered to be sedentary or locally nomadic (DoEE 2018a). It is thought to persist where food and water resources are available, but move through vegetated corridors in search of these resources when necessary. This species will largely keep within or in close proximity to wooded or remnant areas for protection from predators, but will move out into modified and degraded environments a short distance, e.g. (100 m) to forage (DoEE 2018a). The project area presents reasonably minor restriction to mobility for this species in some area, however, dense groundcover usually in the form of exotic pasture grasses, will be more of an impediment in some areas.
5. **Role of site location to overall population** - The project area is unlikely to be critical to the survival of the Squatter Pigeon as the species remains common in its northern distribution, the project area is unlikely to support an important population and it uses a range of habitats, including modified and degraded habitats, which are relatively common in the landscape (Ecological Survey & Management 2016).

### **Greater Glider**

The approved conservation advice for this species (TSSC 2016) indicates that taller, moist eucalypt forest with relatively old trees and abundant hollows and a diversity of eucalypt species is favoured by this species. Using the IPE project impact assessment report description, the riparian and alluvial communities are considered to provide suitable habitat for the Greater Glider (Ecological Survey & Management 2016). These communities are considered to provide the greatest availability of large old hollow-bearing trees and provide the greatest connectivity with larger patches of remnant vegetation in the landscape. Riparian and alluvial REs 11.3.2, 11.3.4 and 11.3.25 were therefore assessed as habitat. The following rationale was used in determining habitat indices for the Greater Glider throughout the project area:

1. **Threat to species** - There are few main or local roads in the region, although clearing has likely resulted in narrowing of habitat areas and restricting habitat closely to riparian areas. They are thought to require native forests patches of at least 160 km<sup>2</sup> (TSSC 2016). Predators are present in the landscape, but there is no evidence to suggest they are high in numbers or putting considerable pressure on the Greater Glider.
2. **Quality and availability of food and foraging habitat** - The Greater Glider prefers taller montane, moist eucalypt forests with relatively old trees and abundant hollows and a diversity of eucalypt species (TSSC 2016). Riparian areas generally provide more fertile and higher productivity areas in a rural landscape and therefore are more likely to provide the taller, older, hollow-bearing and diversity of eucalypt species required by the Greater Glider. This type of habitat is restricted in the landscape and often cleared to the high banks of watercourses. However,

riparian areas are often retained in an otherwise cleared or thinned landscape providing refuges and connectivity. A moderate abundance and diversity of flowering Eucalypt species was observed throughout the majority of habitat in the project area. However, the indices varied slightly in a couple of locations in relation to this attribute.

3. **Quality and availability of shelter** - Shelter habitat is defined in the Conservation Advice for the Greater Glider as tree hollows used during the day, and particularly large hollows in large, old trees (TSSC 2008). Due to the restricted nature of riparian habitat and remnant vegetation generally within the landscape, availability of this type of shelter is limited. However, a moderate abundance of hollows was observed throughout the majority of the riparian areas.
4. **Species mobility** - While this is a mobile arboreal species, it is thought to have low dispersal ability and typically small home ranges of 1 to 4 ha. They are thought to have relatively low persistence in small forest fragments and disperse poorly across vegetation that is not native forest (TSSC 2016). Riparian areas of Smoky Creek are considered to be narrower and more fragmented in the landscape and therefore mobility is considered to be slightly more restricted in this habitat areas compared with habitat along Billy's Gully.
5. **Role of site location to overall population** - The project area is unlikely to be critical to the survival of the species as the population present is unlikely to be an important population and the project area does not provide a particularly unique, large or important area of habitat for this species.

### **Koala**

In line with the IPE project habitat mapping criteria, any 'forest or woodland containing species that are Koala food trees, or any shrubland with emergent Koala food trees (i.e. trees of any of the following genera: *Angophora*, *Corymbia*, *Eucalyptus*, *Lophostemon*, *Melaleuca*)' is considered potential habitat for the Koala (Ecological Survey & Management 2016). All remnant and regrowth vegetation within the project area was assessed as Koala habitat. The following rationale was used in determining habitat indices for the Koala throughout the project area:

1. **Threat to species** - There is a moderate level of threat from the Goonyella Railway and local Broadlea Road. There is limited vegetation in the local area. Mining and petroleum exploration activities, involving clearing and track construction, occurs throughout the region, reducing availability of food trees and increasing irregular vehicle movements in the local area. Predators are present in the landscape, but there is no evidence to suggest they are high in numbers or putting considerable pressure on the Koala.
2. **Quality and availability of food and foraging habitat** - The local landscape has been largely cleared of native vegetation for cattle grazing,

mining and exploration activities. Better quality habitat is associated with an abundance of food trees and this is often prominent on watercourses and in some open woodland communities, while shrubby woodlands on skeletal soils (i.e. land zones 7 and 8) and regrowth communities provide fewer foraging resources in the form of food trees.

3. **Quality and availability of shelter** - The Koala referral guideline indicates shelter habitat is likely to be 'riparian environments and other areas with reliable soil moisture and fertility'. Riparian communities and open woodland communities on sandy plains (i.e. land zone 5) are likely to provide a greater abundance of food and shelter trees in the project area. Therefore, these communities will generally score higher for this indices.
4. **Species mobility** - The Koala is considered to be a highly mobile species with large home ranges recorded between 8 and 135 ha depending on the location and the environment. The species is known to disperse up to 16 km in certain landscapes and several kilometres within largely cleared landscapes (DoEE 2018b). The mobility of this species within the project area is variable and influenced by the extent of clearing and thinning and factors that may restrict movement on ground between shelter and food trees, e.g. steep sided banks along watercourse, dense grass cover a very low shrubby understorey.
5. **Role of site location to overall population** - The project area has the potential to provide habitat critical to the survival of the species as outlined in the IPE Project Terrestrial Ecology Assessment report (Ecological Survey & Management 2016). This is because, although the species has not been recorded as part of the project, it is highly likely to occur and the riparian areas potentially provide connectivity with large tracts of habitat in the surrounding landscape. However, the project area does not provide particularly unique Koala habitat within the landscape and numbers are likely to be low within the project area itself, given there was little evidence of this species despite targeted seasonal surveys.

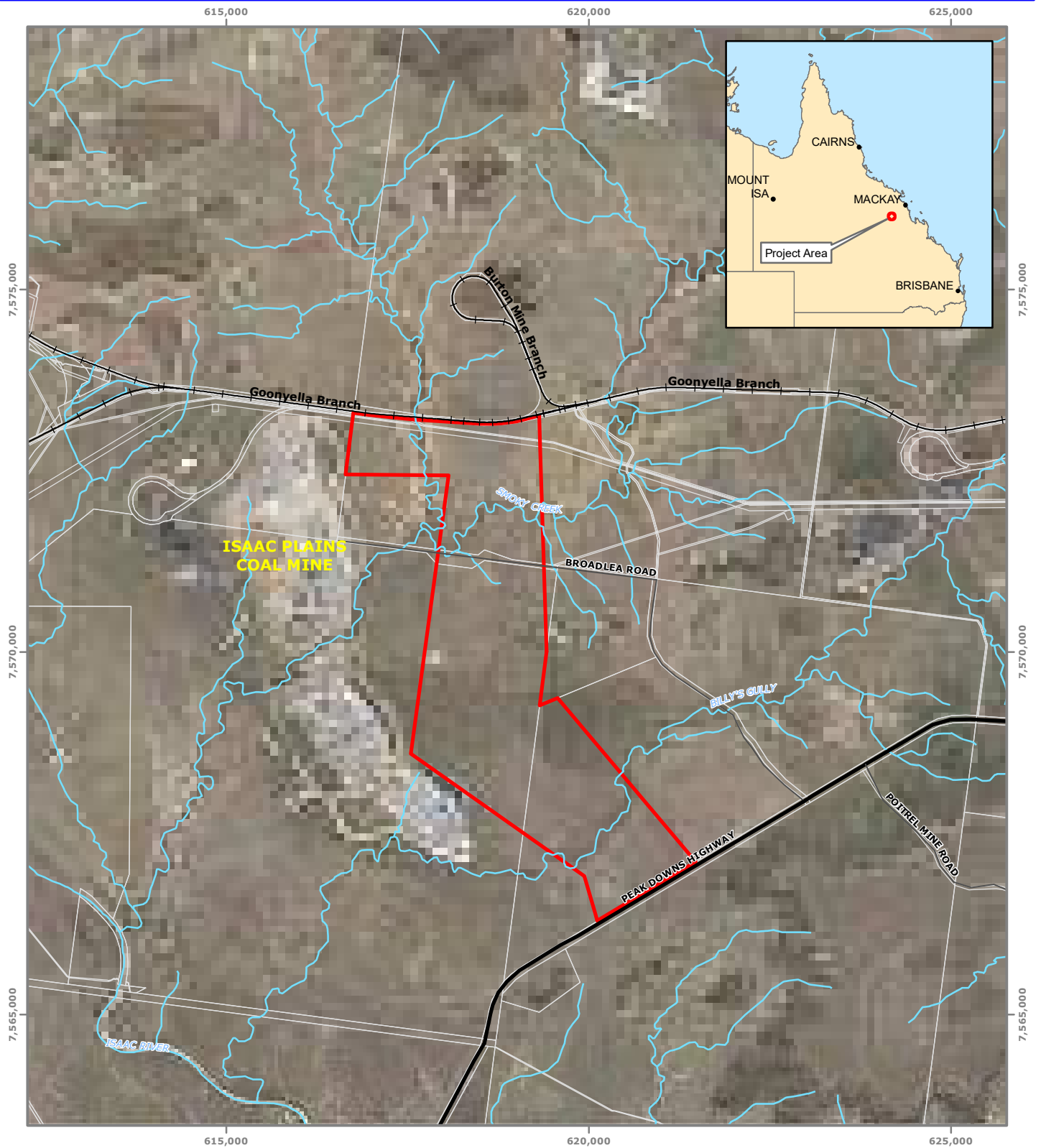
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## Figures





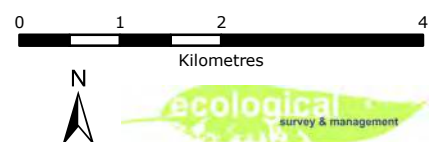
**Legend**

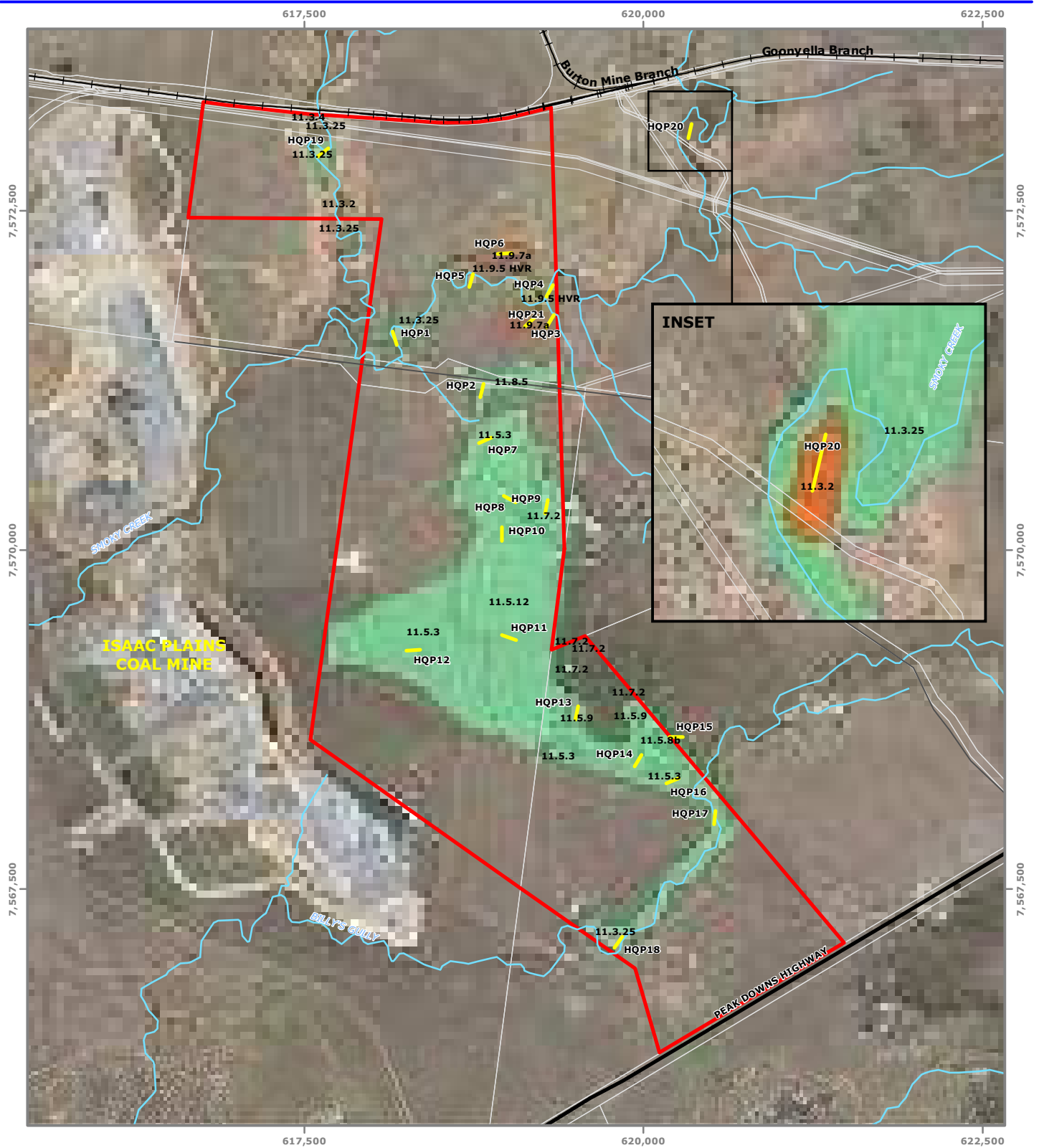
- Project Area
- Highway
- Street/Local Road
- Railway
- Vegetation Management Act Watercourse
- Cadastral Boundary

**Figure 1 : Location of the Isaac Plains East project area**

Isaac Plains East Project  
Habitat Quality Assessments

Map Number: 18018\_HQA\_01\_B  
Date: 05 July 2018  
Map Projection: GDA 1994 MGA Zone 55  
Imagery: Digital Globe  
Data: Roads, Watercourse, DCDB - (c)DNRM 2016





**Legend**

- Project Site
- Highway
- Street/Local Road
- Railway
- Vegetation Management Act Watercourse
- Cadastral Boundary
- Habitat Quality Plots

**Field-validated Vegetation Mapping**

**Remnant Vegetation**

- Of concern
- Least concern

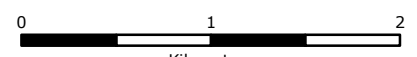
**High Value Regrowth**

- Endangered

**Figure 2 : Location of habitat quality plots**

Isaac Plains East Project  
Habitat Quality Assessments

Map Number: 18018\_HQA\_02\_C  
Date: 05 July 2018  
Map Projection: GDA 1994 MGA Zone 55  
Imagery: Digital Globe  
Data: Roads, Watercourse, DCDB - (c)DNRM 2016



## **Appendix A**

Breakdown of habitat quality data

### Habitat quality plot data

<b>Assessment Unit:</b>	<b>1</b>	<b>2</b>					
<b>Area of assessment unit (ha):</b>	1.2	48.6					
<b>Regional Ecosystem:</b>	<b>11.3.2</b>	<b>11.3.25/11.3.4</b>					
<b>BVG1M:</b>	17a	16a					
<b>Habitat quality plot:</b>	<b>20</b>	<b>1</b>	<b>4</b>	<b>5</b>	<b>19</b>	<b>17</b>	<b>18</b>
<b>Ecological Condition Indicator</b>							
1. Recruitment of woody perennial species (%)	100.0	75.0	50.0	50.0	75.0	75.0	75.0
2. Native plant species richness - Trees (No.)	2.0	6.0	3.0	7.0	5.0	7.0	6.0
3. Shrubs (No.)	9.0	10.0	6.0	12.0	14.0	8.0	10.0
4. Grasses (No.)	6.0	3.0	1.0	4.0	6.0	8.0	8.0
5. Forbs and Other (No.)	14.0	14.0	17.0	12.0	21.0	29.0	20.0
6. Tree canopy height (m)	18.4	24.8	24.0	22.5	20.0	15.6	14.2
7. Tree canopy cover (%)	12.5	40.4	13.1	53.7	29.5	47.0	47.6
8. Shrub canopy cover (%)	15.9	22.8	2.4	30.1	16.5	3.5	16.4
9. Native perennial grass cover (%)	13.8	0.0	0.9	0.4	0.0	3.1	0.7
10. Organic litter (%)	10.1	38.6	4.9	36.1	49.3	37.5	44.1
11. Large Euc. trees/ha (40 cm dbh)	16.0	10.0	1.0	11.0	3.0	1.0	7.0
11. Large Non-Euc trees/ha	10.0	15.0	40.0	10.0	13.0	4.0	2.0
12. Coarse woody debris (m/ha)	325.0	145.0	0.0	162.5	210.0	265.0	80.0
13. Non-native plant cover (%)	69.0	69.3	51.0	79.8	59.1	51.0	73.4
<b>Habitat indices</b>							
1. Threat to species	7	7	7	7	7	7	7
2. Quality and availability of food and foraging habitat	5	1	1	5	5	10	10
3. Quality and availability of shelter	5	5	5	5	5	5	5
4. Species mobility capacity	7	7	7	7	7	10	10
5. Role of site location to overall population	1	1	1	1	1	1	1
<b>Squatter Pigeon Index</b>	<b>25</b>	<b>21</b>	<b>21</b>	<b>25</b>	<b>25</b>	<b>33</b>	<b>33</b>
1. Threat to species	7	7	7	7	7	7	7
2. Quality and availability of food and foraging habitat	5	5	5	1	5	10	5
3. Quality and availability of shelter	5	5	5	1	5	5	5
4. Species mobility capacity	4	4	4	4	4	7	7
5. Role of site location to overall population	1	1	1	1	1	1	1
<b>Greater Glider Index</b>	<b>22</b>	<b>22</b>	<b>22</b>	<b>14</b>	<b>22</b>	<b>30</b>	<b>25</b>
1. Threat to species	7	7	7	7	7	7	7
2. Quality and availability of food and foraging habitat	1	5	5	1	5	10	5
3. Quality and availability of shelter	5	5	5	1	5	10	10
4. Species mobility capacity	7	4	4	4	4	7	7
5. Role of site location to overall population	1	1	1	1	1	1	1
<b>Koala Index</b>	<b>21</b>	<b>22</b>	<b>22</b>	<b>14</b>	<b>22</b>	<b>35</b>	<b>30</b>

<b>Assessment Unit:</b>	<b>3</b>			<b>4</b>	<b>5</b>		<b>7</b>
<b>Area of assessment unit (ha):</b>	105.2			3.4	9.7		14.6
<b>Regional Ecosystem:</b>	<b>11.5.3</b>			<b>11.5.8b</b>	<b>11.5.9</b>		<b>11.7.2</b>
<b>BVG1M:</b>	17a			9e	18b		24a
<b>Habitat quality plot:</b>	<b>7</b>	<b>12</b>	<b>16</b>	<b>15</b>	<b>8</b>	<b>13</b>	<b>9</b>
<b>Ecological Condition Indicator</b>							
1. Recruitment of woody perennial species (%)	100.0	100.0	100.0	75.0	100.0	100.0	100.0
2. Native plant species richness - Trees (No.)	3.0	2.0	2.0	6.0	5.0	3.0	4.0
3. Shrubs (No.)	11.0	4.0	7.0	5.0	14.0	8.0	7.0
4. Grasses (No.)	5.0	3.0	8.0	8.0	9.0	14.0	7.0
5. Forbs and Other (No.)	17.0	23.0	20.0	17.0	20.0	30.0	16.0
6. Tree canopy height (m)	13.3	15.9	16.8	15.0	15.8	16.1	10.4
7. Tree canopy cover (%)	35.6	20.8	20.2	26.5	25.9	23.2	44.6
8. Shrub canopy cover (%)	5.9	2.1	6.9	3.3	34.2	21.5	16.7
9. Native perennial grass cover (%)	2.9	1.4	1.7	8.6	1.0	13.6	20.4
10. Organic litter (%)	28.4	32.4	40.0	35.4	35.4	40.0	46.5
11. Large Euc. trees/ha (40 cm dbh)	9.0	2.0	3.0	2.0	6.0	5.0	0.0
11. Large Non-Euc trees/ha	0.0	0.0	0.0	1.0	4.0	0.0	8.0
12. Coarse woody debris (m/ha)	107.5	285.0	177.5	225.0	82.5	52.5	415.0
13. Non-native plant cover (%)	51.0	51.0	88.0	51.0	51.0	67.9	4.9
<b>Habitat indices</b>							
1. Threat to species	15	15	15	7	15	15	7
2. Quality and availability of food and foraging habitat	10	10	10	10	5	5	1
3. Quality and availability of shelter	5	5	5	5	5	5	5
4. Species mobility capacity	10	10	10	10	10	7	7
5. Role of site location to overall population	1	1	1	1	1	1	1
<b>Squatter Pigeon Index</b>	<b>41</b>	<b>41</b>	<b>41</b>	<b>33</b>	<b>36</b>	<b>33</b>	<b>21</b>
1. Threat to species	n/a	n/a	n/a	n/a	n/a	n/a	n/a
2. Quality and availability of food and foraging habitat	n/a	n/a	n/a	n/a	n/a	n/a	n/a
3. Quality and availability of shelter	n/a	n/a	n/a	n/a	n/a	n/a	n/a
4. Species mobility capacity	n/a	n/a	n/a	n/a	n/a	n/a	n/a
5. Role of site location to overall population	n/a	n/a	n/a	n/a	n/a	n/a	n/a
<b>Greater Glider Index</b>	<b>n/a</b>	<b>n/a</b>	<b>n/a</b>	<b>n/a</b>	<b>n/a</b>	<b>n/a</b>	<b>n/a</b>
1. Threat to species	7	7	7	7	7	7	7
2. Quality and availability of food and foraging habitat	5	5	5	10	5	5	1
3. Quality and availability of shelter	10	10	10	5	10	10	5
4. Species mobility capacity	7	7	7	10	10	7	7
5. Role of site location to overall population	1	1	1	1	1	1	1
<b>Koala Index</b>	<b>30</b>	<b>30</b>	<b>30</b>	<b>33</b>	<b>33</b>	<b>30</b>	<b>21</b>

<b>Assessment Unit:</b>	<b>6</b>			<b>8</b>	<b>9</b>		<b>10</b>
<b>Area of assessment unit (ha):</b>	142.2			11.8	8.5		9.0
<b>Regional Ecosystem:</b>	11.5.12			11.8.5	11.9.7a		Regrowth 11.9.5
<b>BVG1M:</b>	9e			11a	17a		25a
<b>Habitat quality plot:</b>	<b>10</b>	<b>11</b>	<b>14</b>	<b>2</b>	<b>3</b>	<b>6</b>	<b>21</b>
<b>Ecological Condition Indicator</b>							
1. Recruitment of woody perennial species (%)	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2. Native plant species richness - Trees (No.)	2.0	2.0	2.0	2.0	2.0	2.0	3.0
3. Shrubs (No.)	10.0	9.0	8.0	22.0	12.0	5.0	14.0
4. Grasses (No.)	12.0	10.0	12.0	11.0	11.0	2.0	5.0
5. Forbs and Other (No.)	22.0	22.0	20.0	22.0	29.0	16.0	17.0
6. Tree canopy height (m)	13.3	17.7	16.7	14.8	20.1	12.2	8.8
7. Tree canopy cover (%)	27.4	28.6	16.3	19.3	5.0	31.4	2.3
8. Shrub canopy cover (%)	11.0	33.1	28.1	12.6	24.0	1.5	16.3
9. Native perennial grass cover (%)	0.0	3.1	12.7	11.0	1.5	0.0	11.0
10. Organic litter (%)	47.2	27.2	43.6	14.5	31.0	35.9	35.1
11. Large Euc. trees/ha (40 cm dbh)	7.0	7.0	6.0	4.0	6.0	3.0	0.0
11. Large Non-Euc trees/ha	1.0	5.0	0.0	0.0	3.0	0.0	4.0
12. Coarse woody debris (m/ha)	97.5	237.5	75.0	180.0	195.0	0.0	110.0
13. Non-native plant cover (%)	51.0	51.0	61.5	25.9	46.9	88.0	42.5
<b>Habitat indices</b>							
1. Threat to species	15	15	15	n/a	n/a	n/a	n/a
2. Quality and availability of food and foraging habitat	10	10	10	n/a	n/a	n/a	n/a
3. Quality and availability of shelter	5	5	5	n/a	n/a	n/a	n/a
4. Species mobility capacity	10	7	10	n/a	n/a	n/a	n/a
5. Role of site location to overall population	1	1	1	n/a	n/a	n/a	n/a
<b>Squatter Pigeon Index</b>	<b>41</b>	<b>38</b>	<b>41</b>	<b>n/a</b>	<b>n/a</b>	<b>n/a</b>	<b>n/a</b>
1. Threat to species	n/a	n/a	n/a	n/a	n/a	n/a	n/a
2. Quality and availability of food and foraging habitat	n/a	n/a	n/a	n/a	n/a	n/a	n/a
3. Quality and availability of shelter	n/a	n/a	n/a	n/a	n/a	n/a	n/a
4. Species mobility capacity	n/a	n/a	n/a	n/a	n/a	n/a	n/a
5. Role of site location to overall population	n/a	n/a	n/a	n/a	n/a	n/a	n/a
<b>Greater Glider Index</b>	<b>n/a</b>	<b>n/a</b>	<b>n/a</b>	<b>n/a</b>	<b>n/a</b>	<b>n/a</b>	<b>n/a</b>
1. Threat to species	7	7	7	1	7	7	7
2. Quality and availability of food and foraging habitat	5	5	5	1	1	5	1
3. Quality and availability of shelter	10	10	10	5	1	5	5
4. Species mobility capacity	4	1	7	4	4	7	7
5. Role of site location to overall population	1	1	1	1	1	1	1
<b>Koala Index</b>	<b>27</b>	<b>24</b>	<b>30</b>	<b>12</b>	<b>14</b>	<b>25</b>	<b>21</b>

## **Appendix B**

Photos in habitat quality plots

## Habitat quality plot 1



Plate B-01: HQP 1, 0 m - looking along plot



Plate B-02: HQP 1, 100 m - looking along plot



Plate B-03: HQP 1, 50 m - looking north



Plate B-04: HQP 1, 50 m - looking east



Plate B-05: HQP 1, 50 m - looking south



Plate B-06: HQP 1, 50 m - looking west



Plate B-07: HQP 1, 50 m - ground cover



## Habitat quality plot 2



Plate B-08: HQP 2, 0 m - looking along plot



Plate B-09: HQP 2, 100 m - looking along plot



Plate B-10: HQP 2, 50 m - looking north



Plate B-11: HQP 2, 50 m - looking east



Plate B-12: HQP 2, 50 m - looking south



Plate B-13: HQP 2, 50 m - looking west



Plate B-14: HQP 2, 50 m - ground cover

### Habitat quality plot 3



Plate B-15: HQP 3, 0 m - looking along plot



Plate B-16: HQP 3, 100 m - looking along plot



Plate B-17: HQP 3, 50 m - looking north



Plate B-18: HQP 3, 50 m - looking east



Plate B-19: HQP 3, 50 m - looking south



Plate B-20: HQP 3, 50 m - looking west



Plate B-21: HQP 3, 50 m - ground cover

## Habitat quality plot 4



Plate B-22: HQP 4, 0 m - looking along plot



Plate B-23: HQP 4, 100 m - looking along plot



Plate B-24: HQP 4, 50 m - looking north



Plate B-25: HQP 4, 50 m - looking east



Plate B-26: HQP 4, 50 m - looking south



Plate B-37: HQP 4, 50 m - looking west



Plate B-28: HQP 4, 50 m - ground cover

## Habitat quality plot 5



Plate B-29: HQP 5, 0 m - looking along plot



Plate B-30: HQP 5, 100 m - looking along plot



Plate B-31: HQP 5, 50 m - looking north



Plate B-32: HQP 5, 50 m - looking east



Plate B-33: HQP 5, 50 m - looking south



Plate B-34: HQP 5, 50 m - looking west



Plate B-35: HQP 5, 50 m - soils

## Habitat quality plot 6



Plate B-36: HQP 6, 0 m - looking along plot



Plate B-37: HQP 6, 100 m - looking along plot



Plate B-38: HQP 6, 50 m - looking north



Plate B-39: HQP 6, 50 m - looking east



Plate B-40: HQP 6, 50 m - looking south



Plate B-41: HQP 6, 50 m - looking west



Plate B-42: HQP 6, 50 m - ground cover

## Habitat quality plot 7



Plate B-43: HQP 7, 0 m - looking along plot



Plate B-44: HQP 7, 100 m - looking along plot



Plate B-45: HQP 7, 50 m - looking north



Plate B-46: HQP 7, 50 m - looking east



Plate B-47: HQP 7, 50 m - looking south



Plate B-48: HQP 7, 50 m - looking west



Plate B-49: HQP 7, 50 m - ground cover

## Habitat quality plot 8



Plate B-50: HQP 8, 0 m - looking along plot



Plate B-51: HQP 8, 100 m - looking along plot



Plate B-52: HQP 8, 50 m - looking north



Plate B-53: HQP 8, 50 m - looking east



Plate B-54: HQP 8, 50 m - looking south



Plate B-55: HQP 8, 50 m - looking west



Plate B-56: HQP 8, 50 m - ground cover

## Habitat quality plot 9

{corrupted}

Plate B-57: HQP 9, 0 m - looking along plot



Plate B-59: HQP 9, 50 m - looking north



Plate B-61: HQP 9, 50 m - looking south



Plate B-63: HQP 9, 50 m - ground cover



{corrupted}

Plate B-58: HQP 9, 100 m - looking along plot



Plate B-60: HQP 9, 50 m - looking east



Plate B-62: HQP 9, 50 m - looking west





## Habitat quality plot 10



Plate B-64: HQP 10, 0 m - looking along plot



Plate B-65: HQP 10, 100 m - looking along plot



Plate B-66: HQP 10, 50 m - looking north



Plate B-67: HQP 10, 50 m - looking east



Plate B-68: HQP 10, 50 m - looking south



Plate B-69: HQP 10, 50 m - looking west



Plate B-70: HQP 10, 50 m - ground cover

## Habitat quality plot 11



Plate B-71: HQP 11, 0 m - looking along plot



Plate B-72: HQP 11, 100 m - looking along plot



Plate B-73: HQP 11, 50 m - looking north



Plate B-74: HQP 11, 50 m - looking east



Plate B-75: HQP 11, 50 m - looking south



Plate B-76: HQP 11, 50 m - looking west



Plate B-77: HQP 11, 50 m - ground cover

## Habitat quality plot 12



Plate B-78: HQP 12, 0 m - looking along plot



Plate B-79: HQP 12, 100 m - looking along plot



Plate B-80: HQP 12, 50 m - looking north



Plate B-81: HQP 12, 50 m - looking east



Plate B-82: HQP 12, 50 m - looking south



Plate B-83: HQP 12, 50 m - looking west



Plate B-84: HQP 12, 50 m - ground cover

### Habitat quality plot 13



Plate B-85: HQP 13, 0 m - looking along plot



Plate B-86: HQP 13, 100 m - looking along plot



Plate B-87: HQP 13, 50 m - looking north



Plate B-88: HQP 13, 50 m - looking east



Plate B-89: HQP 13, 50 m - looking south



Plate B-90: HQP 13, 50 m - looking west



Plate B-91: HQP 13, 50 m - ground cover

## Habitat quality plot 14



Plate B-92: HQP 14, 0 m - looking along plot



Plate B-93: HQP 14, 100 m - looking along plot



Plate B-94: HQP 14, 50 m - looking north



Plate B-95: HQP 14, 50 m - looking east



Plate B-96: HQP 14, 50 m - looking south



Plate B-97: HQP 14, 50 m - looking west



Plate B-98: HQP 14, 50 m - ground cover

## Habitat quality plot 15



Plate B-92: HQP 15, 0 m - looking along plot



Plate B-93: HQP 15, 100 m - looking along plot



Plate B-94: HQP 15, 50 m - looking north



Plate B-95: HQP 15, 50 m - looking east



Plate B-96: HQP 15, 50 m - looking south



Plate B-97: HQP 15, 50 m - looking west



Plate B-98: HQP 15, 50 m - ground cover

## Habitat quality plot 16



Plate B-99: HQP 16 - 0 m - looking along plot



Plate B-100: HQP 16, 100 m - looking along plot



Plate B-101: HQP 16, 50 m - looking north



Plate B-102: HQP 16, 50 m - looking east



Plate B-103: HQP 16, 50 m - looking south



Plate B-104: HQP 16, 50 m - looking west



Plate B-105: HQP 16, 50 m - ground cover

## Habitat quality plot 17



Plate B-106: HQP 17, 0 m - looking along plot



Plate B-107: HQP 17, 100 m - looking along plot



Plate B-108: HQP 17, 50 m - looking north



Plate B-109: HQP 17, 50 m - looking east



Plate B-110: HQP 17, 50 m - looking south



Plate B-111: HQP 17, 50 m - looking west



Plate B-112: HQP 17, 50 m - ground cover



## Habitat quality plot 18



Plate B-113: HQP 18, 0 m - looking along plot



Plate B-114: HQP 18, 100 m - looking along plot



Plate B-115: HQP 18, 50 m - looking north



Plate B-116: HQP 18, 50 m - looking east



Plate B-117: HQP 18, 50 m - looking south



Plate B-118: HQP 18, 50 m - looking west



Plate B-119: HQP 18, 50 m - ground cover

## Habitat quality plot 19



Plate B-120: HQP 19, 0 m - looking along plot



Plate B-121: HQP 19, 100 m - looking along plot



Plate B-122: HQP 19, 50 m - looking north



Plate B-123: HQP 19, 50 m - looking east



Plate B-124: HQP 19, 50 m - looking south



Plate B-125: HQP 19, 50 m - looking west



Plate B-126: HQP 19, 50 m - ground cover

## Habitat quality plot 20



Plate B-127: HQP 20, 0 m - looking along plot



Plate B-128: HQP 20, 100 m - looking along plot



Plate B-129: HQP 20, 50 m - looking north



Plate B-130: HQP 20, 50 m - looking east



Plate B-131: HQP 20, 50 m - looking south



Plate B-132: HQP 20, 50 m - looking west



Plate B-133: HQP 20, 50 m - soils

## Habitat quality plot 21



Plate B-134: HQP 21, 0 m - looking along plot



Plate B-135: HQP 21, 100 m - looking along plot



Plate B-136: HQP 21, 50 m - looking north



Plate B-137: HQP 21, 50 m - looking east



Plate B-138: HQP 21, 50 m - looking south



Plate B-139: HQP 21, 50 m - looking west



Plate B-140: HQP 21, 50 m - soils

# IPE Environmental Authority

**Environmental Authority EPML00932713 Isaac Plains Mine**

*This environmental authority is issued by the administering authority under Chapter 5 of the Environmental Protection Act 1994.*

**Permit<sup>1</sup> number: EPML00932713**

**Environmental authority takes effect on 24 January 2018**

**The anniversary date of this environmental authority is 3 November.**

An annual return and the payment of the annual fee will be due each year on this day.

**Environmental authority holder(s)**

Name	Registered address
Stanmore IP Coal Pty Ltd	Level 8 100 Edward Street BRISBANE CITY QLD 4000

**Environmentally relevant activity and location details**

Environmentally relevant activities	Location(s)
<b>Environmental Protection Regulation 2008, Schedule 2A:</b> <b>ERA 13 Mining black coal</b>	ML70342 ML700016
<b>Environmental Protection Regulation 2008, Schedule 2:</b> <b>ERA 31(2)(b) Mineral Processing</b> - processing, in a year, the following quantities of mineral products, other than coke - more than 100,000t <b>ERA 38(1)(b) Surface coating</b> – anodising, electroplating, enamelling or galvanising using, in a year, the following quantity of surface coating materials - more than 100t but not more than 1000t <b>ERA 60(1)(d) operating a facility for disposing of</b> , in a year, the following quantity of waste mentioned in subection (1)(a)(i) - more than 200,000t <b>ERA 63(1)(b)(i) Sewage treatment</b> - operating sewage treatment works, other than no-release works, with a total daily peak design capacity of - more than 100 but not more than 1500EP - if treated effluent is discharged from the works to an infiltration trench or through an irrigation scheme	ML700017 ML700018 ML700019

<sup>1</sup> Permit includes licences, approvals, permits, authorisations, certificates, sanctions or equivalent/similar as required by legislation

**Additional information for applicants**Environmentally relevant activities

The description of any environmentally relevant activity (ERA) for which an environmental authority is issued is a restatement of the ERA as defined by legislation at the time the approval is issued. Where there is any inconsistency between that description of an ERA and the conditions stated by an environmental authority as to the scale, intensity or manner of carrying out an ERA, then the conditions prevail to the extent of the inconsistency.

An environmental authority authorises the carrying out of an ERA and does not authorise any environmental harm unless a condition stated by the authority specifically authorises environmental harm.

A person carrying out an ERA must also be a registered suitable operator under the *Environmental Protection Act 1994* (EP Act).

Contaminated land

It is a requirement of the EP Act that if an owner or occupier of land becomes aware a notifiable activity (as defined in Schedule 3 and Schedule 4) is being carried out on the land, or that the land has been, or is being, contaminated by a hazardous contaminant, the owner or occupier must, within 22 business days after becoming so aware, give written notice to the chief executive.



Signature

Ben Byrd  
Department of Environment and Science  
Delegate of the administering authority  
*Environmental Protection Act 1994*

24 January 2018

Date

**Enquiries:**  
Business Centre (Coal)  
Department of Environment and Science  
99 Hospital Road Emerald Qld 4720  
PO Box 3028  
EMERALD QLD 4720  
Phone: (07) 4987 9320  
Email: CRMining@ehp.qld.gov.au

**Obligations under the *Environmental Protection Act 1994***

In addition to the requirements found in the conditions of this environmental authority, the holder must also meet their obligations under the EP Act, and the regulations made under the EP Act. For example, the holder must comply with the following provisions of the Act:

- general environmental duty (section 319);
- duty to notify environmental harm (section 320-320G);
- offence of causing serious or material environmental harm (sections 437-439);
- offence of causing environmental nuisance (section 440);
- offence of depositing prescribed water contaminants in waters and related matters (section 440ZG); and
- offence to place contaminant where environmental harm or nuisance may be caused (section 443).

**Conditions of environmental authority**

The environmentally relevant activities conducted at the location as described above must be conducted in accordance with the following site specific conditions of approval.

Agency interest: General	
Condition number	Condition
A1	<p><b>General</b></p> <p>This environmental authority authorises environmental harm referred to in the conditions. Where there is no condition or this environmental authority is silent on a matter, the lack of a condition or silence does not authorise environmental harm.</p>
A2	<p><b>Authorised activities</b></p> <p>In carrying out the mining activities authorised by this environmental authority, disturbance of land:</p> <p>a) is authorised in the areas marked 'A'; and</p> <p>b) is not authorised in the areas marked 'B'; and</p> <p>c) is only authorised in areas marked 'C' to the extent reasonably necessary for infrastructure.</p> <p>The areas stated in a) to c) of this condition, are shown in <b>Appendix 1, Figure 1A: Authorised mining activities – Isaac Plains East</b> and <b>Figure 1B: Authorised mining activities – Isaac Plains Mine</b> of this environmental authority.</p>
A3	<p><b>Financial assurance</b></p> <p>The activity must not be carried out until the environmental authority holder has given financial assurance to the administering authority as security for compliance with this environmental authority and any costs or expenses, or likely costs or expenses, mentioned in section 298 of the <i>Environmental Protection Act 1994</i>.</p>



## Environmental authority EPML00932713 – Isaac Plains Coal Mine

<b>A4</b>	The amount of financial assurance must be reviewed by the holder of this environmental authority when a plan of operations is amended or replaced, or this environmental authority is amended.
<b>A5</b>	If the amount of financial assurance held by the administering authority has been discounted and either the nominated period of financial assurance has ended, or an event or change in circumstance has resulted in the holder of the environmental authority no longer being able to meet one or more of the mandatory pre-requisites or applicable discount criteria, the holder of the environmental authority must amend the financial assurance within <b>fifteen (15) business days</b> of the period ending or becoming aware of the event or change and give the administering authority the increased amount of financial assurance.
<b>A6</b>	<p><b>Maintenance of measures, plant and equipment</b></p> <p>The holder of this environmental authority must:</p> <ul style="list-style-type: none"> <li>a) install all measures, plant and equipment necessary to ensure compliance with the conditions of this environmental authority;</li> <li>b) maintain such measures, plant and equipment in a proper and efficient condition;</li> <li>c) operate such measures, plant and equipment in a proper and efficient manner; and</li> <li>d) ensure all instruments and devices used for the measurement or monitoring of any parameter under any condition of this environmental authority are properly calibrated.</li> </ul>
<b>A7</b>	<p><b>Monitoring records</b></p> <p>Except where specified otherwise in another condition of this environmental authority, all monitoring records or reports required by this environmental authority must be kept for a period of not less than <b>five (5) years</b>.</p>
<b>A8</b>	All records, reports, plans and programs required by this environmental authority, must be made available to the administering authority within <b>five (5) business days</b> of the administering authority's request.
<b>A9</b>	<p>Where monitoring is a requirement of this environmental authority, ensure that an appropriately qualified person(s) conducts the monitoring.</p> <p>The environmental authority holder must ensure that all monitoring required under a condition of this environmental authority is performed by a person(s) with appropriate experience or qualifications.</p>
<b>A10</b>	<p><b>Notification of emergencies, incidents and exceptions</b></p> <p>The holder of this environmental authority must notify the administering authority via the Pollution Hotline, (or WaTERS where applicable) or its successor within <b>twenty four (24) hours</b>, after becoming aware of any emergency or incident which results in the release of contaminants not in accordance, or reasonably expected to be not in accordance with, the conditions of this environmental authority.</p>

<b>A11</b>	<p>If the environmental authority holder is required to give notification to the administering authority of an event or incident under <b>Condition A10</b>, the notification must include the following information:</p> <ul style="list-style-type: none"> <li>a) the number of the environmental authority;</li> <li>b) the holder of the environmental authority;</li> <li>c) the name and telephone number of a designated contact person who is able to talk with the administering authority on behalf of the operator in relation to the event or release;</li> <li>d) the location of the event or release, including a physical address and lot on plan description (if available) and any other information necessary to identify the specific location of the event or release;</li> <li>e) the time of the event or release (if known);</li> <li>f) the time the holder of the environmental authority became aware of the event or release;</li> <li>g) if the event or release has impacted, or may impact on, a person's land — whether the person whose land has been, or may be, impacted by the event or release has been notified;</li> <li>h) the suspected cause of the incident;</li> <li>i) the environmental harm caused, threatened, or suspected to be caused by the incident; and</li> <li>j) actions taken to prevent any further incident and mitigate any environmental harm caused by the incident.</li> </ul>
<b>A12</b>	<p>Within <b>ten (10) business days</b> following the initial notification as per <b>Condition A10</b> of an emergency or incident, or receipt of monitoring results, whichever is the latter, further written advice must be provided to the administering authority, including the following:</p> <ul style="list-style-type: none"> <li>a) results and interpretation of any samples taken and analysed;</li> <li>b) outcomes of actions taken at the time to prevent or minimise unlawful environmental harm; and</li> <li>c) proposed actions to prevent a recurrence of the emergency or incident.</li> </ul>
<b>A13</b>	<p><b>Coal extraction</b></p> <p>The environmental authority holder is approved for the coal extraction rate of up to <b>four (4) million tonnes per annum (Mtpa)</b> of run-of-mine (ROM) ore in accordance with this environmental authority.</p>

<b>A14</b>	<p><b>Complaints</b></p> <p>The holder of this environmental authority must record all environmental complaints received including:</p> <ul style="list-style-type: none"> <li>a) name, address and contact number for of the complainant;</li> <li>b) time and date of complaint;</li> <li>c) reasons for the complaint;</li> <li>d) investigations undertaken;</li> <li>e) conclusions formed;</li> <li>f) actions taken to resolve the complaint;</li> <li>g) any abatement measures implemented; and</li> <li>h) person responsible for resolving the complaint.</li> </ul>
<b>A15</b>	<p>The person undertaking the authorised mining activity must investigate any complaints of nuisance or environmental harm. If the complaints are validated, immediately implement abatement measures so that the environmental harm or nuisance to which the complaint relates ceases or no longer negatively impacts the sensitive receptor or commercial place.</p>
<b>A16</b>	<p>The environmental authority holder must, when requested by the administering authority undertake relevant specified monitoring to investigate any complaint of environmental harm or nuisance. The environmental authority holder must:</p> <ul style="list-style-type: none"> <li>a) within a timeframe nominated or agreed to by the administering authority, commence monitoring;</li> <li>b) undertake the monitoring for a duration nominated or agreed to by the administering authority; and</li> <li>c) provide the results of the investigation (including an analysis and interpretation of the monitoring results) and abatement measures, where implemented, to the administering authority within <b>ten (10) business days</b> of completion of the investigation or monitoring, or no later than <b>ten (10) business days</b> after the end of the timeframe nominated by the administering authority to undertake the investigation.</li> </ul>
<b>A17</b>	<p>If the monitoring undertaking in accordance with <b>Condition A16</b> indicates the occurrence of environmental harm or nuisance then the environmental authority holder must:</p> <ul style="list-style-type: none"> <li>a) address any complaint including the use of appropriate dispute resolution if required; and</li> <li>b) immediately implement abatement measures so that the environmental harm or nuisance to which the complaint relates ceases or no longer negatively impacts the sensitive receptor.</li> </ul>
<b>A18</b>	<p>In consultation with the administering authority, cooperate with and participate in any community environmental liaison committee established in respect of either the licensed place specifically or the industrial estate where the licensed place is located.</p>

<b>A19</b>	<p><b>Risk management</b></p> <p>The environmental authority holder must develop and implement a risk management system for all stages of mining activities which mirrors the content requirement of the Standards Australia Risk management – Principles and guidelines (AS/NZS ISO 31000:2009), or the latest edition of a Standards Australia for risk management.</p>
<b>A20</b>	<p><b>Third-party reporting</b></p> <p>The environmental authority holder must nominate an appropriately qualified independent, third party auditor to audit compliance with the conditions of this environmental authority. The third party audit must be completed by <b>31 December 2018</b>, and then at regular intervals not exceeding <b>thirty-six (36) months</b>.</p>
<b>A21</b>	<p>Within <b>ninety (90) days</b> of completing the audit, provide a written report to the administering authority that has been certified by the appropriately qualified independent third party auditor, detailing any non-compliance issues that were found (if no non-compliance issues were found this should be stated in the report). If non-compliance issues were found the report must also address:</p> <ul style="list-style-type: none"> <li>a) actions taken by the holder of this environmental authority to ensure compliance with this environmental authority; and</li> <li>b) actions taken to prevent a recurrence of non-compliance.</li> </ul>
<b>A22</b>	<p>Where a condition of this environmental authority requires compliance with a standard, policy or guideline and the standard is amended or changed subsequent to the issue of this environmental authority, the holder of this environmental authority must:</p> <ul style="list-style-type: none"> <li>a) comply with the amended or changed standard, policy or guideline within <b>two (2) years</b> of the amendment or change being made, unless a different period is specified in the amended standard or relevant legislation, or where the amendment or change relates specifically to regulated structures referred to in <b>Conditions G1 to G37</b>, the time specified in that condition; and</li> <li>b) until compliance with the amended or changed standard, policy or guideline is achieved, continue to remain in compliance with the corresponding provision that was current immediately prior to the relevant amendment or change.</li> </ul>

<b>Agency interest: Air</b>	
<b>Condition number</b>	<b>Condition</b>
<b>B1</b>	The release of dust or particulate matter or both resulting from the authorised mining activities must not cause an environmental nuisance, at any sensitive receptor or commercial place.

<b>B2</b>	<p>When requested by the administering authority or as a result of a complaint, dust and particulate monitoring must be undertaken, and the results thereof notified to the administering authority within <b>fourteen (14) days</b> following completion of the monitoring period. Dust and particulate matter emissions generated by the authorised mining activities must not exceed the following levels when measured at any sensitive receptor or commercial place:</p> <ol style="list-style-type: none"> <li>a) Dust deposition of 120 milligrams per square metre per day, averaged over 1 month, when monitored in accordance with the most recent version of Australian Standard AS3580.10.1 Methods for sampling and analysis of ambient air—Determination of particulate matter—Deposited matter – Gravimetric method.</li> <li>b) A concentration of particulate matter with an aerodynamic diameter of less than 10 micrometres (PM<sub>10</sub>) suspended in the atmosphere of 50 micrograms per cubic metre over a 24-hour averaging time, for no more than 5 exceedances recorded each year, when monitored in accordance with the most recent version of either: <ol style="list-style-type: none"> <li>i. Australian Standard AS3580.9.6 Methods for sampling and analysis of ambient air—Determination of suspended particulate matter— PM<sub>10</sub> high volume sampler with size-selective inlet – Gravimetric method; or</li> <li>ii. Australian Standard AS3580.9.9 Methods for sampling and analysis of ambient air—Determination of suspended particulate matter— PM<sub>10</sub> low volume sampler— Gravimetric method; or</li> <li>iii. Australian Standard AS3580.9.11 Methods for sampling and analysis of ambient air—Determination of suspended particulate matter— PM<sub>10</sub> beta attenuation monitors.</li> </ol> </li> <li>c) A concentration of particulate matter with an aerodynamic diameter of less than 2.5 micrometres (PM<sub>2.5</sub>) suspended in the atmosphere of 25 micrograms per cubic metre over a 24-hour averaging time, when monitored in accordance with the most recent version of AS/NZS3580.9.10 Methods for sampling and analysis of ambient air—Determination of suspended particulate matter—PM (sub)2.5(/sub) low volume sampler—Gravimetric method.</li> <li>d) A concentration of particulate matter suspended in the atmosphere of 90 micrograms per cubic metre over a 1 year averaging time, when monitored in accordance with the most recent version of AS/NZS3580.9.3:2003 Methods for sampling and analysis of ambient air—Determination of suspended particulate matter—Total suspended particulate matter (TSP)—High volume sampler gravimetric method.</li> </ol>
<b>B3</b>	<p>If the monitoring indicates an exceedance of the relevant limits in <b>Condition B2</b>, then the environmental authority holder must investigate whether the exceedance is due to emissions from the activity. If the authorised mining activities are found to be the cause of the exceedance then the environmental authority holder must immediately implement dust abatement measures so that emissions of dust from the activity do not result in further environmental nuisance.</p>
<b>B4</b>	<p>If during the monitoring period nominated as per <b>Condition B2</b>, there is an exceedance of the relevant limits listed in <b>Condition B2</b>, the environmental authority holder must notify the administering authority within <b>seven (7) days</b> of the exceedance occurring. The notification must also include the actions taken in accordance with <b>Condition B3</b>.</p>

<b>B5</b>	<p><b>Dust Management Plan</b></p> <p>A Dust Management Plan must be developed and implemented by an appropriately qualified person for all stages of the authorised mining activities. The dust management plan must be submitted to the administering authority for review and comment by <b>29 June 2018</b>.</p>
<b>B6</b>	<p>The Dust Management Plan required by <b>Condition B5</b> must include:</p> <ol style="list-style-type: none"> <li>a preventative management system for PM<sub>10</sub>, PM<sub>2.5</sub> and TSP;</li> <li>real time monitoring program for PM<sub>10</sub>, PM<sub>2.5</sub> and TSP between the Isaac Plains Coal Mine and the Township of Moranbah;</li> <li>Trigger Action Response Program; and</li> <li>procedures for updating the IPCM website to enable public access to the monitoring results.</li> </ol>
<b>B7</b>	<p>An annual report on the dust management plan required by <b>Condition B6</b> must be submitted to the administering authority with each annual return. The report must include:</p> <ol style="list-style-type: none"> <li>a review of the suitability of the preventative dust management system and the trigger action response program;</li> <li>recommendations or improvements to the dust management plan, including whether additional monitoring locations are required; and</li> <li>the results of the real time monitoring program and the actions taken to reduce potential impacts on sensitive receptors and commercial places from the authorised mining activities.</li> </ol>

Agency interest: Water	
Condition number	Condition
<b>C1</b>	<p><b>Contaminant release</b></p> <p>Contaminants must not be released directly or indirectly to any waters as a result of the authorised mining activities, except as permitted under the conditions of this environmental authority.</p>
<b>C2</b>	<p>Unless otherwise permitted under the conditions of this environmental authority, the release of mine affected water to waters must only occur from the release points specified in <b>Table 1: Mine Affected Water Release Points, Sources and Receiving Waters</b> and depicted in <b>Appendix 1, Figure 2: Location of Water Release Points and Monitoring Points</b> attached to this environmental authority.</p>
<b>C3</b>	<p>The release of mine affected water to internal water management infrastructure that is installed and operated in accordance with a water management plan that complies with <b>Conditions C31 to C35</b> inclusive is permitted.</p>

**Table 1: Mine Affected Water Release Points, Sources and Receiving Waters**

Release Point (RP)	Easting (GDA94 – Zone 55)	Northing (GDA94 – Zone 55)	Mine Affected Water Source and Location	Monitoring Point	Receiving Waters Description
RP 1	614974.040	7569713.469	Release Dam 1	Spillway	Smoky Creek
RP 2	616695.040	7567301.469	Release Dam 2	Spillway	Billy's Gully
RP 3	616554.040	7570197.469	S1 pit	Pump intake (via bleed-off valve)	Smoky Creek
RP 4	615114.040	7569350.469	S2 Sediment Dam	Pump intake (via bleed-off valve)	Smoky Creek
RP 5	617929.040	7567111.469	S3 pit	Pump intake (via bleed-off valve)	Billy's Gully

<b>C4</b>	The release of mine affected water to waters in accordance with <b>Condition C2</b> must not exceed the release limits stated in <b>Table 2: Mine Affected Water Release Limits</b> when measured at the monitoring points specified in <b>Table 1: Mine Affected Water Release Points, Sources and Receiving Waters</b> for each quality characteristic.
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**Table 2: Mine Affected Water Release Limits**

Quality Characteristic	Release Limits	Monitoring frequency
Electrical conductivity (uS/cm)	Release limits specified in <b>Table 4</b> for variable flow criteria.	Daily during release (the first sample must be taken within 2 hours of commencement of release)
pH (pH Unit)	6.5 (minimum) 9.0 (maximum)	Daily during release (the first sample must be taken within 2 hours of commencement of release)
Total Suspended Solids (mg/L)	As per <b>Condition C6</b>	Daily during release (first sample within 2 hours of commencement of release)
Sulphate (SO <sub>4</sub> <sup>2-</sup> ) (mg/L)	Release limits specified in <b>Table 4</b> for variable flow criteria.	Daily during release (first sample within 2 hours of commencement of release)

<b>C5</b>	<p>The release of mine affected water to waters from the release points must be monitored at the locations specified in <b>Table 1: Mine Affected Water Release Points, Sources and Receiving Waters</b> for each quality characteristics and at the frequency specified in <b>Table 2: Mine Affected Water Release Limits</b> and <b>Table 3: Release Contaminant Trigger Investigation Levels</b>.</p> <p><i>Note: the administering authority will take into consideration any extenuating circumstances prior to determining an appropriate enforcement response in the event <b>Condition C5</b> is contravened due to a temporary lack of safe or practical access. The administering authority expects the environmental authority holder to take all reasonable and practicable measures to maintain safe and practical access to designated monitoring locations.</i></p>
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**Table 3: Release Contaminant Trigger Investigation Levels**

Quality Characteristic	Trigger Levels (µg/L)	Comment on Trigger Level	Monitoring Frequency
Aluminium	55	<i>For aquatic ecosystem protection, based on LOR for ICPMS</i>	Commencement of release and thereafter weekly during release
Arsenic	13	<i>For aquatic ecosystem protection, based on SMD guideline</i>	
Cadmium	0.2	<i>For aquatic ecosystem protection, based on SMD guideline</i>	
Chromium	1.0	<i>For aquatic ecosystem protection, based on SMD guideline</i>	
Copper	2.0	<i>For aquatic ecosystem protection, based on LOR for ICPMS</i>	
Iron	300	<i>For aquatic ecosystem protection, based on low reliability guideline</i>	
Lead	10	<i>For aquatic ecosystem protection, based on LOR for ICPMS</i>	
Mercury	0.2	<i>For aquatic ecosystem protection, based on LOR for CV FIMS</i>	
Nickel	11	<i>For aquatic ecosystem protection, based on SMD guideline</i>	
Zinc	8.0	<i>For aquatic ecosystem protection, based on SMD guideline</i>	
Boron	370	<i>For aquatic ecosystem protection, based on SMD guideline</i>	
Cobalt	90	<i>For aquatic ecosystem protection, based on low reliability guideline</i>	
Manganese	1900	<i>For aquatic ecosystem protection, based on SMD guideline</i>	
Molybdenum	34	<i>For aquatic ecosystem protection, based on low reliability guideline</i>	
Selenium	10	<i>For aquatic ecosystem protection, based on LOR for ICPMS</i>	
Silver	1.0	<i>For aquatic ecosystem protection, based on LOR for ICPMS</i>	
Uranium	1.0	<i>For aquatic ecosystem protection, based on LOR for ICPMS</i>	
Vanadium	10	<i>For aquatic ecosystem protection, based on LOR for ICPMS</i>	
Ammonia	900	<i>For aquatic ecosystem protection, based on SMD guideline</i>	
Nitrate	1100	<i>For aquatic ecosystem protection, based on ambient Qld WQ Guidelines (2006) for TN</i>	
Petroleum hydrocarbons (C6-C9)	20		
Petroleum hydrocarbons (C10-C36)	100		
Fluoride (total)	2000	<i>Protection of livestock and short term irrigation guideline</i>	
Sodium	As per Condition C6		

1. All metals and metalloids must be measured as total (unfiltered) and dissolved (filtered). Trigger levels for metal/metalloids apply if **dissolved** results exceed trigger.

2. The list of quality characteristics required to be monitored as per **Table 3** will be reviewed once the results of the monitoring data is gathered for the interim period until **31 December 2011** or an earlier date if the data is, or becomes, available and if it is determined that there is no need to monitor for certain individual quality characteristics these can be removed from **Table 3**.

3. SMD – slightly moderately disturbed level of protection; guideline refers ANZECC & ARMCANZ (2000).

4. LOR – typical reporting for method stated. ICPMS/CV FIMS – analytical method required to achieve LOR.

<b>C6</b>	The following must be determined and submitted to the administering authority via an amendment to the environmental authority by <b>29 June 2018</b> : a) release limits for Total Suspended Solids in <b>Table 2: Mine Affected Water Release Limits</b> ; and b) trigger level for Sodium in <b>Table 3: Release Contaminant Trigger Investigation Levels</b> .
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C7	<p>If quality characteristics of the release exceed any of the trigger levels specified in <b>Table 3: Release Contaminant Trigger Investigation Levels</b> during a release event at the locations listed in <b>Table 1: Mine Affected Water Release Points, Sources and Receiving Waters</b>, the environmental authority holder must compare the downstream results recorded at the monitoring points specified in <b>Table 8: Receiving Water Upstream Background Sites and Down Stream Monitoring Points</b> to the trigger values specified in <b>Table 3: Release Contaminant Trigger Investigation Levels</b> and:</p> <p>a) where the downstream results do not exceed the trigger values then no action is to be taken; or</p> <p>b) where the downstream results exceed the trigger values specified <b>Table 3: Release Contaminant Trigger Investigation Levels</b> for any quality characteristic, compare the results of the downstream sites to the results from upstream monitoring sites listed in <b>Table 8: Receiving Water Upstream Background Sites and Down Stream Monitoring Points</b> and;</p> <p>i. if the downstream result is less than the upstream site data, then no action is to be taken; or</p> <p>ii. if the downstream result is greater than the upstream monitoring site data, complete an investigation into the potential for environmental harm and provide a written report to the administering authority in the next annual return, outlining:</p> <p>1) details of the investigations carried out; and</p> <p>2) actions taken to prevent environmental harm.</p> <p><b>Note:</b> <i>Where an exceedance of a trigger level has occurred and is being investigated, in accordance with <b>Condition C7(b)(ii)</b>, no further reporting is required for subsequent trigger events for that quality characteristic.</i></p>
C8	<p>If an exceedance in accordance with <b>Condition C7(b)(ii)</b> is identified, the holder of the authority must notify the administering authority within <b>fourteen (14) days</b> of receiving the result.</p>
C9	<p><b>Mine affected water release events</b></p> <p>The environmental authority holder must ensure an automatic stream flow gauging station/s is installed, operated and maintained to determine and record stream flows at the locations and flow recording frequency specified in <b>Table 4: Mine Affected Water Release During Flow Events</b>.</p>
C10	<p>The release of mine affected water to waters in accordance with <b>Condition C2</b> must only take place during periods of natural flow events in accordance with the receiving water flow criteria for discharge specified in <b>Table 4: Mine Affected Water Release During Flow Events</b> for the release point(s) specified in <b>Table 1: Mine Affected Water Release Points, Sources and Receiving Waters</b>.</p>
C11	<p>The release of mine affected water to waters in accordance with <b>Condition C2</b> must not exceed the Electrical Conductivity, Sulphate release limits or the Maximum Release Rate (for all combined release point flows) for each receiving water flow criteria for discharge specified in <b>Table 4: Mine Affected Water Release During Flow Events</b> when measured at the monitoring points specified in <b>Table 1: Mine Affected Water Release Points, Sources and Receiving Waters</b>.</p>

Table 4: Mine Affected Water Release During Flow Events

Receiving waters/ stream	Release Point (RP)	Gauging station	Gauging Station Easting (GDA94 – Zone55)	Gauging Station Northing (GDA94 – Zone 55)	Receiving Water Flow Recording Frequency	Receiving Water Flow Criteria for discharge (m <sup>3</sup> /s)	Maximum release rate (for all combined RP flows)	Electrical Conductivity and Sulphate Release Limits
Isaac River (Via Smoky Creek & Billy's Gully)	RP1, RP2, RP3, RP4 & RP5	130414A Isaac River at Goonyella	600500.90	7582839.20	Continuous (minimum daily)	<b>Low Flow</b> <4m <sup>3</sup> /s for a period of 28 days after natural flow events that exceed 4 m <sup>3</sup> /s	< 2m <sup>3</sup> /s	Electrical conductivity (µS/cm): 720µS/cm  Sulphate (SO <sub>4</sub> <sup>2-</sup> ): 250 mg/L
						<b>Medium Flow</b> 4m <sup>3</sup> /sec	0.142m <sup>3</sup> /sec	Electrical conductivity (µS/cm): 3,000µS/cm  Sulphate (SO <sub>4</sub> <sup>2-</sup> ): 300mg/L
						<b>Medium Flow</b> 10m <sup>3</sup> /sec	0.257m <sup>3</sup> /sec	Electrical Conductivity (µS/cm): 4,000 Sulphate (SO <sub>4</sub> <sup>2-</sup> ): 300mg/L
						<b>High Flow</b> 50m <sup>3</sup> /sec	1.09m <sup>3</sup> /sec	Electrical conductivity (µS/cm): 5,000µS/cm Sulphate (SO <sub>4</sub> <sup>2-</sup> ): 400mg/L
						<b>Very High Flow</b> 100m <sup>3</sup> /sec	2.02m <sup>3</sup> /sec	Electrical conductivity (µS/cm): 5,000µS/cm  Sulphate (SO <sub>4</sub> <sup>2-</sup> ) 400mg/L
						<b>Flood Flow</b> 250m <sup>3</sup> /sec	3.07m <sup>3</sup> /sec	Electrical conductivity (µS/cm): 8,000µS/cm  Sulphate (SO <sub>4</sub> <sup>2-</sup> ) 400mg/L

<b>C12</b>	Releases to waters must be undertaken so as not to cause erosion of the bed and banks of the receiving waters, or cause a material build-up of sediment in such waters.
<b>C13</b>	<p><b>Notification of release event</b></p> <p>The environmental authority holder must notify the administering authority via WaTERS within <b>twenty-four (24) hours</b> after commencing to release mine affected water in accordance with <b>Condition C2</b>. Notification must include the following information:</p> <ul style="list-style-type: none"> <li>a) release commencement date and time;</li> <li>b) details regarding the compliance of the release with the conditions of Agency interest: Water of this environmental authority (including contaminant limits, natural flow, discharge volume);</li> <li>c) release point/s;</li> <li>d) release rate;</li> <li>e) Release salinity; and</li> <li>f) receiving water/s including the natural flow rate.</li> </ul>
<b>C14</b>	<p>The environmental authority holder must notify the administering authority via WaTERS within <b>twenty-four (24) hours</b> after cessation of a release event, of the cessation of a release notified under <b>Condition C13</b> and within <b>twenty-eight (28) days</b> provide the following information in writing:</p> <ul style="list-style-type: none"> <li>a) release cessation date and time;</li> <li>b) natural flow volume in receiving water;</li> <li>c) the total volume of the release and the daily quantity of mine affected water released from each release point; and</li> <li>d) details regarding the compliance of the release with the conditions of Agency Interest: Water of this environmental authority (including contamination limits, natural flow, discharge volume).</li> </ul> <p><i>Note: Successive or intermittent releases occurring within <b>twenty-four (24) hours</b> of the cessation of any individual release can be considered part of a single release event and do not require individual notification for the purpose of compliance with <b>Conditions C13 and C14</b>, provided the relevant details of the release are included within the notification provided in accordance with <b>Conditions C13 and C14</b>.</i></p>
<b>C15</b>	<p><b>Notification of release event exceedance</b></p> <p>If the release limits defined in <b>Table 2: Mine Affected Water Release Limits</b> are exceeded, the holder of the environmental authority must notify the administering authority via WaTERS within <b>twenty-four (24) hours</b> of receiving the results.</p>

<b>C16</b>	<p>The environmental authority holder must, within <b>twenty-eight (28) days</b> of a release that is not compliant with the conditions of this environmental authority, provide a report to the administering authority via WaTERS detailing:</p> <ul style="list-style-type: none"> <li>a) the reason for the release;</li> <li>b) the location of the release;</li> <li>c) the total volume of the release and the daily quantity of mine affected water released from each release point, and which (if any) part of these releases were non-compliant;</li> <li>d) the total duration of the release and which (if any) part of this period was non-compliant;</li> <li>e) all in situ and any water quality monitoring results (including all laboratory analyses);</li> <li>f) identification of any environmental harm as a result of the non-compliance; and</li> <li>g) any other matters pertinent to the water release event.</li> </ul>
<b>C17</b>	<p><b>Monitoring of water storage quality</b></p> <p>Water storages stated in <b>Table 5: Water Storage Monitoring</b> which are associated with the release points must be monitored for:</p> <ul style="list-style-type: none"> <li>a) the water quality characteristics specified in <b>Table 6: Onsite Water Storage Contaminant Limits</b> at the monitoring locations and at the monitoring frequency specified in <b>Table 5: Water Storage Monitoring</b>; and</li> <li>b) the volume of water held in the each of the water storages listed in <b>Table 5: Water Storage Monitoring</b>.</li> </ul>

**Table 5: Water Storage Monitoring**

Water Storage Description	Easting (GDA94 – Zone 55)	Northing (GDA94 – Zone 55)	Monitoring Location	Frequency of Monitoring
Release Dam 1	614974.040	7569713.469	Spillway	Quarterly
Release Dam 2	616695.040	7567301.469	Spillway	Quarterly
S1 pit	616554.040	7570197.469	Pump intake (via bleed-off valve)	Quarterly
S2 Sediment Dam	615114.040	7569350.469	Pump intake (via bleed-off valve)	Quarterly
S3 pit	617929.040	7567111.469	Pump intake (via bleed-off valve)	Quarterly

<b>C18</b>	<p>In the event that waters storages defined in <b>Table 5: Water Storage Monitoring</b> exceed the contaminant limits defined in <b>Table 6: Onsite Water Storage Contaminant Limits</b>, the holder of the environmental authority must implement measures, where practicable, to prevent access to waters by all livestock.</p>
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**Table 6: Onsite Water Storage Contaminant Limits**

Quality Characteristic	Test Value	Contaminant Limit
pH (pH unit)	Range	Greater than 4, less than 9 <sup>2</sup>
EC (µS/cm)	Maximum	5970 <sup>1</sup>
Sulphate (mg/L)	Maximum	1000 <sup>1</sup>
Fluoride (mg/L)	Maximum	2.0 <sup>1</sup>
Aluminium (mg/L)	Maximum	5.0 <sup>1</sup>
Arsenic (mg/L)	Maximum	0.5 <sup>1</sup>
Cadmium (mg/L)	Maximum	0.01 <sup>1</sup>
Cobalt (mg/L)	Maximum	1.0 <sup>1</sup>
Copper (mg/L)	Maximum	1.0 <sup>1</sup>
Lead (mg/L)	Maximum	0.1 <sup>1</sup>
Nickel (mg/L)	Maximum	1.0 <sup>1</sup>
Zinc (mg/L)	Maximum	20 <sup>1</sup>

<sup>1</sup> Contaminant limit based on ANZECC & ARMCANZ (2000) stock water quality guidelines.

<sup>2</sup> Page 4.2-15 of ANZECC & ARMCANZ (2000) "Soil and animal health will not generally be affected by water with pH in the range of 4–9".

**Note:** Total measurements (unfiltered) must be taken and analysed

<b>C19</b>	<p><b>Receiving environment monitoring and contaminant trigger levels</b></p> <p>The quality of the receiving waters must be monitored at the locations specified in <b>Table 8: Receiving Water Upstream Background Sites and Down Stream Monitoring Points</b> and depicted in <b>Appendix 1, Figure 2: Location of Water Release Points and Monitoring Points</b> and <b>Appendix 1, Figure 3: Location of MP3</b> attached to this environmental authority, for each quality characteristic and at the monitoring frequency stated in <b>Table 7: Receiving Waters Contaminant Trigger Levels</b>.</p>
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**Table 7: Receiving Waters Contaminant Trigger Levels**

Quality Characteristic	Trigger Level	Monitoring Frequency
pH	6.5 – 8.0	Daily during the release
Electrical Conductivity (µS/cm)	1000	
Total Dissolved Solids (mg/L)	As per <b>Condition C20</b>	
Total Suspended Solids	As per <b>Condition C20</b>	
Sulphate (SO <sub>4</sub> <sup>2-</sup> ) (mg/L)	1000	

## Environmental authority EPML00932713 – Isaac Plains Coal Mine

<b>C20</b>	A trigger level for Total Dissolved Solids and Total Suspended Solids for <b>Table 7: Receiving Waters Contaminant Trigger Levels</b> must be determined and submitted to the administering authority via an amendment to the environmental authority by <b>29 June 2018</b> .
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**Table 8: Receiving Water Upstream Background Sites and Down Stream Monitoring Points**

Monitoring Points	Receiving Waters Location Description	Easting (GDA94 – Zoning 55)	Northing (GDA94 – Zoning 55)
Upstream Background Monitoring Points			
Monitoring Point 1	W1 - Smokey Creek 2870 metres upstream of RP 1	616758.4	7570831.3
Monitoring Point 2	W3 - Billy's Gully 2140 metres upstream of RP 2	618602.04	7566960.5
Downstream Monitoring Points			
Monitoring Point 3	W2 – Isaac River downstream of Peak Downs Highway 13900 m downstream of RP 1 9500 m downstream of RP 2	616690.407	7561249.432
Monitoring Point 4	W4 - Billy's Gully 1340 meters downstream of RP2	616415.04	7566527.5
Monitoring Point 5	W5 - Smoky Creek 750 meters Downstream of RP1	614925.04	7569302.5

**Note:** The data from background monitoring points must not be used where they are affected by releases from other mines.

<b>C21</b>	<p>If quality characteristics of the receiving water at the downstream Monitoring Point 3 (<b>W2 – Isaac River</b>) exceed any of the trigger levels specified in <b>Table 7: Receiving Waters Contaminant Trigger Levels</b> during a release event the environmental authority holder must compare the downstream results to the upstream results in the receiving waters and:</p> <ol style="list-style-type: none"> <li>a) where the downstream result is the same or a lower value than the upstream value for the quality characteristic then no action is to be taken; or</li> <li>b) where the downstream results exceed the upstream results complete an investigation into the potential for environmental harm and provide a written report to the administering authority in the next annual return, outlining: <ol style="list-style-type: none"> <li>i. details of the investigations carried out; and</li> <li>ii. actions taken to prevent environmental harm.</li> </ol> </li> </ol> <p><b>Note:</b> Where an exceedance of a trigger level has occurred and is being investigated, in accordance with <b>Condition C21 b) ii</b>, no further reporting is required for subsequent trigger events for that quality characteristic.</p>
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C22	<p><b>Receiving environment monitoring program (REMP)</b></p> <p>The environmental authority holder must develop and implement a Receiving Environment Monitoring Program (REMP) to monitor, identify and describe any adverse impacts to surface water environmental values, quality and flows due to the authorised mining activity. This must include monitoring the effects of the mine on the receiving environment periodically (under natural flow conditions) and while mine affected water is being discharged from the site.</p> <p>For the purposes of the REMP, the receiving environment is the waters of Smoky Creek, Billy's Gully and connected or surrounding waterways within <b>ten (10) kilometres</b> downstream of the release. The REMP should encompass any sensitive receiving waters or environmental values downstream of the authorised mining activity that will potentially be directly affected by an authorised release of mine affected water.</p>
C23	<p>The REMP must:</p> <ol style="list-style-type: none"> <li>a) assess the condition or state of receiving waters, including upstream conditions, spatially within the REMP area, considering background water quality characteristics based on accurate and reliable monitoring data that takes into consideration temporal variation (e.g. seasonality); and</li> <li>b) be designed to facilitate assessment against water quality objectives for the relevant environmental values that need to be protected; and</li> <li>c) include monitoring from background reference sites (e.g. upstream or background) and downstream sites from the release (as a minimum, the locations specified in <b>Table 8: Receiving Water Upstream Background Sites and Down Stream Monitoring Points</b>); and</li> <li>d) specify the frequency and timing of sampling required in order to reliably assess ambient conditions and to provide sufficient data to derive site specific background reference values in accordance with the Queensland Water Quality Guidelines 2006. This should include monitoring during periods of natural flow irrespective of mine or other discharges; and</li> <li>e) include monitoring and assessment of dissolved oxygen saturation, temperature and all water quality parameters listed in <b>Table 2: Mine Affected Water Release Limits</b> and <b>Table 3: Release Contaminant Trigger Investigation Levels</b>); and</li> <li>f) include, where appropriate, monitoring of metals/metalloids in sediments (in accordance with ANZECC &amp; ARMCANZ 2000, BATLEY and/or the most recent version of AS5667.1 Guidance on Sampling of Bottom Sediments); and</li> <li>g) include, where appropriate, monitoring of macroinvertebrates in accordance with the AusRivas methodology, and</li> <li>h) apply procedures and/or guidelines from ANZECC &amp; ARMCANZ 2000 and other relevant guideline documents; and</li> <li>i) describe sampling and analysis methods and quality assurance and control; and</li> <li>j) incorporate stream flow and hydrological information in the interpretations of water quality and biological data.</li> </ol>

<b>C24</b>	A report outlining the findings of the REMP, including all monitoring results and interpretations in accordance with <b>Conditions C22</b> and <b>C23</b> must be prepared annually and made available to the administering authority. This must include an assessment of background reference water quality, the condition of downstream water quality compared against water quality objectives, and the suitability of current discharge limits to protect downstream environmental values.
<b>C25</b>	<p><b>Water reuse</b></p> <p>Mine affected water may be piped or trucked or transferred by some other means that does not contravene the conditions of this environmental authority and deposited into artificial water storage structures, such as farm dams or tanks, or used directly at properties owned by the environmental authority holder or a third party for the purpose of:</p> <ul style="list-style-type: none"> <li>a) supplying stock water subject to compliance with the quality release limits specified in <b>Table 9: Stock Water Release Limits</b>; or</li> <li>b) supplying irrigation water subject to compliance with quality release limits in <b>Table 10: Irrigation Water Release Limits</b>; or</li> <li>c) supplying water for construction and/or road maintenance in accordance with the conditions of this environmental authority.</li> </ul>

**Table 9: Stock Water Release Limits**

Quality characteristic	Units	Minimum	Maximum
pH	pH units	6.5	8.5
Electrical Conductivity	µS/cm	N/A	5000

**Table 10: Irrigation Water Release Limits**

Quality characteristic	Units	Minimum	Maximum
pH	pH units	6.5	8.5
Electrical Conductivity	µS/cm	N/A	Site specific value to be determined in accordance with ANZECC & ARMCANZ (2000) Irrigation Guidelines and provided through an amendment to the environmental authority prior to release of irrigation water.

<b>C26</b>	Mine affected water may be piped or trucked or transferred by some other means that does not contravene the conditions of this environmental authority and deposited into artificial water storage structures, such as dams or tanks, for the purpose of supplying water to an adjoining mine. The volume, pH and electrical conductivity of water transferred to an adjoining mine must be monitored and recorded.
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## Environmental authority EPML00932713 – Isaac Plains Coal Mine

<b>C27</b>	<p>If the responsibility for mine affected water is given or transferred to another person in accordance with <b>Conditions C25 or C26</b>:</p> <ul style="list-style-type: none"> <li>a) the responsibility for the mine affected water must only be given or transferred in accordance with a written agreement (the third party agreement); and</li> <li>b) the third party agreement must include a commitment from the person utilising the mine affected water to use it in such a way as to prevent environmental harm or public health incidents and specifically make the persons aware of the General Environmental Duty (GED) under section 319 of the <i>Environmental Protection Act 1994</i>, environmental sustainability of the water disposal and protection of environmental values of waters; and</li> <li>c) the third party agreement must be signed by both parties to the agreement.</li> </ul>
<b>C28</b>	<p>The release of any contaminants as permitted by this environmental authority, directly or indirectly to waters, other than internal water management infrastructure that is installed and operated in accordance with a water management plan that complies with <b>Conditions C31 to C35</b> inclusive:</p> <ul style="list-style-type: none"> <li>a) must not produce any visible discolouration of receiving waters; and</li> <li>b) must not produce any slick or other visible or odorous evidence of oil, grease or petrochemicals nor contain visible floating oil, grease, scum, litter or other objectionable matter.</li> </ul>
<b>C29</b>	<p><b>Annual water monitoring reporting</b></p> <p>The following information must be recorded in relation to all water monitoring required under the conditions of this environmental authority and submitted to the administering authority in the specified format with each annual return:</p> <ul style="list-style-type: none"> <li>a) the date on which the sample was taken;</li> <li>b) the time at which the sample was taken;</li> <li>c) the monitoring point at which the sample was taken;</li> <li>d) the measured or estimated daily quantity of mine affected water released from all release points;</li> <li>e) the release flow rate at the time of sampling for each release point;</li> <li>f) the results of all monitoring and details of any exceedances of the conditions of this environmental authority; and</li> <li>g) water quality monitoring data must be provided to the administering authority in the specified electronic format upon request.</li> </ul>
<b>C30</b>	<p><b>Activities within watercourses</b></p> <p>Destroying native vegetation, excavating, or placing fill in a watercourse, lake or spring necessary for and associated with mining operations must be undertaken in accordance with Department of Natural Resources and Mines <i>Guideline - Activities in a Watercourse, Lake or Spring associated with Mining Activities</i>.</p>

## Environmental authority EPML00932713 – Isaac Plains Coal Mine

<b>C31</b>	<p><b>Water Management Plan</b></p> <p>A Water Management Plan must be developed and implemented by an appropriately qualified person.</p>
<b>C32</b>	<p>The Water Management Plan required by <b>Condition C31</b> must:</p> <ul style="list-style-type: none"> <li>a) provide for effective management of actual and potential environmental impacts resulting from water management associated with the mining activity carried out under this environmental authority; and</li> <li>b) be developed in accordance with Department of Environment and Heritage Protection guideline Preparation of water management plans for mining activities and include: <ul style="list-style-type: none"> <li>i. a study of the source of contaminants;</li> <li>ii. a water balance model for the site;</li> <li>iii. a water management system for the site;</li> <li>iv. measures to manage and prevent saline drainage;</li> <li>v. measures to manage and prevent acid rock drainage;</li> <li>vi. contingency procedures for emergencies; and</li> <li>vii. a program for monitoring and review of the effectiveness of the water management plan.</li> </ul> </li> </ul>
<b>C33</b>	<p>The Water Management Plan required by <b>Condition C31</b> must be reviewed each calendar year and a report prepared by an appropriately qualified person. The report must:</p> <ul style="list-style-type: none"> <li>a) assess the plan against the requirements under <b>Condition C32</b>;</li> <li>b) include recommended actions to ensure actual and potential environmental impacts are effectively managed for the coming year; and</li> <li>c) identify any amendments made to the water management plan following the review.</li> </ul>
<b>C34</b>	<p>The holder of this environmental authority must attach to the review report required by <b>Condition C33</b>, a written response to the report and recommended actions, detailing the actions taken or to be taken by the environmental authority holder on stated dates:</p> <ul style="list-style-type: none"> <li>a) to ensure compliance with this environmental authority; and</li> <li>b) to prevent a recurrence of any non-compliance issues identified.</li> </ul>
<b>C35</b>	<p>The review report required by <b>Condition C33</b> and the written response to the review report required by <b>Condition C34</b> must be submitted to the administering authority with the subsequent annual return under the signature of the appointed signatory for the annual return.</p>
<b>C36</b>	<p><b>Saline drainage</b></p> <p>The holder of this environmental authority must ensure proper and effective measures are taken to avoid or otherwise minimise the generation and/or release of saline drainage.</p>

<b>C37</b>	<p><b>Acid rock drainage</b></p> <p>The holder of this environmental authority holder must ensure proper and effective measures are taken to avoid or otherwise minimise the generation and/or release of acid rock drainage.</p>
<b>C38</b>	<p><b>Stormwater and water sediment controls</b></p> <p>An Erosion and Sediment Control Plan must be developed by an appropriately qualified person and implemented for all stages of the authorised mining activities on the site to minimise erosion and the release of sediment to receiving waters and contamination of stormwater.</p>
<b>C39</b>	<p>Stormwater, other than mine affected water, is permitted to be released to waters from:</p> <ul style="list-style-type: none"> <li>a) erosion and sediment control structures that are installed and operated in accordance with the Erosion and Sediment Control Plan required by <b>Condition C38</b>; and</li> <li>b) water management infrastructure that is installed and operated, in accordance with a Water Management Plan that complies with <b>Conditions C31 to C35</b> inclusive, for the purpose of ensuring water does not become mine affected water.</li> </ul>
<b>C40</b>	<p>The maintenance and cleaning of any vehicles, plant or equipment must not be carried out in areas from which contaminants can be released into any receiving waters.</p>
<b>C41</b>	<p>Any spillage of wastes, contaminants or other materials must be cleaned up as quickly as practicable to minimise the release of wastes, contaminants or materials to any stormwater drainage system or receiving waters.</p>
<b>C42</b>	<p><b>Groundwater</b></p> <p>The holder of this environmental authority must not release contaminants to groundwater.</p>
<b>C43</b>	<p><b>Monitoring and reporting</b></p> <p>A Groundwater Management and Monitoring Program for all stages of the authorised mining activities on site must:</p> <ul style="list-style-type: none"> <li>a) be developed, certified and implemented by an appropriately qualified person by <b>29 June 2018</b>;</li> <li>b) have all determinations of groundwater quality monitoring and groundwater biological monitoring be performed by an appropriately qualified person; and</li> <li>c) be able to detect a change in groundwater quality values and levels due to activities that are part of the authorised mining activities.</li> </ul>

## Environmental authority EPML00932713 – Isaac Plains Coal Mine

<b>C44</b>	<p>The Groundwater Management and Monitoring Program required by <b>Condition C43</b> and the data collected must be reviewed on an annual basis by an appropriately qualified person. The review must:</p> <ul style="list-style-type: none"> <li>a) include the assessment of groundwater levels and quality data;</li> <li>b) assess the suitability of the groundwater monitoring network, including an assessment of whether groundwater parameter trigger values or compliance bores are required for all groundwater aquifers potentially impacted by the authorised mining activities; and</li> <li>c) be in a report submitted to the administering authority within <b>twenty-eight (28) days</b> of receiving annual groundwater data.</li> </ul>
<b>C45</b>	<p>Groundwater must be monitored at the locations and frequencies defined in <b>Table 11: Groundwater monitoring locations frequency</b> for the standing water levels and the parameters identified in <b>Table 12: Groundwater contaminant triggers</b>. Results and analysis of groundwater monitoring must be submitted annually to the administering authority with the report required by <b>Condition C44(c)</b>.</p>
<b>C46</b>	<p><b>Exceedance investigation</b></p> <p>If groundwater quality characteristics in Burton Coal Bore 2 or Swap Bore 1 exceed any of the trigger levels identified in <b>Table 12: Groundwater contaminant triggers</b> the holder of this environmental authority must:</p> <ul style="list-style-type: none"> <li>a) notify the administering authority via WaTERS or the pollution hotline within <b>seven (7) days</b> of receiving the analysis results;</li> <li>b) complete an investigation into the potential for environmental harm.</li> </ul>
<b>C47</b>	<p>If groundwater levels for the bores identified in <b>Table 13: Groundwater level monitoring</b> exceed any of the trigger level thresholds identified in <b>Table 13: Groundwater level monitoring</b> the holder of this environmental authority must:</p> <ul style="list-style-type: none"> <li>a) notify the administering authority via WaTERS or the pollution hotline within <b>seven (7) days</b> of receiving the analysis results;</li> <li>b) complete an investigation into the potential for environmental harm.</li> </ul>
<b>C48</b>	<p>An exceedance investigation under <b>Condition C46</b> or <b>Condition C47</b> must be completed and submitted to the administering authority via WaTERS within <b>ninety (90) days</b> of the notification made under <b>Condition C46(a)</b> or <b>Condition C47(a)</b>.</p>
<b>C49</b>	<p>If the exceedance investigation in <b>Condition C46</b> or <b>Condition C47</b> identifies environmental harm is occurring, the environmental authority holder must immediately implement appropriate abatement measures to prevent the continuation or re-occurrence of environmental harm to groundwater.</p>
<b>C50</b>	<p><b>Bore construction and maintenance and decommissioning</b></p> <p>The construction, maintenance and management of groundwater bores (including groundwater monitoring bores) must be undertaken in a manner that prevents or minimises impacts to the environment and ensures the integrity of the bores to obtain accurate monitoring.</p>

Table 11: Groundwater monitoring locations and frequency

Monitoring Point	Aquifer Type	Location		Surface RL*	Screening interval (mbgl)	Monitoring frequency
		Easting (GDA94 – Zone 55)	Northing (GDA94 – Zone 55)			
<b>Reference Bores</b>						
Burton Coal Bore 2	Rewan Formation	620610.0	7573958.5	240.67	<b>Condition C51</b>	Quarterly
Swamp Bore 1	Rewan Formation	621744.0	7569149.5	245.85	<b>Condition C51</b>	Quarterly
MB1	Coal Measures	618679	7572034	236.54	22.5 – 28.4	Quarterly
MB2	Coal Measures	618960	757957	242.88	48.7 – 51.6	Quarterly
MB3	Coal Measures	618933	7568292	253.00	49.7 – 52.6	Quarterly
MB4	Quaternary Colluvium / Tertiary Sediments	<b>Condition C51</b>	<b>Condition C51</b>	<b>Condition C51</b>	<b>Condition C51</b>	Quarterly
MB5	Coal Measures	618394	7570698	241.83	36.4 – 39.3	Quarterly
MB8	Coal Measures	619301	7570675	<b>Condition C51</b>	<b>Condition C51</b>	Quarterly
MB9	Coal Measures	620329	7568312	<b>Condition C51</b>	<b>Condition C51</b>	Quarterly
MB10	Tertiary basalt	620660	7567991	<b>Condition C51</b>	<b>Condition C51</b>	Quarterly
MB11	Alluvium	618832	7571923	<b>Condition C51</b>	<b>Condition C51</b>	Quarterly

\*RL must be measured to the nearest 5cm from the top of the bore casing

<b>C51</b>	<p>The following information must be determined and submitted to the administering authority via an amendment to the environmental authority by <b>29 June 2018</b>:</p> <p>a) Information for <b>Table 11: Groundwater monitoring locations and frequency</b> including:</p> <ol style="list-style-type: none"> <li>i. Location details for MB4;</li> <li>ii. Surface RL and Screening interval for monitoring points Burton Coal Bore 2, Swamp Bore 1, MB4, MB8, MB9, MB10 and MB11; and</li> </ol> <p>b) The image for <b>Appendix 1, Figure 4 Groundwater Monitoring Bore Locations</b>.</p>
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**Table 12: Groundwater contaminant triggers**

Parameter	Unit	Trigger Values – Swamp Bore 1	Trigger Values – Burton Coal Bore 2	Limit type
Aluminium	µg/L	10	10	Maximum
Antimony	µg/L	1	1	Maximum
Arsenic	µg/L	1	4.8	Maximum
Calcium	mg/L	570	170	Maximum
Chloride	mg/L	3500	1900	Maximum
Carbonate	mg/L	1	7.9	Maximum
Total Dissolved Solids	mg/L	7600	3900	Maximum
Electrical Conductivity	µS/cm	9500	6700	Maximum
Bicarbonate	mg/L	98	800	Maximum
Iron	µg/L	1000	270	Maximum
Magnesium	mg/L	170	230	Maximum
Mercury	µg/L	0.1	0.1	Maximum
Molybdenum	µg/L	1	1.1	Maximum
Total Petroleum Hydrocarbons C6-C9	µg/L	20	20	Maximum
Total Petroleum Hydrocarbons C10-C36	µg/L	50	50	Maximum
pH	pH Units	7.2 - 7.8	7.0 - 8.6	Minimum/maximum
Potassium	mg/L	25	8.5	Maximum
Selenium	µg/L	10	10	Maximum
Silver	µg/L	1	1	Maximum
Sulfate	mg/L	155	123	Maximum
Sodium	mg/L	1300	931	Maximum
Suspended Solids (Total)	mg/L	43	30	Maximum

Table 13: Groundwater level monitoring

Monitoring location	Trigger level threshold (m)
Burton Coal Bore 2	2
Swamp Bore 1	5
MB4	8
MB10	16
MB11	5

<b>C52</b>	<p>The following information must be recorded in relation to all groundwater water sampling:</p> <ul style="list-style-type: none"> <li>a) the date on which the sample was taken;</li> <li>b) the time at which the sample was taken;</li> <li>c) the monitoring point at which the sample was taken; and</li> <li>d) the results of all monitoring.</li> </ul>
<b>C53</b>	<p><b>Sewage Treatment</b></p> <p>Treated sewage effluent is authorised to be released to land in accordance with the release limits stated in <b>Table 14: Contaminant release limits to land</b> at the following locations:</p> <ul style="list-style-type: none"> <li>a) within the nominated area(s) identified in <b>Appendix 1, Figure 5: Sewage treatment plant and effluent disposal</b>; and</li> <li>b) other land for the purpose of dust suppression and/or firefighting.</li> </ul>

Table 14: Contaminant release limits to land

Contaminant	Unit	Release limit	Limit type	Frequency
5 day Biochemical oxygen demand (BOD)	mg/L	20	Maximum	Monthly
Total suspended solids	mg/L	30	Maximum	Monthly
Nitrogen	mg/L	30	Maximum	Monthly
Phosphorus	mg/L	15	Maximum	Monthly
E-coli	Organisms/100mL	1000	Maximum	Monthly
pH	pH units	6.0 – 9.0	Range	Monthly

<b>C54</b>	The release of treated effluent to land must be carried out in a manner such that: <ul style="list-style-type: none"> <li>a) vegetation is not damaged;</li> <li>b) there is no surface ponding of treated sewage effluent; and</li> <li>c) there is no run-off of treated sewage effluent.</li> </ul>
<b>C55</b>	If areas irrigated with treated sewage effluent are accessible to employees or the general public, prominent signage must be provided advising that effluent is present and care should be taken to avoid consuming or otherwise coming into unprotected contact with the effluent.
<b>C56</b>	All treated sewage effluent released to land must be monitored at the frequency and for the parameters specified in <b>Table 14: Contaminant release limits to land</b> .
<b>C57</b>	The monthly volume of treated sewage effluent released to land must be measured and records kept of the volumes of effluent released.
<b>C58</b>	A minimum area of <b>1428m<sup>2</sup></b> of land, excluding any necessary buffer zones, must be utilised for the irrigation and/or beneficial reuse of treated sewage effluent.
<b>C59</b>	Treated sewage effluent must only be supplied to another person or organisation that has a written plan detailing how the user of the treated sewage effluent will comply with their general environmental duty under section 319 of the <i>Environmental Protection Act 1994</i> whilst using the treated sewage effluent.

<b>Agency interest: Noise and Vibration</b>	
<b>Condition number</b>	<b>Condition</b>
<b>D1</b>	Noise, vibration and airblast overpressure resulting from the authorised mining activities must not cause a nuisance, at any sensitive receptor or commercial place.
<b>D2</b>	<p><b>Noise monitoring</b></p> <p>When requested by the administering authority, or as a result of a complaint, noise monitoring must be undertaken and the results thereof notified to the administering authority within <b>fourteen (14) days</b> following completion of the monitoring period. Noise from the authorised mining activities must not exceed the limits specified in <b>Table 15: Noise limits</b> at any sensitive receptor or commercial place.</p>



<b>D3</b>	Monitoring required by <b>Condition D2</b> must include: <ul style="list-style-type: none"> <li>a) LA 10, adj, 10 mins;</li> <li>b) LA 1, adj, 10 mins;</li> <li>c) the level and frequency of occurrence of impulsive or tonal noise;</li> <li>d) atmospheric conditions including wind speed and direction;</li> <li>e) effects due to extraneous factors such as traffic noise; and</li> <li>f) location date and time of recording.</li> </ul>
<b>D4</b>	If the monitoring indicates an exceedance of the relevant limits in <b>Table 15: Noise limits</b> , then the environmental authority holder must investigate whether the exceedance is due to the authorised mining activity. If the authorised mining activities are found to be the cause of the exceedance then the environmental authority holder must immediately implement noise abatement measures so that noise from the activity does not result in further environmental nuisance.
<b>D5</b>	If during monitoring as required by <b>Condition D2</b> , there is an exceedance of the relevant limits listed in <b>Table 15: Noise limits</b> , the environmental authority holder must notify the administering authority within <b>seven (7) days</b> of the exceedance occurring. The notification must also include the actions taken in accordance with <b>Condition D4</b> .

**Table 15: Noise limits**

Noise level dB(A)	Monday to Sunday (including public holidays)		
	7am - 6pm	6pm - 10pm	10pm - 7am
	<b>Noise measured at a 'Sensitive Receptor'</b>		
LA10, adj, 10 mins	B/g + 5	B/g + 5	B/g + 3
LA1, adj, 10 mins	B/g + 10	B/g + 10	B/g + 8
	<b>Noise measured at a 'Commercial place'</b>		
LA10, adj, 10 mins	B/g + 10	B/g + 10	B/g + 5
LA1, adj, 10 mins	B/g + 15	B/g + 15	B/g + 10

<b>D6</b>	The method of measurement and reporting of noise monitoring must comply with the current edition of the administering authority's <i>Noise Measurement Manual</i> .
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<b>D7</b>	<p><b>Vibration nuisance</b></p> <p>When requested by the administering authority, or as a result of a complaint, vibration monitoring must be undertaken, and the results thereof notified to the administering authority within <b>fourteen (14) days</b> following completion of the monitoring period. Vibration from the authorised mining activities must not exceed the limits specified in <b>Table 16: Vibration Limits</b>, at any sensitive receptor or commercial place</p>
<b>D8</b>	<p>Monitoring required by <b>Condition D7</b> must include:</p> <ul style="list-style-type: none"> <li>a) peak particle velocity (mm/s);</li> <li>b) air blast overpressure level (dB linear peak);</li> <li>c) location of the blast/s within the mining area (including which bench level);</li> <li>d) atmospheric conditions including temperature, relative humidity and wind speed and direction; and</li> <li>e) location, date and time of recording.</li> </ul>

**Table 16: Vibration limits**

Vibration Parameter	Vibration measured at a sensitive or commercial place	
	Monday to Sunday 9am - 7pm	Other times and public holidays
Peak particle velocity (mm/s)	Maximum 5 mm/s for 4 out of 5 consecutive blasts	No blasting to occur
Peak particle velocity (mm/s)	10 mm/s maximum	No blasting to occur

<b>D9</b>	<p>If the monitoring indicates an exceedance of the relevant limits in <b>Table 16: Vibration Limits</b> then the environmental authority holder must investigate whether the exceedance is due to the authorised mining activity. If the authorised mining activities are found to be the cause of the exceedance then the environmental authority holder must immediately implement abatement measures so that vibration from the activity does not result in further environmental nuisance.</p>
<b>D10</b>	<p>If during monitoring as required by <b>Condition D7</b>, there is an exceedance of the relevant limits listed in <b>Table 16: Vibration limits</b>, the environmental authority holder must notify the administering authority within <b>seven (7) days</b> of the exceedance occurring. The notification must also include the actions taken in accordance with <b>Condition D9</b>.</p>
<b>D11</b>	<p>Every explosive blast for the mining activity shall be designed by a competent person to achieve the criteria specified in <b>Table 16: Vibration limits</b> and <b>Table 17: Airblast overpressure level</b>.</p>
<b>D12</b>	<p>All relevant information pertaining to the design of every explosive blast for the mining activity in relation to the criteria specified in <b>Table 16: Vibration limits</b> and <b>Table 17: Airblast overpressure level</b> shall be kept in written and diagrammatic form.</p>

<b>D13</b>	<p><b>Airblast overpressure nuisance</b></p> <p>When requested by the administering authority, or as a result of a complaint, airblast overpressure monitoring must be undertaken and the results thereof notified to the administering authority within <b>fourteen (14) days</b> following completion of the monitoring period. The airblast overpressure level from blasting operations must not exceed the limits defined in <b>Table 17: Airblast overpressure level</b> at any sensitive receptor or commercial place.</p>
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**Table 17: Airblast overpressure level**

Parameter	Airblast overpressure measured at a sensitive receptor or commercial place	
	Monday to Sunday 9am - 7pm	Other times and public holidays
Air blast overpressure level (dB [Lin] Peak)	Maximum 115 dB for 4 out of 5 consecutive blasts	No blasting to occur
Air blast overpressure level (dB [Lin] Peak)	120 dB maximum	No blasting to occur

<b>D14</b>	<p>Airblast overpressure monitoring required by <b>Condition D13</b> must include the following descriptors, characteristics and conditions:</p> <ul style="list-style-type: none"> <li>a) location of the blast(s) within the mining area (including which bench level);</li> <li>b) atmospheric conditions including temperature, relative humidity and wind speed and direction; and</li> <li>c) location, date and time of recording.</li> </ul>
<b>D15</b>	<p>If the monitoring indicates an exceedance of the relevant limits in <b>Table 17: Airblast overpressure level</b> then the environmental authority holder must investigate whether the exceedance is due to the authorised mining activity. If the authorised mining activities are found to be the cause of the exceedance then the environmental authority holder must immediately implement airblast overpressure abatement measures so that vibration from the activity does not result in further environmental nuisance.</p>
<b>D16</b>	<p>If during monitoring as required by <b>Condition D13</b>, there is an exceedance of the relevant limits listed in <b>Table 17: Airblast overpressure level</b>, the environmental authority holder must notify the administering authority within <b>seven (7) days</b> of the exceedance occurring. The notification must also include the actions taken in accordance with <b>Condition D15</b>.</p>
<b>D17</b>	<p>The method of measurement and reporting of airblast overpressure levels must comply with the current edition of the administering authority's <i>Noise Measurement Manual</i>.</p>

Agency interest: Waste	
Condition number	Condition
E1	<p><b>Storage and disposal of tyres</b></p> <p>Scrap tyres stored awaiting disposal or transport for take-back and recycling, or waste-to-energy options must be stored in stable stacks and at least <b>ten (10) metres</b> from any other scrap tyre storage area, or combustible or flammable material, including vegetation.</p>
E2	<p>Where no feasible recycling or waste-to-energy options are available, disposing of scrap tyres resulting from the authorised mining activities in spoil emplacements is acceptable, provided tyres are placed as deep in the spoil as reasonably practicable. A record must be kept of the number and location for tyres disposed.</p>
E3	<p>Scrap tyres resulting from the authorised mining activities disposed within the operational land must not impede saturated aquifers or compromise the stability of the consolidated landform.</p>
E4	<p><b>Waste management</b></p> <p>Unless otherwise permitted by a condition of this environmental authority or with prior approval from the administering authority and in accordance with a relevant standard operating procedure, waste must not be burnt.</p>
E5	<p><b>Waste disposal</b></p> <p>Waste, other than any spoil, tailings or overburden removed as part of the authorised mining activity or permitted by another condition of the environmental authority, must not be disposed of within any void created by this activity.</p>

<p><b>E6</b></p>	<p><b>Mine waste</b></p> <p>A Mining Waste Management Plan must be developed and implemented by an appropriately qualified person for every stage of the mining activities. The Mining Waste Management Plan must be submitted to the administering authority by <b>29 June 2018</b> for review and comment. The Mining Waste Management Plan must at a minimum include:</p> <ul style="list-style-type: none"> <li>a) characterisation programs to ensure that all mining waste is progressively characterised during disposal for net acid producing potential, salinity and the following contaminants: pH, Electrical Conductivity (EC), Acid Neutralising Capacity (ANC), Net Acid Generation (NAG) (reporting NAG capacity and NAG pH after oxidation), Total Sulphur (S), Chromium Reducible Sulphur (Scr), Boron (B) Cadmium (Cd), Iron (Fe), Aluminium (Al), Copper (Cu), Magnesium (Mg), Manganese (Mn), Calcium (Ca), Sodium (Na), Zinc (Zn) and Sulphate (SO<sub>4</sub>);</li> <li>b) characterisation programs to ensure that the physical properties of the mining waste is progressively characterised during disposal;</li> <li>c) the availability or leachability of metals from the mining waste;</li> <li>d) quantification of PAF from mining waste present;</li> <li>e) review impacts of the PAF mining waste on the rehabilitation;</li> <li>f) management actions for mining waste that has been identified as having a high availability or leachability of metals;</li> <li>g) management actions for mining waste that has been defined as PAF;</li> <li>h) identification of environmental impacts and potential environmental impacts;</li> <li>i) control measures for routine operations to minimise likelihood of environmental harm;</li> <li>j) contingency plans and emergency procedures for non-routine situations;</li> <li>k) periodic review of environmental performance and continual improvement.</li> <li>l) containment of tailings;</li> <li>m) records to indicate locations and characteristics of tailings stored within the tailings storage facility;</li> <li>n) the management of seepage and leachates from tailings storages both during operation and the foreseeable future;</li> <li>o) the control of fugitive emissions to air; and</li> <li>p) a program for progressive sampling and characterisation to identify acid producing potential and metal concentrations of tailings.</li> </ul>
<p><b>E7</b></p>	<p>Within <b>twenty (20) business days</b> of receiving comments from the administering authority as per <b>Condition E6</b>, the Mining Waste Management Plan must be updated to address the comments, amended to adopt any recommendations and submitted to the administering authority for approval.</p>

Agency interest: Land	
Condition number	Condition
F1	<p><b>Preventing contaminant release to land</b></p> <p>Contaminants must not be released to land unless otherwise authorised by a condition of this environmental authority.</p>
F2	<p><b>Topsoil</b></p> <p>Topsoil must be strategically stripped ahead of mining in accordance with a topsoil management plan.</p>
F3	<p>A topsoil inventory which identifies the topsoil requirements for the authorised mining activities and availability of suitable topsoil on site must be detailed in the plan of operations.</p>
F4	<p>Land disturbed by the authorised mining activities must be rehabilitated to a safe, stable and non-polluting landform, with a self-sustaining vegetation cover in accordance with:</p> <ol style="list-style-type: none"> <li><b>Appendix 2, Table 1: Rehabilitation Requirements;</b></li> <li><b>Table 18: Residual Void Design;</b></li> <li><b>Table 19: Rehabilitation Schedule;</b> and</li> <li>the rehabilitation management plan required by <b>Condition F7</b>.</li> </ol>
F5	<p>The environmental authority holder may only retain items of infrastructure which are beneficial to the post-mining land use, when there is written agreement between the environmental authority holder and the post-mining landowner/holder.</p> <p>Where the post-mining landowner/holder, is also the environmental authority holder, infrastructure cannot remain without the administering authority's agreement.</p>
F6	<p>Only the residual voids detailed in <b>Table 18: Residual Void Design</b>, are permitted at the approved place. Each residual void must comply with its design requirements specified in <b>Table 18: Residual Void Design</b>.</p>

F7	<p><b>Rehabilitation Management Plan</b></p> <p>A Rehabilitation Management Plan for all areas disturbed by the authorised mining activities must be developed and implemented by an appropriately qualified person that includes, at a minimum, the following:</p> <ol style="list-style-type: none"> <li>a) a map of existing areas of rehabilitation including classification and status of rehabilitation;</li> <li>b) a strategy and schedule for the progressive rehabilitation of all disturbance during the life of mine;</li> <li>c) a strategy for successfully achieving rehabilitation requirements of this environmental authority;</li> <li>d) details of the grazing trials that are to be undertaken on overburden emplacement areas as per <b>Condition F11</b>;</li> <li>e) details of the objectives and success criteria for rehabilitation of each mining domain to achieve rehabilitation outcomes listed in <b>Appendix 2, Table 1: Rehabilitation Requirements</b> and <b>Table 18: Residual Void Design</b>;</li> <li>f) details of landform design to achieve rehabilitation outcomes listed <b>Appendix 2, Table 1: Rehabilitation Requirements</b> including end of mine design and schematic representation of final landform inclusive of: <ol style="list-style-type: none"> <li>i. drainage design and features;</li> <li>ii. slope designs;</li> <li>iii. cover design;</li> <li>iv. erosion controls proposed on reformed land;</li> </ol> </li> <li>g) details of how landform design will be consistent with surrounding topography;</li> <li>h) details of how the final land uses will align with local planning scheme requirements;</li> <li>i) specify the spoil characteristics, soil analysis and soil separation for use on rehabilitation;</li> <li>j) specify the topsoil requirements for the site and how topsoil will be managed for use in rehabilitation;</li> <li>k) details of any topsoil deficit and how any deficit will be managed for successful rehabilitation;</li> <li>l) details of rehabilitation methods to be applied to each domain;</li> <li>m) describe the monitoring of reference sites inclusive of identification of at least <b>three (3)</b> reference sites for each mine domain for use in rehabilitation monitoring and completion of <b>Table 20: Reference Sites</b> in this environmental authority;</li> <li>n) description of rehabilitation indicators and how these will be monitored;</li> <li>o) description of management actions to address unsuccessful rehabilitation or redesign;</li> <li>p) description of wastewater collection and reticulation and treatment systems;</li> <li>q) description of any risks to groundwater and how these will be managed; and</li> </ol>
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## Environmental authority EPML00932713 – Isaac Plains Coal Mine

	r) description of seepage and leachate management considerations, including the prevention and management of acid mine drainage.
<b>F8</b>	The Rehabilitation Management Plan required by <b>Condition F7</b> must be submitted to the administering authority by <b>29 June 2018</b> for review and comment.
<b>F9</b>	Within <b>twenty (20) business days</b> of receiving comments from the administering authority as per <b>Condition F8</b> , the Rehabilitation Management Plan must be updated to address the comments, amended to adopt any recommendations and submitted to the administering authority for approval
<b>F10</b>	Where there is an inconsistency between the rehabilitation management plan and this environmental authority, the requirements of this environmental authority prevail.
<b>F11</b>	Grazing trials must be conducted on ML70342 to inform the final rehabilitation outcomes for overburden emplacement areas to achieve a safe, stable and a non-polluting landform with a sustainable final land use of grazing.
<b>F12</b>	Rehabilitation must commence and be undertaken progressively in accordance with the: <ul style="list-style-type: none"> <li>a) Rehabilitation Management Plan;</li> <li>b) the plan of operations; and</li> <li>c) <b>Table 19: Rehabilitation Schedule.</b></li> </ul>



Table 18: Residual Void Design

Void identification	Void high wall – competent rock slope	Void high wall incompetent rock slope	Void low wall	Void low wall – incompetent rock slope	Void maximum surface area (ha)	Void maximum depth (m)	Void volume (Mm <sup>3</sup> ) (+/- 2.5%)
N1 / N2	275% (70°)	n/a	n/a	73% (36°)	91	110	41
S1	275% (70°)	n/a	n/a	73% (36°)	6	80	3
S2	275% (70°)	n/a	n/a	73% (36°)	54	90	20
S3	275% (70°)	n/a	n/a	73% (36°)	46	90	18
E1	275% (70°)	100% (45°)	73% (36°) - 100% (45°)	n/a	20	80	7
E2 / E3 / E4	275% (70°)	100% (45°)	73% (36°) - 100% (45°)	n/a	107	90	38
E5	275% (70°)	100% (45°)	73% (36°) - 100% (45°)	n/a	20	80	8

Table 19: Rehabilitation Schedule

Time Frame	Domain	Area	Activity
30 June 2022	Overburden emplacement areas	At least 240 ha on ML70342	Reshaped to final landform design, topsoiled and seeded.
30 June 2025	Overburden emplacement areas	At least 170 ha on ML700016, ML700017, ML700018 and ML700019. At least 210 ha on ML70342.	Reshaped to final landform design, topsoiled and seeded.
29 June 2029	All domains, other than final voids	Remaining disturbance on all tenures	Reshaped to final landform design, topsoiled and seeded.
29 June 2029	Final voids	All final voids	Reshaped to final landform design as per requirements of <b>Table F18</b> .

<b>F13</b>	<p><b>Rehabilitation monitoring program</b></p> <p>A Rehabilitation Monitoring Program must be developed and implemented by an appropriately qualified person for the life of this environmental authority.</p>
<b>F14</b>	The Rehabilitation Monitoring Program required by <b>Condition F13</b> must be submitted to the administering authority by <b>29 June 2018</b> for review and comment.
<b>F15</b>	Within <b>twenty (20) business days</b> of receiving comments from the administering authority on the Rehabilitation Monitoring Program submitted in accordance with <b>Condition F13</b> , the Rehabilitation Monitoring Program must be updated to address the comments and resubmitted to the administering authority for approval.
<b>F16</b>	Where there is an inconsistency between the Rehabilitation Monitoring Program and this environmental authority, the requirements of this environmental authority prevail.
<b>F17</b>	<p>The environmental authority holder must review the Rehabilitation Monitoring Program required by <b>Condition F13</b> at intervals no greater than <b>thirty-six (36) months</b> from <b>29 June 2018</b>. If the environmental authority holder needs to make changes to the Rehabilitation Monitoring Program they must:</p> <ol style="list-style-type: none"> <li>submit the Rehabilitation Monitoring Program to the administering authority for review and comment; and</li> <li>within <b>twenty (20) business days</b> of receiving comments from the administering authority, the Rehabilitation Monitoring Plan must be updated to address the comments and resubmitted to the administering authority for approval</li> </ol>

<b>F18</b>	<p>The holder of this environmental authority must submit to the administering authority, with each plan of operations, a report of the findings of the rehabilitation monitoring program which contains, at a minimum, the following:</p> <ul style="list-style-type: none"> <li>a) how the rehabilitation objectives in the rehabilitation management plan required by <b>Condition F7</b> are being met;</li> <li>b) if the rehabilitation objectives are not being met, the corrective actions to be taken;</li> <li>c) a statistical analysis of how areas of rehabilitation compare to analogue sites listed in <b>Table 20: Reference Sites</b>;</li> <li>d) a statistical analysis of how areas of rehabilitation are meeting the requirements of <b>Condition F4</b>;</li> <li>e) the sampling and monitoring intensity used in the Rehabilitation Monitoring Program required by <b>Condition F13</b>; and</li> <li>f) justification of the sampling and monitoring intensity used in the Rehabilitation Monitoring Program required by <b>Condition F13</b>.</li> </ul>
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**Table 20: Reference Sites**

Reference Site	Domain Reference	Easting (GDA94 – Zone 55)	Northing (GDA94 – Zone 55)	Description
IP02	All domains, other than final voids	Start 617070 End 617059	Start 7570775 End 7570720	Buffel grass pasture with very sparse shrubs
IP04	All domains, other than final voids	Start 616491 End 616391	Start 7572166 End 7572166	Buffel grass pasture with very sparse shrubs
IP09	All domains, other than final voids	TBA	TBA	Buffel grass pasture with very sparse shrubs

<b>F19</b>	<p><b>Vegetation management</b></p> <p>Cleared vegetation from the site must be managed in accordance with the following hierarchy:</p> <ul style="list-style-type: none"> <li>a) recycle, e.g. mulching of vegetation and use in rehabilitation on the site; and</li> <li>b) other alternative management options implemented in a way that causes the least amount of environmental harm.</li> </ul>
<b>F20</b>	<p><b>Chemical Storage</b></p> <p>Chemicals and fuels stored, must be effectively contained and where relevant, meet Australian Standards, where such a standard is applicable.</p>

Agency interest: Regulated Structures	
Condition number	Condition
G1	The consequence category of any structure must be assessed by a suitably qualified and experienced person in accordance with the <i>Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (ESR/2016/1933)</i> or its successor at the following times:  a) prior to the design and construction of the structure, if it is not an existing structure; or b) prior to any change in its purpose or the nature of its stored contents.
G2	A consequence assessment report and certification must be prepared for each structure assessed and the report may include a consequence assessment for more than one structure.
G3	Certification must be provided by the suitably qualified and experienced person who undertook the assessment, in the form set out in the <i>Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (ESR/2016/1933)</i> or its successor.
G4	<b>Design and Construction<sup>1</sup> of a Regulated Structure</b>  <b>Conditions G5 to G9 inclusive do not apply to existing structures</b>
G5	All regulated structures must be designed by, and constructed <sup>2</sup> under the supervision of, a suitably qualified and experienced person in accordance with the requirements of the <i>Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (ESR/2016/1933)</i> or its successor.  <i>Note: <sup>1</sup> construction of a dam includes modification of an existing dam – refer to the definitions.</i>  <i><sup>2</sup> certification of design and construction may be undertaken by different persons</i>
G6	Construction of a regulated structure is prohibited unless:  a) the holder has submitted a consequence category assessment report, and certification to the administering authority; and  b) certification for the design, design plan, and the associated operating procedures has been certified by a suitably qualified and experienced person in compliance with the relevant condition of this authority.
G7	Certification must be provided by the suitably qualified and experienced person who oversees the preparation of the design plan, in the form set out in the <i>Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (ESR/2016/1933)</i> or its successor, and must be recorded in the Register of Regulated Structures.

<b>G8</b>	<p>Regulated Structures must:</p> <ul style="list-style-type: none"> <li>a) be designed and constructed in accordance with the <i>Manual for Assessing Consequence Categories and Hydraulic Performance of structures (ESR/2016/1933)</i> or its successor;</li> <li>b) be designed and constructed with due consideration given to ensuring that the design integrity would not be compromised on account of: <ul style="list-style-type: none"> <li>i. floodwaters from entering the regulated dam from any watercourse or drainage line; and</li> <li>ii. wall failure due to erosion by floodwaters arising from any watercourse or drainage line.</li> </ul> </li> </ul>
<b>G9</b>	<p>Certification by a suitably qualified and experienced person who supervises the construction must be submitted to the administering authority on the completion of construction of the regulated structure, and state that:</p> <ul style="list-style-type: none"> <li>a) the 'as constructed' drawings and specifications meet the original intent of the design plan for that regulated structure; and</li> <li>b) construction of the regulated structure is in accordance with the design plan.</li> </ul>
<b>G10</b>	<p><b>Notification of affected persons</b></p> <p>All affected persons must be provided with a copy of the emergency action plan in place for each regulated structure:</p> <ul style="list-style-type: none"> <li>a) for existing structures that are regulated structures, within <b>ten (10) business days</b> of this condition taking effect;</li> <li>b) prior to the operation of the new regulated structure; and</li> <li>c) if the emergency action plan is amended, within <b>five (5) business days</b> of it being amended.</li> </ul>

<b>G11</b>	<p><b>Operation of a regulated structure</b></p> <p>Operation of a regulated structure, except for an existing structure, is prohibited unless the holder has submitted to the administering authority in respect of regulated structure, all of the following:</p> <ul style="list-style-type: none"> <li>i. one paper copy and one electronic copy of the design plan and certification of the design plan in accordance with <b>Condition G6</b>, and</li> <li>ii. a set of 'as constructed' drawings and specifications, and</li> <li>iii. certification of the 'as constructed drawings and specifications' in accordance with <b>Condition G9</b>;</li> <li>iv. where the regulated structure is to be managed as part of an integrated containment system for the purposes of sharing the DSA volume across the system, a copy of the certified system design plan;</li> <li>v. the requirements of this authority relating to the construction of the regulated structure have been met; and</li> <li>vi. the holder has entered the details required under this authority, into a Register of Regulated Structures; and</li> <li>vii. there is a current operational plan for the regulated structures.</li> </ul>
<b>G12</b>	<p>For existing structures that are regulated structures:</p> <ul style="list-style-type: none"> <li>a) where the existing structure that is a regulated structure is to be managed as part of an integrated containment system for the purposes of sharing DSA volumes across the system, the holder must submit to the administering authority within <b>twelve (12) months</b> of the commencement of this condition a copy of the certified system design plan including that structure; and</li> <li>b) there must be a current operational plan for the existing structures.</li> </ul>
<b>G13</b>	<p>Each regulated structure must be maintained and operated, for the duration of its operational life until decommissioned and rehabilitate, in a manner that is consistent with the current design plan and, if applicable, and the associated certified 'as constructed' drawings.</p>
<b>G14</b>	<p><b>Mandatory Reporting Level</b></p> <p><b>Conditions G15 to G18</b> inclusive only apply to Regulated Structures which have not been certified as low consequence category for 'failure to contain – overtopping'.</p>
<b>G15</b>	<p>The Mandatory Reporting Level (the MRL) must be marked on a regulated dam in such a way that during routine inspections of that dam, it is clearly observable.</p>
<b>G16</b>	<p>The holder must, as soon as practical and within <b>forty-eight (48) hours</b> of becoming aware, notify the administering authority when the level of the contents of a regulated dam reaches the MRL.</p>
<b>G17</b>	<p>The holder must immediately on becoming aware that the MRL has been reached, act to prevent occurrence of any unauthorised discharge from the regulated dam.</p>

<b>G18</b>	The holder must record any changes to the MRL in the Register of Regulated Structures.
<b>G19</b>	<p><b>Design Storage Allowance</b></p> <p>The holder must assess the performance of each regulated dam or linked containment system over the preceding November to May period based on actual observations of the available storage in each regulated dam or linked containment system taken prior to <b>1 July</b> each year.</p>
<b>G20</b>	By <b>1 November</b> of each year, storage capacity must be available in each regulated dam (or network of linked containment systems with a shared DSA volume), to meet the Design Storage Allowance (DSA) volume for the dam (or network of linked containment systems).
<b>G21</b>	The holder must, as soon as practicable but within <b>forty-eight (48) hours</b> of becoming aware that the regulated dam (or network of linked containment systems) will not have the available storage to meet the DSA volume on <b>1 November</b> of any year, notify the administering authority.
<b>G22</b>	The holder must, immediately on becoming aware that a regulated dam (or network of linked containment systems) will not have the available storage to meet the DSA volume on <b>1 November</b> of any year, act to prevent the occurrence of any unauthorised discharge from the regulated dam or linked containment system.
<b>G23</b>	<p><b>Annual Inspection Report</b></p> <p>Each regulated structure must be inspected each calendar year by a suitably qualified and experienced person.</p>
<b>G24</b>	At each annual inspection, the condition and adequacy of all components of the regulated structure must be assessed and a suitably qualified and experienced person must prepare an annual inspection report containing details of the assessment and include a recommendations section, with any recommended actions to ensure the integrity of the regulated structure or a positive statement that no recommendations are required.
<b>G25</b>	The suitably qualified and experienced person who prepared the annual inspection report must certify the report in accordance with the <i>Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (ESR/2016/1933)</i> or its successor.
<b>G26</b>	<p>The holder must within <b>twenty (20) business days</b> of receipt of the annual inspection report, provide the administering authority:</p> <ul style="list-style-type: none"> <li>a) the recommendations section of the inspection report; and</li> <li>b) if applicable, any actions being taken in response to those recommendation; and.</li> <li>c) if, following receipt of the recommendations and (if applicable) action, the administering authority requests a full copy of the annual inspection report from the holder, provide this to the administering authority within <b>ten (10) business days</b> of receipt of the request.</li> </ul>

<b>G27</b>	<p><b>Transfer Arrangements</b></p> <p>The holder must provide a copy of any reports, documentation and certifications prepared under this authority, including but not limited to any Register of Regulated Structures, consequence assessment, design plan and other supporting documentation, to a new holder on transfer of this authority.</p>
<b>G28</b>	<p><b>Register of Regulated Structures</b></p> <p>A Register of Regulated Structures must be established and maintained by the holder for each regulated structure.</p>
<b>G29</b>	<p>The holder must provisionally enter the required information in the Register of Regulated Structures when a design plan for a regulated dam is submitted to the administering authority.</p>
<b>G30</b>	<p>The holder must make a final entry of the required information in the Register of Regulated Structures once compliance with <b>Condition G11</b> and <b>G12</b> has been achieved.</p>
<b>G31</b>	<p>The holder must ensure that the information contained in the Register of Regulated Structures is current and complete on any given day.</p>
<b>G32</b>	<p>All entries in the Register of Regulated Structures must be approved by the chief executive officer for the holder of this authority or their delegate, as being accurate and correct.</p>
<b>G33</b>	<p>The holder must, at the same time as providing the annual return, supply to the administering authority a copy of the records contained in the Register of Regulated Structures, in the electronic format required by the administering authority.</p>
<b>G34</b>	<p><b>Transitional arrangements</b></p> <p>All existing structures, that have not been assessed in accordance with either the Manual or the former Manual for Assessing Hazard Categories and Hydraulic Performance of Dams must be assessed and certified in accordance with the Manual within <b>six (6) months</b> of amendment of the environmental authority adopting this schedule.</p>
<b>G35</b>	<p>All existing structures must subsequently comply with the timetable for any further assessments in accordance with the Manual specified in <b>Table 21: Transitional hydraulic performance requirements for existing structures</b>, depending on the consequence category for each existing structure assessed in the most recent previous certification for that structure.</p>



Table 21: Transitional hydraulic performance requirements for existing structures

Transition period required for existing structures to achieve the requirements of the <i>Manual for Assessing Consequence Categories and Hydraulic Performance of Dams</i>			
Compliance with criteria	High consequence	Significant consequence	Low consequence
>90% and a history of good compliance performance in last 5 years	No transition required	No transition required	No transitional conditions apply. Review consequence assessment every 7 years.
>70%-≤90%	Within 7 years, unless otherwise agreed with the administering authority, based on no history of unauthorised releases.	Within 10 years, unless otherwise agreed with the administering authority, based on no history of unauthorised releases.	No transitional conditions apply. Review consequence assessment every 7 years.
>50-≤70%	Within 5 years unless otherwise agreed with the administering authority, based on no history of unauthorised releases.	Within 7 years unless otherwise agreed with the administering authority, based on no history of unauthorised releases.	Review consequence assessment every 7 years.
≤50%	Within 5 years or as per compliance requirements (e.g. TEP timing)	Within 5 years or as per compliance requirements (e.g. TEP timing)	Review consequence assessment every 5 years.
Regulated levee designed to prevent the ingress of clean flood water <100% compliant <sup>7</sup>	Within 5 years unless otherwise agreed with the administering authority.		

<b>G36</b>	<p><b>Table 21: Transitional hydraulic performance requirements for existing structures</b> ceases to apply for a structure once any of the following events has occurred:</p> <ul style="list-style-type: none"> <li>a) It has been brought into compliance with the hydraulic performance criteria applicable to the structure under the Manual; or</li> <li>b) It has been decommissioned; or</li> <li>c) It has been certified as no longer being assessed as a regulated structure.</li> </ul>
<b>G37</b>	Certification of the transitional assessment required by <b>Conditions G34</b> and <b>G35</b> (as applicable) must be provided to the administering authority within <b>six (6) months</b> of amendment of the authority adopting this schedule.

Agency interest: Nature Conservation	
Condition number	Condition
H1	<b>Impacts of Prescribed Environmental Matters</b> Significant residual impacts to prescribed environmental matters are not authorised under this environmental authority or the <i>Environmental Offsets Act 2014</i> unless the impact(s) is specified in <b>Table 22: Significant residual impacts to prescribed environmental matters</b> and as per <b>Appendix 1: Figures 6 to 9</b> .
H2	An environmental offset made in accordance with the <i>Environmental Offsets Act 2014</i> and Queensland Environmental Offsets Policy, as amended from time to time, must be undertaken for the maximum extent of impact to each prescribed environmental matter authorised in <b>Table 22: Significant residual impacts to prescribed environmental matters</b> , for which an offset is required.

Table 22: Significant residual impacts to prescribed environmental matters

Prescribed environmental matter	Location of impact	Maximum extent of impact	Offset Required
<b>REGULATED VEGETATION</b>			
Of concern regional ecosystem (not within an urban area) – 11.9.7a	As per Figure 6	3.7 ha	Yes
Regional ecosystems (not within an urban area) within the defined distance from the defining banks of a relevant watercourse on the vegetation management watercourse map – 11.3.25	As per Figure 6	0.7ha	Yes
<b>PROTECTED WILDLIFE HABITAT</b>			
Habitat for an animal that is vulnerable wildlife – Squatter pigeon – <i>Geophaps scripta scripta</i> *	As per Figure 7	73.7ha	No
Habitat for an animal that is vulnerable wildlife – Koala – <i>Phascolarctos cinereus</i> *	As per Figure 8	124.8ha	No
Habitat for an animal that special least concern wildlife – Short-beaked echidna -	As per Figure 9	122.3ha	No

\*offsets for these values are to be determined by the EPBC approval conditions.

H3	Prior to the commencement of any impacts to a prescribed environmental matter for which an environmental offset is required by <b>Condition H2</b> , an analysis of the estimated maximum extent of impact to each prescribed environmental matter must be provided to the administering authority.
H4	The analysis required by <b>Condition H3</b> must be approved by the administering authority before the notice of election, if applicable, is given to the administering authority.

<b>H5</b>	The notice of election for the environmental offset required by <b>Condition H4</b> must be provided to the administering authority no less than <b>three (3) months</b> before the proposed commencement of the significant residual impacts for which the environmental offset is required.
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**END OF CONDITIONS**

**Definitions**

**20th percentile flow** means the 20th percentile of all daily flow measurements (or estimations) of daily flow over a 10 year period for a particular site. The 20th percentile calculation should only include days where flow has been measured (or estimated), i.e. not dry weather days.

**accepted engineering standards** in relation to dams, means those standards of design, construction, operation and maintenance that are broadly accepted within the profession of engineering as being good practice for the purpose and application being considered. In the case of dams, the most relevant documents would be publications of the Australian National Committee on Large Dams (ANCOLD), guidelines published by Queensland government departments, and relevant Australian and New Zealand Standards.

**acceptance criteria** means the measures by which the actions implemented to rehabilitate the land are deemed to be complete. The acceptance criteria indicate the success of the rehabilitation outcome or remediation of areas which have been significantly been disturbed by the mining activities. Acceptance criteria may include information regarding:

- a) vegetation establishment, survival and succession;
- b) vegetation productivity, sustained growth and structure development;
- c) fauna colonisation and habitat development;
- d) ecosystem processes such as soil development and nutrient cycling, and the recolonisation of specific fauna groups such as collembola, mites and termites which are involved in these processes;
- e) microbiological studies including recolonisation by mycorrhizal fungi, microbial biomass and respiration;
- f) effects of various establishment treatments such as deep ripping, topsoil handling, seeding and fertiliser application on vegetation growth and development;
- g) resilience of vegetation to disease, insect attack, drought and fire; and
- h) vegetation water use and effects on ground water levels and catchment yields.

**acid rock drainage** means any contaminated discharge emanating from a mining activity formed through a series of chemical and biological reactions, when geological strata is disturbed and exposed to oxygen and moisture as a result of mining activity.

**administering authority** means the Department of Environment and Heritage protection or its successor within the Queensland Government.

**AEP** means the Annual Exceedance Probability: the probability that at least one event in excess of a particular magnitude will occur in any given year.

**Affected person** is someone whose drinking water can potentially be impacted as a result of discharges from a dam or their life can be put at risk due to dwellings or workplaces being in the path of a dam break flood.

**airblast overpressure** means energy transmitted from the blast site within the atmosphere in the form of pressure waves. The maximum excess pressure in this wave, above ambient pressure is the peak airblast overpressure measured in decibels linear (dBL).

**ambient (or total) noise** at a place, means the level of noise at the place from all sources (near and far), measured as the Leq for an appropriate time interval.

**annual inspection report** means an assessment prepared by a suitably qualified and experienced person containing details of the assessment against the most recent consequence assessment report and design plan (or system design plan):

- a) against recommendations contained in previous annual inspections reports;
- b) against recognised dam safety deficiency indicators;
- c) for changes in circumstances potentially leading to a change in consequence category;
- d) for conformance with the conditions of this authority;
- e) for conformance with the 'as constructed' drawings;
- f) for the adequacy of the available storage in each regulated dam, based on an actual observation or observations taken after 31 May each year but prior to 1 November of that year, of accumulated sediment, state of the containment barrier and the level of liquids in the dam (or network of linked containment systems);
- g) for evidence of conformance with the current operational plan.

**ANZECC** means the *Australian and New Zealand Guidelines for Fresh Marine Water Quality 2000*

**appropriately qualified person** means a person who has professional qualifications, training, skills or experience relevant to the nominated subject matter and can give authoritative assessment, advice and analysis on performance relative to the subject matter using the relevant protocols, standards, methods or literature.

**approved place** means the mining project that consists of the mining leases listed on the title page of this environmental authority.

**artesian bore** includes a shaft, well gallery, spear or excavation, and any works constructed in connection with the shaft, well gallery, spear or excavation, that taps an aquifer and the water flows or has flowed, naturally to the surface.

**assess** or **assessed** or **assessment** by a suitably qualified and experienced person in relation to a consequence assessment of a dam, means that a statutory declaration has been made by that person and, when taken together with any attached or appended documents referenced in that declaration, all of the following aspects are addressed and are sufficient to allow an independent audit at any time:

- a) exactly what has been assessed and the precise nature of that assessment;
- b) the relevant legislative, regulatory and technical criteria on which the assessment has been based;
- c) the relevant data and facts on which the assessment has been based, the source of that material, and the efforts made to obtain all relevant data and facts; and
- d) the reasoning on which the assessment has been based using the relevant data and facts, and the relevant criteria.

**associated works** in relation to a dam, means:

- a) operations of any kind and all things constructed, erected or installed for that dam; and
- b) any land used for those operations.

**authority** means an environmental authority granted under the *Environmental Protection Act 1994*.

**bed and banks** for a waters, river, creek, stream, lake, lagoon, pond, swamp, wetland or dam means land over which the water of the waters, lake, lagoon, pond, swamp, wetland or dam normally flows or that is normally covered by the water, whether permanently or intermittently; but does not include land adjoining or adjacent to the bed and banks that is from time to time covered by floodwater.

**beneficial use** in respect of dams means that the current or proposed owner of the land on which a dam stands, has found a use for that dam that is:

- a) of benefit to that owner in that it adds real value to their business or to the general community,
- b) in accordance with relevant provisions of the Environmental Protection Act 1994,
- c) sustainable by virtue of written undertakings given by that owner to maintain that dam, and
- d) the transfer and use have been approved or authorised under any relevant legislation.

**biosolids** means the treated and stabilised solids from sewage.

**blasting** means the use of explosive materials to fracture-

- a) rock, coal and other minerals for later recovery; or
- b) structural components or other items to facilitate removal from a site or for reuse.

**bunded** means within bunding consistent with *Australian Standard 1940*.

**certify or certification or certified or certifying** means assessment and approval must be undertaken by a suitably qualified and experienced person in relation to any assessment or documentation required by this environmental authority, including design plans, 'as constructed' drawings and specifications, construction, operation or an annual report regarding regulated structures, undertaken in accordance with the Board of Professional Engineers of Queensland Policy Certification by RPEQs (ID:1.4(2A)).

**chemical** means –

- a) an agricultural chemical product or veterinary chemical product within the meaning of the *Agricultural and Veterinary Chemicals Code Act 1994 (Commonwealth)*; or
- b) a dangerous good under the dangerous goods code; or
- c) a lead consequenceous substance within the meaning of the Workplace Health and Safety Regulation 1997; or
- d) a drug or poison in the *Standard for the Uniform Scheduling of Drugs and Poisons prepared by the Australian Health Ministers' Advisory Council and published by the Commonwealth*; or
- e) any substance used as, or intended for use as –
  - i. a pesticide, insecticide, fungicide, herbicide, rodenticide, nematocide, miticide, fumigant or related product; or
  - ii. a surface active agent, including, for example, soap or related detergent; or
  - iii. a paint solvent, pigment, dye, printing ink, industrial polish, adhesive, sealant, food additive, bleach, sanitiser, disinfectant, or biocide; or
  - iv. a fertiliser for agricultural, horticultural or garden use; or
- f) a substance used for, or intended for use for –
  - i. mineral processing or treatment of metal, pulp and paper, textile, timber, water or wastewater; or
  - ii. manufacture of plastic or synthetic rubber.

**competent person** means a person with the demonstrated skill and knowledge required to carry out the task to a standard necessary for the reliance upon collected data or protection of the environment.

**commercial place** means a work place used as an office or for business or commercial purposes, which is not part of the mining activity and does not include employees accommodation or public roads.

**consequence** in relation to a structure as defined, means the potential for environmental harm resulting from the collapse or failure of the structure to perform its primary purpose of containing, diverting or controlling flowable substances.

**consequence category** means a category, either low, significant or high, into which a dam is assessed as a result of the application of tables and other criteria in the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (ESR/2016/1933)*.

**consequenceous waste** means any substance, whether liquid, solid or gaseous, derived by or resulting from, the processing of minerals that tends to destroy life or impair or endanger health.

**construction or constructed** in relation to a dam includes building a new dam and modifying or lifting an existing dam, but does not include investigations and testing necessary for the purpose of preparing a design plan.

**contaminate** means to render impure by contact or mixture.

**contaminated** means the substance has come into contact with a contaminant.

**contaminant** A contaminant can be –

- a) a gas, liquid or solid; or
- b) an odour; or
- c) an organism (whether alive or dead), including a virus; or
- d) energy, including noise, heat, radioactivity and electromagnetic radiation; or
- e) a combination of contaminants.

**control measure** means any action or activity that can be used to prevent or eliminate a consequence or reduce it to an acceptable level.

**cover material** means any soil or rock suitable as a germination medium or landform armouring.

**dam** means a land-based structure or a void that contains, diverts or controls flowable substances, and includes any substances that are thereby contained, diverted or controlled by that land-based structure or void and associated works.

**dam crest volume** means the volume of material (liquids and/or solids) that could be within the walls of a dam at any time when the upper level of that material is at the crest level of that dam. That is, the instantaneous maximum volume within the walls, without regard to flows entering or leaving (for example, via spillway).

**design plan** is the documentation required to describe the physical dimensions of the dam, the materials and standards to be used for construction of the dam, and the criteria to be used for operating the dam. The documents must include design and investigation reports, specifications and certifications, together with the planned decommissioning and rehabilitation works and outcomes. A design plan may include 'as constructed' drawings.

**design storage allowance** or "DSA" means the minimum storage required in a dam at the first of November each year in order to meet the hydraulic performance requirements.

**designer** for the purposes of a regulated dam, means the certifier of the design plan for the regulated dam.

**domestic waste** means waste, other than domestic clean-up waste, green waste, recyclable waste, interceptor waste or waste discharged to a sewer, produced as a result of the ordinary use or occupation of domestic premises.

**dwelling** means any of the following structures or vehicles that is principally used as a residence –

- a) a house, unit, motel, nursing home or other building or part of a building; or
- b) a caravan, mobile home or other vehicle or structure on land; or
- c) a water craft in a marina.

**effluent** treated waste water discharged from sewage treatment plants.

**end of pipe** means the location at which water is released to waters or land.

**environmental authority** means an environmental authority granted in relation to an environmentally relevant activity under the *Environmental Protection Act 1994*.

**environmental authority holder** means the holder of this environmental authority.

**environmental offset** has the meaning in section 7 of the *Environmental Offsets Act 2014*.

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Environmental authority EPML00932713 – Isaac Plains Coal Mine

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**environmentally relevant activity** means an environmentally relevant activity as defined in the *Environmental Protection Act 1994* and listed in the *Environmental Protection Regulation 2008*.

**existing structure** means a structure that was in existence prior to the adoption of this schedule of conditions under the authority.

**extreme Storm Storage** – means a storm storage allowance determined in accordance with the criteria in the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (ESR/2016/1933)* published by the administering authority

**financial assurance** means a security required under the *Environmental Protection Act 1994* by the administering authority to cover the cost of rehabilitation or remediation of disturbed land or to secure compliance with the environmental authority.

**floodwater** means water overflowing, or that has overflowed, from waters, river, creek, stream, lake, pond, wetland or dam onto or over riparian land that is not submerged when the watercourse or lake flows between or is contained within its bed and banks.

**flowable substance** means matter or a mixture of materials which can flow under any conditions potentially affecting that substance. Constituents of a flowable substance can include water, other liquids fluids or solids, or a mixture that includes water and any other liquids fluids or solids either in solution or suspension.

**foreseeable future** is the period used for assessing the total probability of an event occurring. Permanent structures and ecological sustainability should be expected to still exist at the end of a 150 year foreseeable future with an acceptable probability of failure before that time.

**general waste** means waste other than regulated waste.

**hydraulic performance** means the capacity of a regulated dam to contain or safely pass flowable substances based on a probability (AEP) of performance failure specified for the relevant consequence category in the *Site Water Management Technical Guideline for Environmental Management of Exploration and Mining in Queensland (DME 1995)*.

**infrastructure** means water storage dams, sediment dams, powerlines, pipelines, haul roads and bitumen roads and light vehicle tracks, buildings and other structures built for the purpose of mining activities but does not include other facilities required for the long term management of mining impacts or the protection of potential resources.

**L<sub>A</sub> 10, adj, 10 mins** means the A-weighted sound pressure level, (*adjusted for tonal character and impulsiveness of the sound*) exceeded for 10% of any 10-minute measurement period, using Fast response.

**L<sub>A</sub> 1, adj, 10 mins** means the A-weighted sound pressure level, (*adjusted for tonal character and impulsiveness of the sound*) exceeded for 1% of any 10-minute measurement period, using Fast response

**L<sub>A, max adj, T</sub>** means the average maximum A-weighted sound pressure level, adjusted for noise character and measured over any 10 minute period, using Fast response.

**lake** includes –

- a) lagoon, swamp or other natural collection of water, whether permanent or intermittent; and
- b) the bed and banks and any other element confining or containing the water.

**land** in the “land schedule” of this document means land excluding waters and the atmosphere.

**land capability** as defined in the *DME 1995 Technical Guidelines for the Environmental Management of Exploration and Mining in Queensland*.

**land suitability** as defined in the *DME 1995 Technical Guidelines for the Environmental Management of Exploration and Mining in Queensland*.



**landfill** means land used as a waste disposal site for lawfully putting solid waste on the land.

**land use** term to describe the selected post mining use of the land, which is planned to occur after the cessation of mining operations.

**levee** means a dam, dyke or bund that is designed only to provide for the containment and diversion of stormwater or flood flows from a contributing catchment, or containment and diversion of flowable materials resulting from unplanned releases from other works of infrastructure, during the progress of those stormwater or flood flows or those unplanned releases; and does not store any significant volume of water or flowable substances at any other times.

**low consequence dam** means any dam that is not a high or significant consequence category as assessed using the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (ESR/2016/1933)*;

**mandatory reporting level** means the volume below the spillway crest, equivalent to the lower of the AEP, 72 hour storm or the AEP wave allowance (AEP is the natural exceedance probability).

**manual** means the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (ESR/2016/1933)* published by the administering authority.

**Maximum extent of impact** means the total, cumulative, residual extent and duration of impact to a prescribed environmental matter that will occur over a project's life after all reasonable avoidance and reasonable on-site mitigation measures have been, or will be, undertaken.

**mine affected water** means the following types of water:

- a) means the following types of water:
  - i. pit water, tailings dam water, processing plant water;
  - ii. water contaminated by a mining activity which would have been an environmentally relevant activity under Schedule 2 of the Environmental Protection Regulation 2008 if it had not formed part of the mining activity;
  - iii. rainfall runoff which has been in contact with any areas disturbed by mining activities which have not yet been rehabilitated, excluding rainfall runoff discharging through release points associated with erosion and sediment control structures that have been installed in accordance with the standards and requirements of an Erosion and Sediment Control Plan to manage such runoff, provided that this water has not been mixed with pit water, tailings dam water, processing plant water or workshop water;
  - iv. groundwater which has been in contact with any areas disturbed by mining activities which have not yet been rehabilitated;
  - v. groundwater from the mine's dewatering activities;
  - vi. a mix of mine affected water (under any of paragraphs i)-v) and other water.
- b) does not include surface water runoff which, to the extent that it has been in contact with areas disturbed by mining activities that have not yet been completely rehabilitated, has only been in contact with:
  - i. land that has been rehabilitated to a stable landform and either capped or revegetated in accordance with the acceptance criteria set out in the environmental authority but only still awaiting maintenance and monitoring of the rehabilitation over a specified period of time to demonstrate rehabilitation success; or
  - ii. land that has partially been rehabilitated and monitoring demonstrates the relevant part of the landform with which the water has been in contact does not cause environmental harm to waters or groundwater, for example:
    - a. areas that are been capped and have monitoring data demonstrating hazardous material adequately contained with the site;
    - b. evidence provided through monitoring that the relevant surface water would have met the water quality parameters for mine affected water release limits in this environmental authority, if those parameters had been applicable to the surface water runoff; or
  - iii. both.

**mineral** means a substance which normally occurs naturally as part of the earth's crust or is dissolved or suspended in water within or upon the earth's crust and includes a substance which may be extracted from such a substance, and includes—

- a) clay if mined for use for its ceramic properties, kaolin and bentonite;
- b) foundry sand;
- c) hydrocarbons and other substances or matter occurring in association with shale or coal and necessarily mined, extracted, produced or released by or in connection with mining for shale or coal or for the purpose of enhancing the safety of current or future mining operations for coal or the extraction or production of mineral oil there from;
- d) limestone if mined for use for its chemical properties;
- e) marble;
- f) mineral oil or gas extracted or produced from shale or coal by in situ processes;
- g) peat;
- h) salt including brine;
- i) shale from which mineral oil may be extracted or produced;
- j) silica, including silica sand, if mined for use for its chemical properties;
- k) rock mined in block or slab form for building or monumental purposes;
- l) But does not include—
- m) living matter;
- n) petroleum within the meaning of the Petroleum Act 1923;
- o) soil, sand, gravel or rock (other than rock mined in block or slab form for building or monumental purposes) to be used or to be supplied for use as such, whether intact or in broken form;
- p) water.

**modification or modifying** (see definition of 'construction')

**natural flow** means the flow of water through waters caused by nature.

**nature** includes:

- a) ecosystems and their constituent parts; and
- b) all natural and physical resources; and
- c) natural dynamic processes.

**notice of election** has the meaning in section 18(2) *Environmental Offsets Act 2014*.

**noxious** means harmful or injurious to health or physical well being, other than trivial harm.

**non standard** means a mining operation that if in the opinion of the administering authority does not have a low risk of serious environmental harm and the activities can not comply with the criteria for standard mining activities prescribed in schedule 1A of the *Environmental Protection Regulation 1998*. The standard mining activity trigger criteria are as follows:

- a) the mining activities do not or will not cause more than 10ha of land to be significantly disturbed at any one time;
- b) the mining activities do not or will not cause more than 5ha of land to be significantly disturbed at any one time;
  - in a riverine area;
  - because of mine workings;
- c) the mining activities are not or will not be carried out in, or within 2km of a category A Environmentally Sensitive Area;

- d) the mining activities are not or will not be carried out in, or within 1km of a category B Environmentally Sensitive Area;
- e) the mining activities do not include a level 1 environmentally relevant activity;
- f) no more than 20 persons are carrying out or will, at any one time, carry out the mining activities.

**offensive** means causing reasonable offence or displeasure; is disagreeable to the sense; disgusting, nauseous or repulsive, other than trivial harm.

**operational land** means the land associated with the project for which this environmental authority has been issued.

**Operational plan** includes:

- a) normal operating procedures and rules (including clear documentation and definition of process inputs in the DSA allowance);
- b) contingency and emergency action plans including operating procedures designed to avoid and/or minimise environmental impacts including threats to human life resulting from any overtopping or loss of structural integrity of the regulated structure.

**Over-burden Emplacement** - means the 2D view of the area from the top of the low wall in the void to toe of the external slopes of the over-burden emplacement.

**palletised** means stored on a movable platform on which batteries are placed for storage or transportation.

**peak particle velocity (ppv)** means a measure of ground vibration magnitude which is the maximum rate of change of ground displacement with time, usually measured in millimetres/second ( $\text{mms}^{-1}$ ).

**Prescribed Environmental Matters** has the meaning in section 10 of the *Environmental Offsets Act 2014*, limited to the matters of State environmental significant listed in schedule 2 of the Environmental Offsets Regulation 2014.

**process water** means water used or produced during the mineral development activities.

**protected area** means - a protected area under the *Nature Conservation Act 1992*; or

- a) a marine park under the *Marine Parks Act 1992*; or
- b) - a World Heritage Area.

**progressive rehabilitation** means rehabilitation (defined below) undertaken progressively or a staged approach to rehabilitation as mining operations are ongoing.

**receiving environment** means all groundwater, surface water, land, and sediments that are not disturbed areas authorised by this environmental authority.

**receiving waters** means all groundwater and surface water that are not disturbed areas authorised by this environmental authority.

**recycled water** means appropriately treated effluent and urban stormwater suitable for further use.

**reference site** (or analogue site) may reflect the original location, adjacent area or another area where rehabilitation success has been completed for a similar biodiversity. Details of the reference site may be as photographs, computer generated images and vegetation models etc.

**Register of Regulated Structures** includes:

- a) Date of entry in the register;
- b) Name of the structure, its purpose and intended/actual contents;
- c) The consequence category of the structure as assessed using the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (ESR/2016/1933)*;
- d) Dates, names, and reference for the design plan plus dates, names, and reference numbers of all document(s) lodged as part of a design plan for the dam;
- e) Name and qualifications of the suitably qualified and experienced person who certified the design plan and 'as constructed' drawings;
- f) For the regulated dam, other than in relation to any levees –
  - i. The dimensions (metres) and surface area (hectares) of the dam measured at the footprint of the dam;
  - ii. Coordinates (latitude and longitude in GDA94) within five metres at any point from the outside of the dam including its storage area
  - iii. Dam crest volume (megalitres);
  - iv. Spillway crest level (metres AHD).
  - v. Maximum operating level (metres AHD);
  - vi. Storage rating table of stored volume versus level (metres AHD);
  - vii. Design storage allowance (megalitres) and associated level of the dam (metres AHD);
  - viii. Mandatory reporting level (metres AHD);
- g) The design plan title and reference relevant to the dam;
- h) The date construction was certified as compliant with the design plan;
- i) The name and details of the suitably qualified and experienced person who certified that the constructed dam was compliant with the design plan;
- j) Details of the composition and construction of any liner;
- k) The system for the detection of any leakage through the floor and sides of the dam;
- l) Dates when the regulated dam underwent an annual inspection for structural and operational adequacy, and to ascertain the available storage volume for 1 November of any year;
- m) Dates when recommendations and actions arising from the annual inspection were provided to the administering authority;
- n) Dam water quality as obtained from any monitoring required under this authority as at 1 November of each year.

**regulated dam** means any dam in the significant or high consequence category as assessed using the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (ESR/2016/1933)* published by the administering authority.

**regulated structure** includes land-based containment structures, levees, bunds and voids, but not a tank or container designed and constructed to an Australian Standard that deals with strength and structural integrity.

**rehabilitation** the process of reshaping and revegetating land to restore it to a stable landform and in accordance with the acceptance criteria set out in this environmental authority and, where relevant, includes remediation of contaminated land.

**representative** means a sample set which covers the variance in monitoring or other data either due to natural changes or operational phases of the mining activities.

**residual void** means an open pit resulting from the removal of ore and/or waste rock which will remain following the cessation of all mining activities and completion of rehabilitation processes.

**saline drainage** means the movement of waters, contaminated with salt(s), as a result of the mining activity.

**Seasonal Variation** means groundwater level fluctuation that is a direct result of seasonal conditions. For example, above average rainfall over an extended period, resulting in aquifer recharge and subsequent rises in groundwater levels. Conversely, below average rainfall periods may result in groundwater level decline due to the lack of recharge over this period. Seasonal variation is most readily observed in shallow unconfined aquifers where a direct connection to surface waters exists, however variations in water levels due to seasonal conditions can occur in other aquifer types where hydraulic linkages to surface waters and other aquifers are more complex.

**self-sustaining** means an area of land which has been rehabilitated and has maintained the required acceptance criteria without human intervention for a period nominated by the administering authority.

**sensitive receptor** means:

- a) a dwelling, residential allotment, mobile home or caravan park, residential marina or other residential premises; or
- b) a motel, hotel or hostel; or
- c) an educational institution; or
- d) a medical centre or hospital; or
- e) a protected area under the *Nature Conservation Act 1992*, the *Marine Parks Act 1992* or a *World Heritage Area*; or
- f) a public park or gardens.

**sewage** means the used water of person's to be treated at a sewage treatment plant.

**significant disturbance** – includes land

- a) if it is contaminated land; or
- b) it has been disturbed and human intervention is needed to rehabilitate it
  - i. to a state required under the relevant environmental authority; or
  - ii. if the environmental authority does not require the land to be rehabilitated to a particular state, to a state immediately before its disturbance.

Some examples of disturbed land include:

- areas where soil has been compacted, removed, covered, exposed or stockpiled;
- areas where vegetation has been removed or destroyed to an extent where the land has been made susceptible to erosion; (vegetation & topsoil)
- areas where land use suitability or capability has been diminished;
- areas within a watercourse, waterway, wetland or lake where mining activities occur;
- areas submerged by tailings or consequenceous contaminant storage and dam walls in all cases;
- areas under temporary infrastructure. Temporary infrastructure includes any infrastructure (roads, tracks, bridges, culverts, dams, bores, buildings, fixed machinery, hardstand areas, airstrips, helipads etc) which is to be removed after mining activities have ceased; or
- areas where land has been contaminated and a suitability statement has not been issued.

**Significant residual impacts** has the meaning in section 8 *Environmental Offsets Act 2014*.

**Spillway** means a weir, channel, conduit, tunnel, gate or other structure designed to permit discharges from the dam, normally under flood conditions or in anticipation of flood conditions.

**stable** means geotechnical stability of the rehabilitated landform where instability related to the excessive settlement and subsidence caused by consolidation / settlement of the wastes deposited, and sliding / slumping instability has ceased.

**storm water** means all surface water runoff from rainfall.

**Structure** means dam or levee.

**Suitably qualified and experienced person** in relation to regulated structures means a person who is a Registered Professional Engineer of Queensland (RPEQ) under the provisions of the *Professional Engineers Act 2002*, and has demonstrated competency and relevant experience:

- a) for regulated dams, an RPEQ who is a civil engineer with the required qualifications in dam safety and dam design.
- b) for regulated levees, an RPEQ who is a civil engineer with the required qualifications in the design of flood protection embankments.

**Note:** *It is permissible that a suitably qualified and experienced person obtain subsidiary certification from an RPEQ who has demonstrated competence and relevant experience in either geomechanics, hydraulic design or engineering hydrology.*

**system design plan** means a plan that manages an integrated containment system that shares the required DSA and/or ESS volume across the integrated containment system.

**trackable waste** means a waste or combination of waste stated in Schedule 1 of the *Environmental Protection (Waste Management) Regulation 2000*.

**trivial harm** means environmental harm which is not material or serious environmental harm and will not cause actual or potential loss or damage to property of an amount of, or amounts totalling more than \$5,000. “tolerable limits” means a range of parameters regarded as being sufficient to meet the objective of protecting relevant environmental values. For example, a range of settlement for a tailings capping, rather than a single value, could still meet the objective of draining the cap quickly, preventing pondage and limiting infiltration and percolation.

**void** means any man-made, open excavation in the ground.

**Void maximum surface area** means the 2D view of the top of the low wall to the top of the highwall.

**waste** as defined in section 13 of the *Environmental Protection Act 1994*.

**waste management hierarchy** has the meaning given by the *Environmental Protection (Waste Management) Policy 2000*.

**waste management principles** has the meaning given by the *Environmental Protection (Waste Management) Policy 2000*.

**water** means –

- a) water in waters or spring;
- b) underground water;
- c) overland flow water; or
- d) water that has been collected in a dam.

**waste water** means used water from the activity, process water or contaminated storm water.

**watercourse** has the meaning in Schedule 4 of the *Environmental Protection Act 1994* and means

1. a river, creek or stream in which water flows permanently or intermittently—
  - a) in a natural channel, whether artificially improved or not; or
  - b) in an artificial channel that has changed the course of the watercourse.
2. Watercourse includes the bed and banks and any other element of a river, creek or stream confining or containing water.

**water quality** means the chemical, physical and biological condition of water.

**waters** includes river, stream, lake, lagoon, pond, swamp, wetland, unconfined surface water, unconfined water natural or artificial watercourse, bed and bank of any waters, dams, non-tidal or tidal waters (including the sea), stormwater channel, stormwater drain, and groundwater and any part thereof.

**wet season** means the time of year, covering one or more months, when most of the average annual rainfall in a region occurs. For the purposes of DSA determination this time of year is deemed to extend from 1 November in one year to 31 May in the following year inclusive.

**µg/L** means micrograms per litre

**µS/cm** means microsiemens per centimetre

## **END OF DEFINITIONS**

Appendix 1

Figure 1A: Authorised mining activities – Isaac Plains East

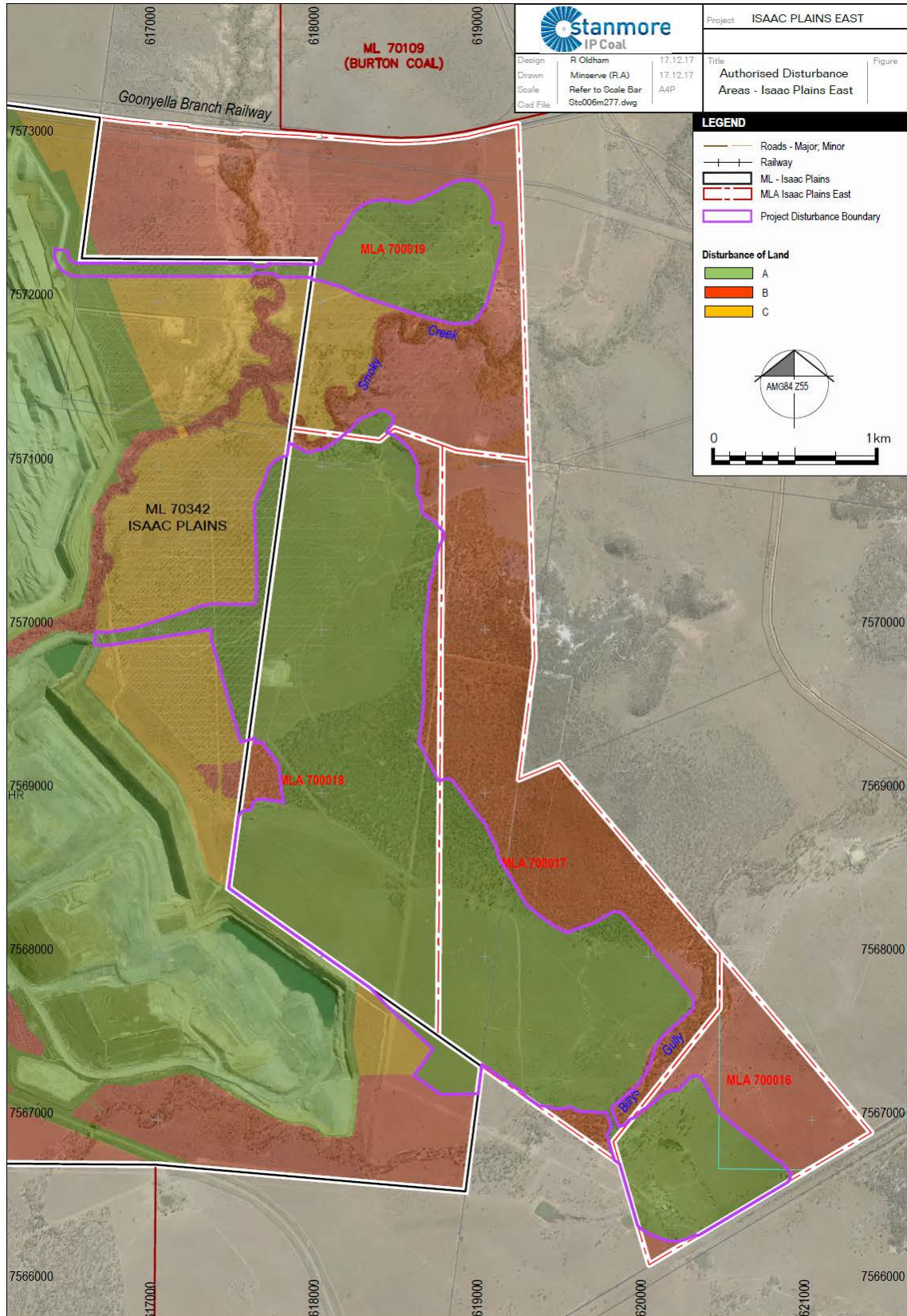




Figure 1B: Authorised mining activities – Isaac Plains Mine

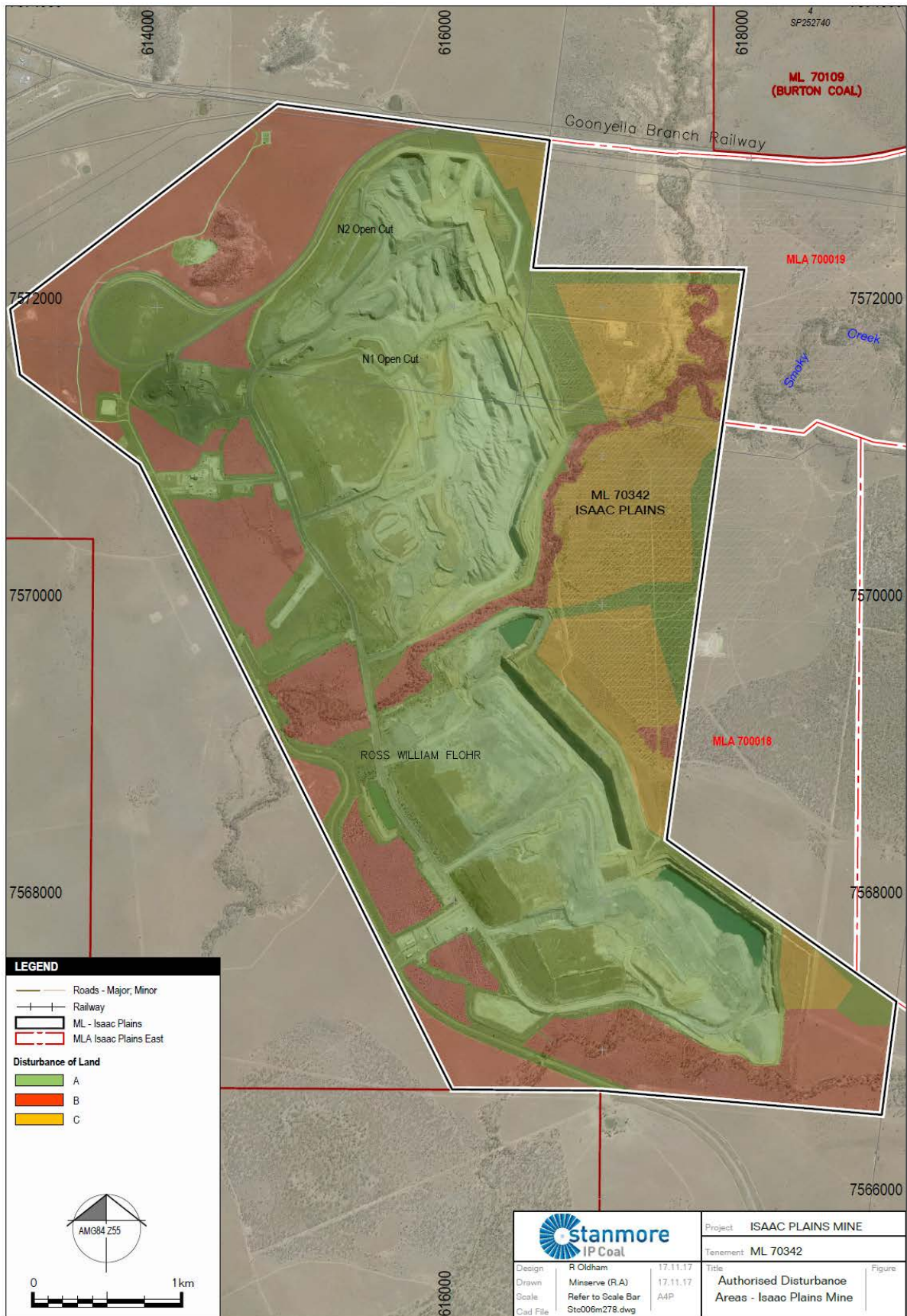


Figure 2: Location of Water Release Points and Monitoring Points

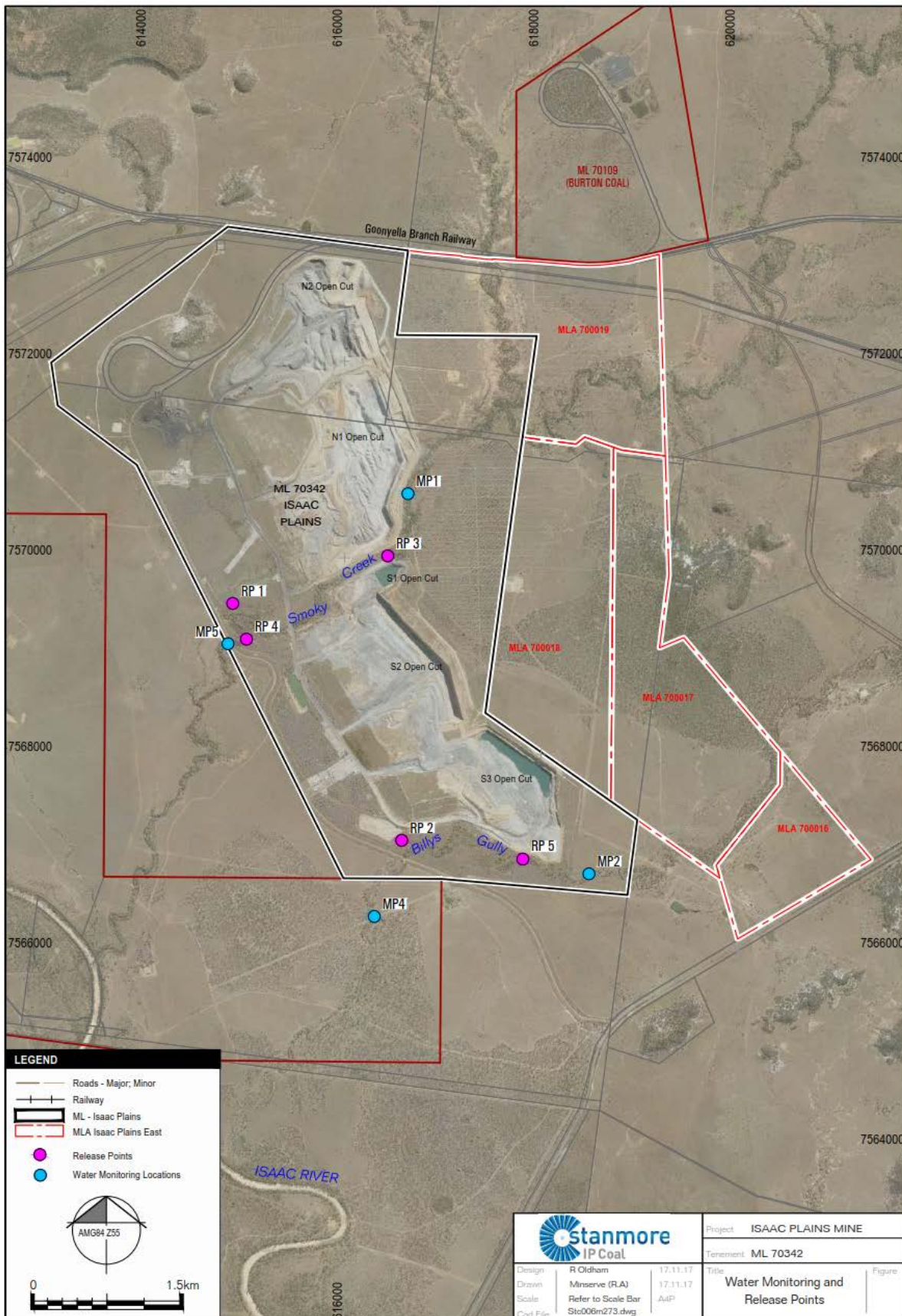


Figure 3: Location of MP3



**Figure 4: Groundwater Monitoring Bore Locations.**

To be provided as per condition C52.

Figure 5: Location of IPCM Sewage system and respective irrigation area



Irrigation for garden application

Total Land Area = **1,428m<sup>2</sup>**

IPCM CHPP	= 502m <sup>2</sup>
IPCM MIA	= 438m <sup>2</sup>
IPCM Admin	= 488m <sup>2</sup>



Figure 6: Authorised impacts to Regulated vegetation

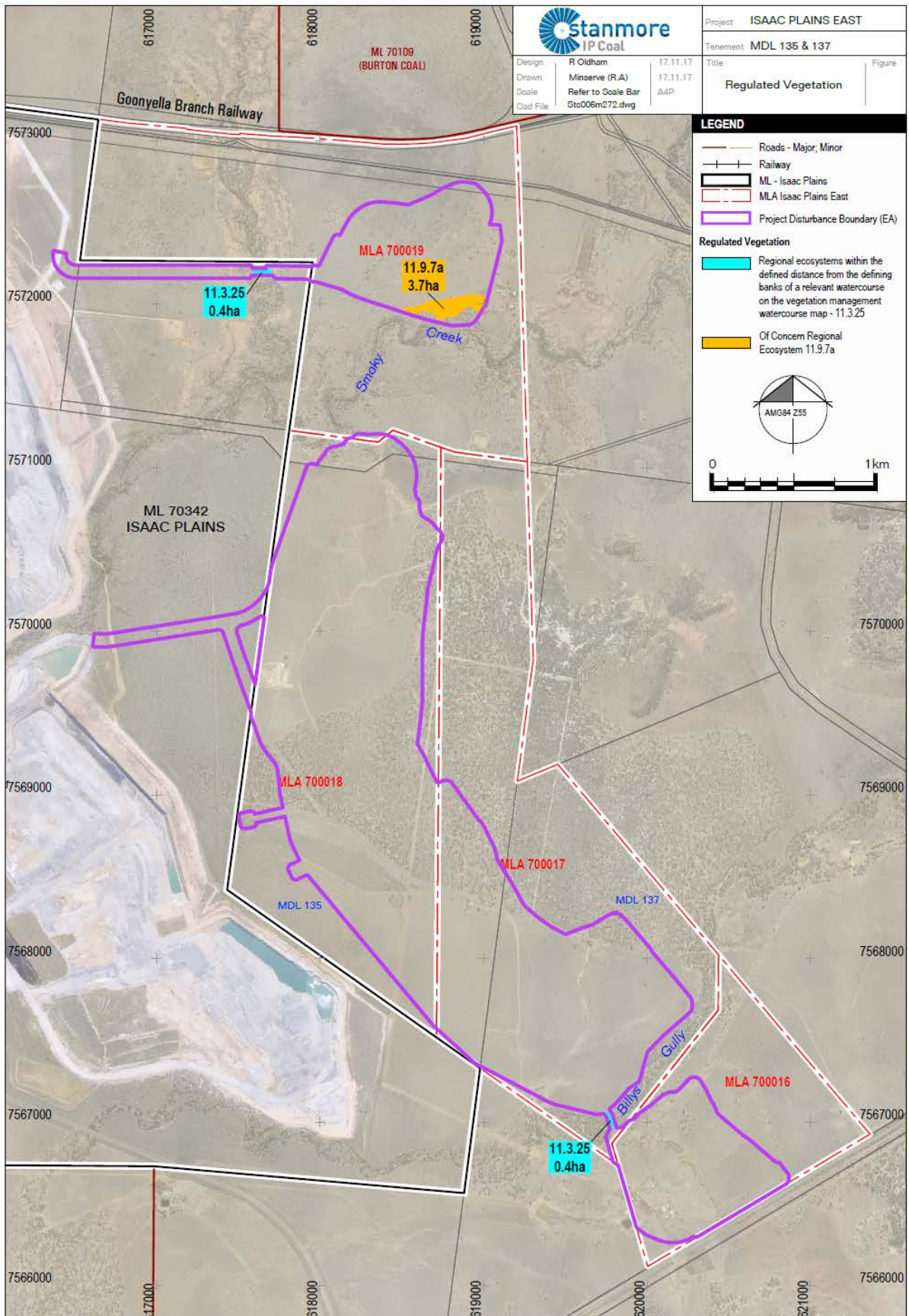


Figure 7: Authorised impacts to Protected wildlife habitat, Squatter pigeon – *Geophaps scripta scripta*

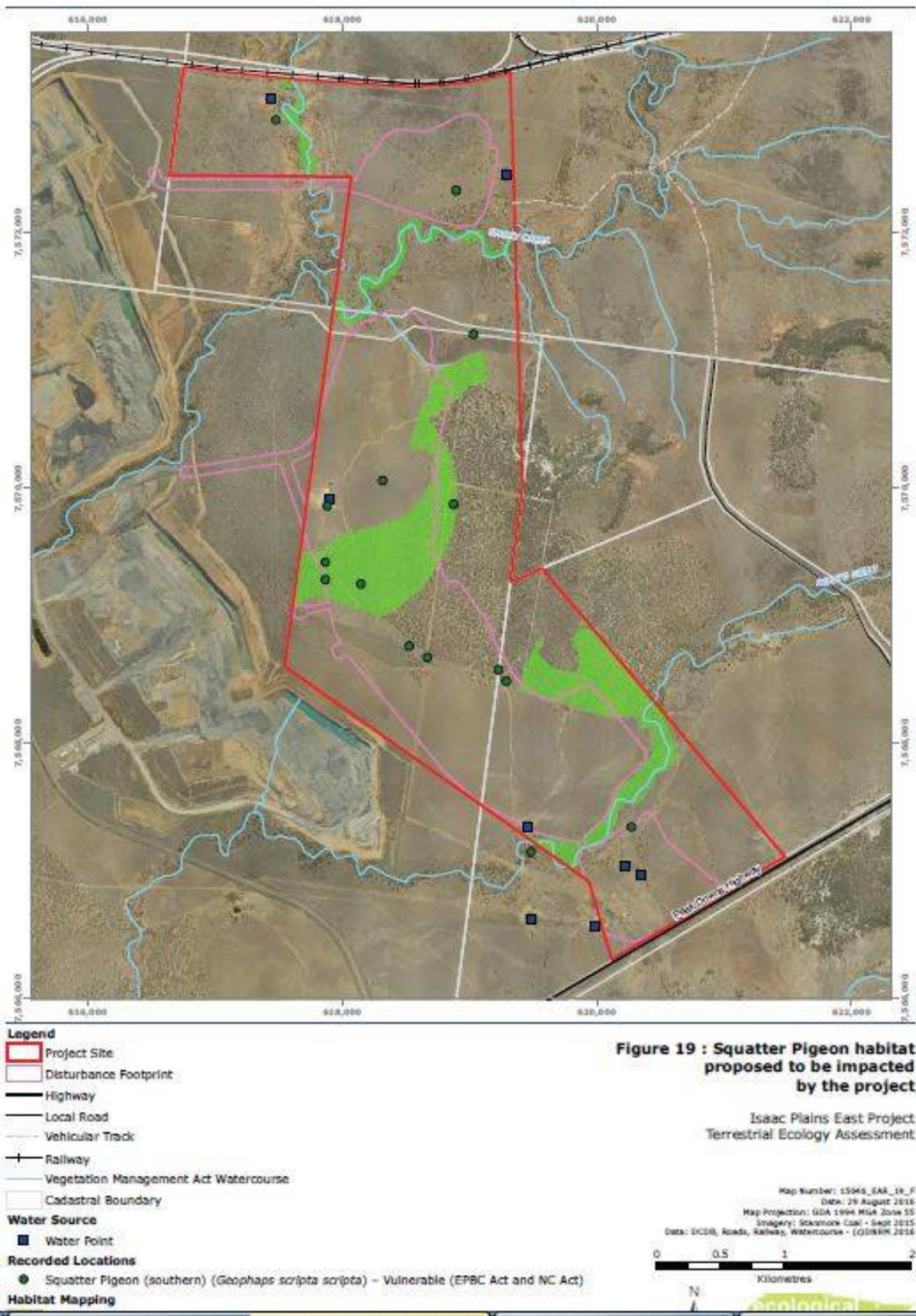


Figure 8: Authorised impacts to Protected wildlife habitat, Koala – *Phascolarctos cinereus*

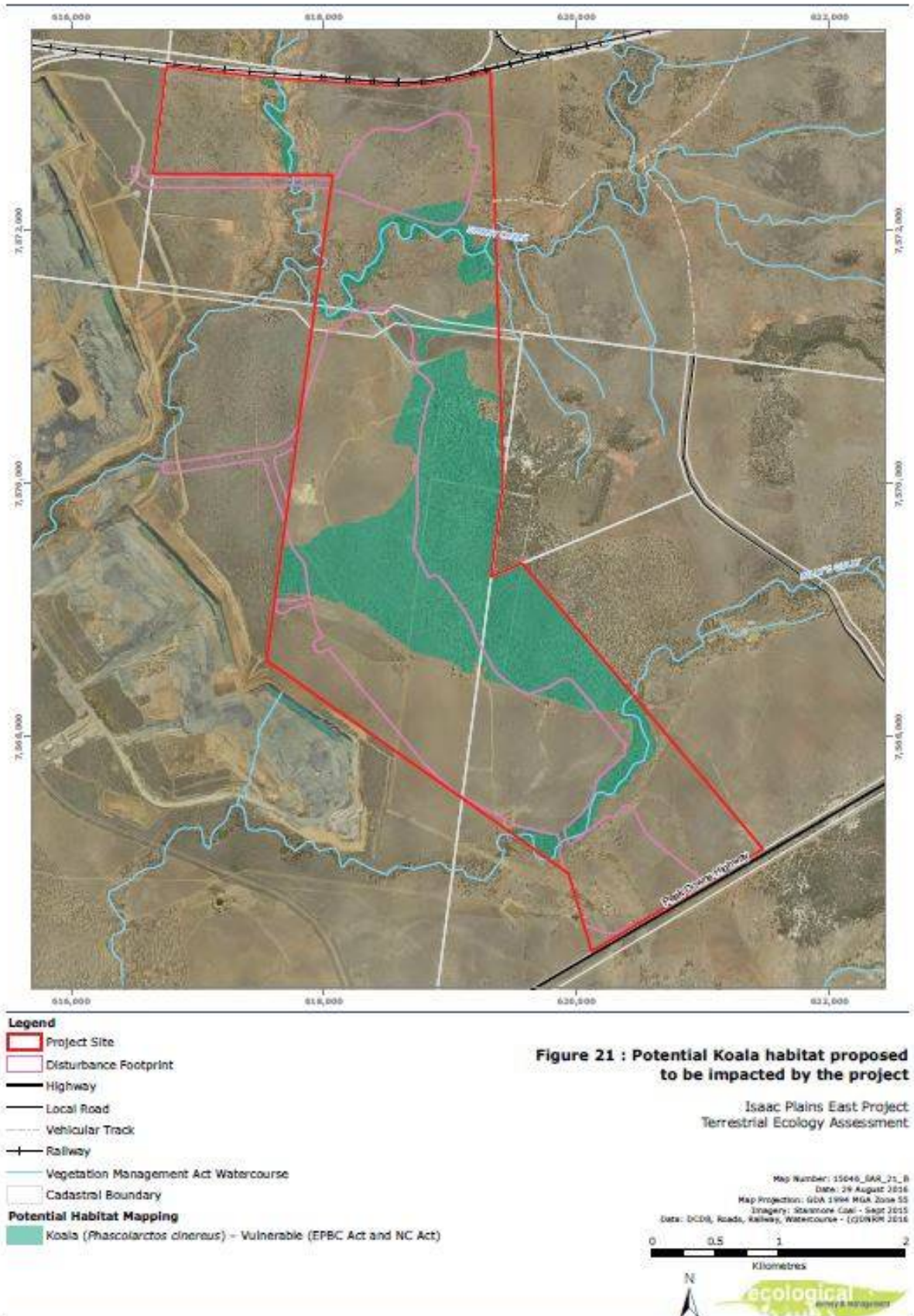
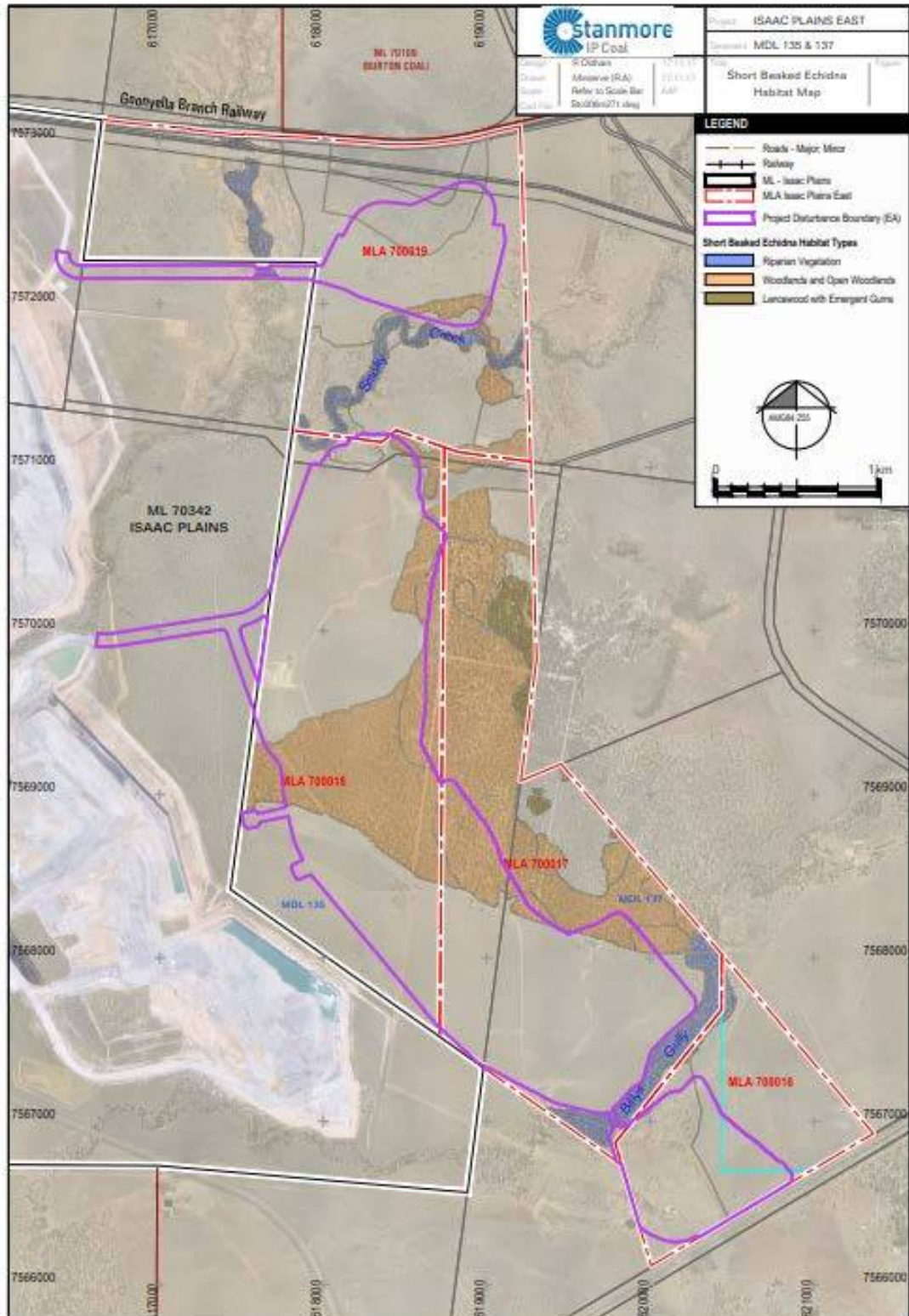




Figure 9: Authorised impacts to Protected wildlife habitat, Short-beaked echidna



Appendix 2, Table 1 Rehabilitation Requirements

MINE DOMAIN	REHABILITATION GOAL	REHABILITATION OBJECTIVES	INDICATORS	COMPLETION CRITERIA
<b>Domain 1 – Mine Infrastructure</b> Areas that are not within the void or overburden domains: <ul style="list-style-type: none"> <li>• Haul roads</li> <li>• Internal service roads</li> <li>• ROM coal stockpile pads and reload pad</li> <li>• Sediment dams</li> <li>• Release dams</li> <li>• Exploration and monitoring bore holes</li> </ul>	Long-term safety	Rehabilitation of exploration drill holes and groundwater monitoring bores	All exploration drill holes and all monitoring bores established on the Mining Leases have been rehabilitated	Certification of the following by an appropriately qualified person: <ul style="list-style-type: none"> <li>• All exploration drill holes and monitoring bores have been rehabilitated in accordance with the applicable Australian Standard or guideline.</li> <li>• All aquifers have been isolated where exploration drill holes or monitoring bores have intersected more than one water bearing strata, in accordance with the 'Minimum Construction Requirements for Water Bores in Australia' (Australian Government, February 2012) or latest edition.</li> </ul>
		Site is safe for humans and animals	Appropriate decommissioning of infrastructure	A risk assessment is to be undertaken by an appropriately qualified person prior to the surrender of the environmental authority to ensure the site is safe and all infrastructure has been decommissioned appropriately and in accordance with the conditions of the environmental authority and any applicable Australian Standard or guideline.  Roads and dams may be left in place to support the post mining grazing land use, in accordance with <b>Condition F5</b> .
			Remediate contaminated land	Evidence, which has been certified by an appropriately qualified person that residual soil contamination on the mining leases has been removed, neutralized or isolated.

## Environmental authority EPML00932713 – Isaac Plains Coal Mine

MINE DOMAIN	REHABILITATION GOAL	REHABILITATION OBJECTIVES	INDICATORS	COMPLETION CRITERIA
			Safety assessment of landform stability (geotechnical issues)	Certification by an appropriately qualified person, that the land is safe for the post-mining land use.
	Non-polluting	No contamination of surface water and groundwater resources	Downstream surface water quality	Evidence, which has been certified by an appropriately qualified person, that surface water monitoring demonstrates the quality of water in the receiving environment meets the following, as a minimum, water quality objectives: <ul style="list-style-type: none"> <li>• pH 6.5-8.5 pH units</li> <li>• EC <math>\leq 720\mu\text{S/cm}</math></li> <li>• TSS <math>\leq 55\text{mg/L}</math></li> <li>• Turbidity <math>\leq 50\text{NTU}</math></li> <li>• Sulfate <math>\leq 25\text{mg/L}</math></li> </ul>
			Groundwater quality	Evidence which has been certified by an appropriately qualified person, that groundwater monitoring demonstrates that the groundwater quality is within 5% of the results of baseline monitoring, or when baseline is not available, reference bores which have not been impacted by mining activities.
	Stable landform	Erosion rates are appropriate for the post mining grazing land use	Slope angle and length	Evidence, which has been certified by an appropriately qualified person, that rehabilitated areas are geotechnically stable.
			Erosion control	Evidence, which has been certified by an appropriately qualified person, that erosion rates of rehabilitated areas are suitable to sustain the intended post-mining grazing land-use.

## Environmental authority EPML00932713 – Isaac Plains Coal Mine

MINE DOMAIN	REHABILITATION GOAL	REHABILITATION OBJECTIVES	INDICATORS	COMPLETION CRITERIA
		Appropriate vegetation cover	Vegetation type and density	<p>Evidence, which has been certified by an appropriately qualified person, that the vegetation type and density of species in rehabilitated areas are suited to the soil composition, slope, aspect, climate and post mining grazing land use.</p> <p>Evidence, which has been certified by an appropriately qualified person, that the variety of vegetation species and their density in rehabilitated areas is comparable to reference sites, and are suited to the post mining grazing land use.</p>
			Foliage and ground cover	<p>Evidence which has been certified by an appropriately qualified person that:</p> <ul style="list-style-type: none"> <li>• foliage and ground cover is comparable to reference sites;</li> <li>• minimum of 70% ground cover is present (or 50% if rocks, logs or other features of cover are present); and</li> <li>• no bare surfaces &gt;20 m<sup>2</sup> in any rehabilitated area or &gt;10 m in length down any rehabilitated slope ≥3.</li> </ul>
			Topsoil and subsoil support the proposed vegetation and land use	<p>Evidence, which has been certified by an appropriately qualified person, that soil properties (e.g. pH, salinity, nutrient content, sodium content) and soil characteristics (e.g. surface roughness, infiltration capacity) support the post mining grazing land use.</p>
	Sustainable land use	Soil properties support the nominated post mining land use		

Environmental authority EPML00932713 – Isaac Plains Coal Mine

MINE DOMAIN	REHABILITATION GOAL	REHABILITATION OBJECTIVES	INDICATORS	COMPLETION CRITERIA	
				Evidence which has been certified by an appropriately qualified person that topsoil has been respread to a suitable depth in rehabilitated areas to sustain the post mining grazing land use.	
		Establish self-sustaining grazing vegetation	Plant regeneration	Evidence, which has been certified by an appropriately qualified person, that species in rehabilitated areas show evidence of flowering, viable seed setting, germination and emergence, and will continue to do so for the foreseeable future.	
			Presence of key plant species	Evidence, which has been certified by an appropriately qualified person, that the vegetation in rehabilitation areas includes the presence of species suitable and complimentary to the post-mining land use, and are at a density and composition comparable to reference sites.	
			Density of key plant species		
			Composition of key plant species		
				Abundance of declared plants (weeds) identified through inspection	Evidence, which has been certified by an appropriately qualified person, that abundance of declared weeds are no greater than reference sites and are adequately controlled on the site.
				Actions taken to eradicate plants declared under local or State legislation	Evidence which has been certified by an appropriately qualified person, that pest animals are adequately controlled on the site.

## Environmental authority EPML00932713 – Isaac Plains Coal Mine

MINE DOMAIN	REHABILITATION GOAL	REHABILITATION OBJECTIVES	INDICATORS	COMPLETION CRITERIA
		Agricultural cattle grazing	Land is suitable for cattle grazing	Evidence, which has been certified by an appropriately qualified person, that rehabilitated areas meet the following percentage breakdown of the land suitability classification for cattle grazing as defined by the Guideline for Agricultural Land Evaluation in Queensland (State Department of Queensland 2013), or any subsequent version, and will continue to sustain these suitability classifications for the foreseeable future: <ul style="list-style-type: none"> <li>Class 3 = 100%</li> </ul>
			Grazing Function	The areas have demonstrated an ability to recover from significant disturbance (e.g. slashing, grazing, fire) by re-establishing target covers.
			Stock access to water sources	Certification by an appropriately qualified person that all water sources in the rehabilitated areas provide water suitable for stock and have an EC $\leq 7800\mu\text{S/cm}$ .
<b>Domain 2 – Overburden Emplacement Areas:</b> <ul style="list-style-type: none"> <li>Areas within the open cut mining area designated to store overburden</li> </ul>	Long-term safety	Structurally safe with no hazardous materials	Safety assessment of landform stability (geotechnical issues)	Certification by an appropriately qualified person, that the land is safe for the post-mining land use.
			Exposure to, and availability of heavy metals and other toxic materials	Evidence, which has been certified by an appropriately qualified person, which confirms the absence of potential for acid mine drainage from the rehabilitated landform.

Environmental authority EPML00932713 – Isaac Plains Coal Mine

MINE DOMAIN	REHABILITATION GOAL	REHABILITATION OBJECTIVES	INDICATORS	COMPLETION CRITERIA
				Evidence, which has been certified by an appropriately qualified person that residual soil contamination on the mining leases has been removed, neutralized or isolated.
	Non-polluting	No contamination of surface water and groundwater resources	Downstream surface water quality	Evidence, which has been certified by an appropriately qualified person, that surface water monitoring demonstrates the quality of water in the receiving environment meets the following, as a minimum, water quality objectives: <ul style="list-style-type: none"> <li>• pH 6.5-8.5 pH units</li> <li>• EC ≤720µS/cm</li> <li>• TSS ≤55mg/L</li> <li>• Turbidity ≤50NTU</li> <li>• Sulfate ≤25mg/L</li> </ul>
			Groundwater quality	Evidence which has been certified by an appropriately qualified person, that groundwater monitoring demonstrates that the groundwater quality is within 5% of the results of baseline monitoring results, or when baseline is not available, reference bores which have not impacted by mining activities.

## Environmental authority EPML00932713 – Isaac Plains Coal Mine

MINE DOMAIN	REHABILITATION GOAL	REHABILITATION OBJECTIVES	INDICATORS	COMPLETION CRITERIA
	Stable landform	Erosion rates are appropriate for landform design	Safety assessment of landform stability (geotechnical issues)	Evidence, which has been certified by an appropriately qualified person, that: <ul style="list-style-type: none"> <li>• All external draining slopes are <math>\leq 15\%</math> (<math>8.5^\circ</math>);</li> <li>• All internal draining slopes, other than void low wall and void high wall are <math>\leq 30\%</math> (<math>17^\circ</math>);</li> <li>• All rehabilitated areas are geo-technically stable for the intended post mining grazing land use.</li> </ul>
			Erosion Control	Evidence, which has been certified by an appropriately qualified person, that erosion rates of rehabilitated areas are suitable for the post mining grazing land use.
	Appropriate vegetation cover	Appropriate vegetation cover	Vegetation type and density	Evidence, which has been certified by an appropriately qualified person, that the vegetation type and density of species in rehabilitated areas are suited to the soil composition, slope, aspect, climate and post mining grazing land use.
				Evidence, which has been certified by an appropriately qualified person, that the variety of vegetation species and their density in rehabilitated areas is comparable to reference sites.



Environmental authority EPML00932713 – Isaac Plains Coal Mine

MINE DOMAIN	REHABILITATION GOAL	REHABILITATION OBJECTIVES	INDICATORS	COMPLETION CRITERIA
			Foliage cover	Evidence which has been certified by an appropriately qualified person that: <ul style="list-style-type: none"> <li>• foliage and ground cover is comparable to reference sites;</li> <li>• minimum of 70% ground cover is present (or 50% if rocks, logs or other features of cover are present); and</li> <li>• no bare surfaces &gt;20 m<sup>2</sup> in any area or &gt;10 m in length down any slope ≥3°.</li> </ul>
	Sustainable land use	Soil properties support the nominated post mining grazing land use	Topsoil and subsoil support the proposed vegetation and land use	Evidence, which has been certified by an appropriately qualified person, that soil properties (e.g. pH, salinity, nutrient content, sodium content) and soil characteristics (e.g. surface roughness, infiltration capacity) support the post mining grazing land use.
		Establish self-sustaining grazing vegetation	Plant regeneration	Evidence which has been certified by an appropriately qualified person, that species in rehabilitated areas show evidence of flowering, viable seed setting, germination and emergence, and will continue to do so for the foreseeable future.
			Presence of key plant species	Evidence, which has been certified by an appropriately qualified person, that the vegetation in

## Environmental authority EPML00932713 – Isaac Plains Coal Mine

MINE DOMAIN	REHABILITATION GOAL	REHABILITATION OBJECTIVES	INDICATORS	COMPLETION CRITERIA
			Density of key plant species	rehabilitated areas includes the presence of species suitable and complimentary to the post-mining land use, and are at a density and composition comparable to reference sites.
			Composition of key plant species	
			Abundance of declared plants (weeds) identified through inspection	Evidence, which has been certified by an appropriately qualified person, that abundance of declared weeds are no greater than reference sites and are adequately controlled on the site.
			Actions taken to eradicate plants declared under local or State legislation	Evidence which has been certified by an appropriately qualified person, that pest animals are adequately controlled on the site.
		Agricultural Cattle Grazing	Land is suitable for ongoing sustained cattle grazing	Evidence, which has been certified by an appropriately qualified person, that rehabilitated areas meet the following percentage breakdown of the land suitability classification for cattle grazing as defined by the Guideline for Agricultural Land Evaluation in Queensland (State Department of Queensland 2013), or any subsequent version, and will continue to sustain these suitability classifications for the foreseeable future: <ul style="list-style-type: none"> <li>• Class 4 = 100%.</li> </ul>
			Grazing Function	The areas have demonstrated an ability to recover from significant disturbance (e.g. slashing, grazing, fire) by re-establishing target covers.

Environmental authority EPML00932713 – Isaac Plains Coal Mine

MINE DOMAIN	REHABILITATION GOAL	REHABILITATION OBJECTIVES	INDICATORS	COMPLETION CRITERIA
			Stock access to water	Certification by an appropriately qualified person that all water sources in the rehabilitated areas provide water suitable for stock and have an EC $\leq 7800\mu\text{S}/\text{cm}$ .
<p><b>Domain 3 – Open Cut Final Voids</b></p> <ul style="list-style-type: none"> <li>• Areas within the open cut mining areas which will remain as final voids as detailed in Table 18: Residual Void Design</li> </ul>	Long-term safety	Structurally safe with no hazardous materials	Safety assessment of landform stability (geotechnical issues)	<p>Certification by an appropriately qualified and experienced person, that final voids are stable, including:</p> <ul style="list-style-type: none"> <li>• Certification that slopes are as per <b>Table 18: Residual Void Design</b> and are geotechnically stable for the foreseeable future;</li> <li>• Certification that drainage measures and structures have been appropriately established and are directing overland flow away from the highwall edge; and</li> <li>• Certification that erosion and sediment control measures have been installed and are operating as designed.</li> </ul>
			Exposure to, and availability of heavy metals and other toxic materials	Evidence, which has been certified by an appropriately qualified person, and based on the results of progressive sampling and geochemical characterisation and site water quality monitoring required by the EA, which confirms the absence of potential for acid mine drainage from the rehabilitated landform.
				Evidence, which has been certified by an appropriately qualified person that residual soil contamination on the mining leases has been removed, neutralized or isolated.

## Environmental authority EPML00932713 – Isaac Plains Coal Mine

MINE DOMAIN	REHABILITATION GOAL	REHABILITATION OBJECTIVES	INDICATORS	COMPLETION CRITERIA
		Safe to humans, livestock and wildlife	Risk to life	Evidence which has been certified by an appropriately qualified and experienced person that the risk of harm to humans, livestock and wildlife has been minimized appropriate safety measures including but not limited to bunds, fencing and any other necessary measures have been installed.
	Non-polluting	No contamination of surface water and groundwater resources	Downstream surface water quality	Evidence, which has been certified by an appropriately qualified person, based on up to date groundwater modelling, that any final void lakes will not overflow nor potentially contaminate any other surface water bodies.  Evidence which has been certified by an appropriately qualified person, that voids do not discharge to any receiving waters, including surface water and groundwater.
			Groundwater quality	Evidence which has been certified by an appropriately qualified person, that groundwater monitoring demonstrates that the groundwater quality is within 5% of the results of baseline monitoring results, or when baseline is not available, reference bores which have not impacted by mining activities.
	Stable landform	Erosion rates are appropriate for landform design	Safety assessment of landform stability (geotechnical issues)	Certification by an appropriately qualified and experienced person that the final voids are stable in the foreseeable future and have been constructed in accordance with RPEQ designs.

## Environmental authority EPML00932713 – Isaac Plains Coal Mine

MINE DOMAIN	REHABILITATION GOAL	REHABILITATION OBJECTIVES	INDICATORS	COMPLETION CRITERIA
Domain 4 - In-pit tailing storage facilities	Long-term safety	Structurally safe with no hazardous materials	Safety assessment of landform stability (geotechnical issues)	<p>Certification by an appropriately qualified person that:</p> <ul style="list-style-type: none"> <li>the land is safe for the post-mining land use.</li> <li>In-pit tailings storage areas are geotechnically stable and capped with overburden material, and in accordance with mine waste management plan in <b>Condition E6</b>.</li> </ul>
			Exposure to, and availability of heavy metals and other toxic materials	Evidence, which has been certified by an appropriately qualified person, which confirms the absence of potential for acid mine drainage from the rehabilitated landform.
	Non-polluting	No contamination of surface water and groundwater resources	Downstream surface water quality	<p>Evidence, which has been certified by an appropriately qualified person, that surface water monitoring demonstrates the quality of water in the receiving environment meets the following, as a minimum, water quality objectives:</p> <ul style="list-style-type: none"> <li>pH 6.5-8.5 pH units</li> <li>EC <math>\leq 720 \mu\text{S}/\text{cm}</math></li> <li>TSS <math>\leq 55 \text{mg}/\text{L}</math></li> <li>Turbidity <math>\leq 50 \text{NTU}</math></li> <li>Sulfate <math>\leq 25 \text{mg}/\text{L}</math></li> </ul>
			Groundwater quality	Evidence which has been certified by an appropriately qualified person, that groundwater monitoring demonstrates that the groundwater quality is within 5% of the results of baseline monitoring results, or when baseline is not available,

Environmental authority EPML00932713 – Isaac Plains Coal Mine

MINE DOMAIN	REHABILITATION GOAL	REHABILITATION OBJECTIVES	INDICATORS	COMPLETION CRITERIA
				reference bores which have not been impacted by mining activities.
	Stable landform	Erosion rates are appropriate for landform design	Safety assessment of landform stability (geotechnical issues)	Evidence, which has been certified by an appropriately qualified person, that rehabilitated areas are geotechnically stable.
			Erosion Control	Evidence, which has been certified by an appropriately qualified person, that erosion rates of rehabilitated areas are suitable for the post mining grazing land use.
	Appropriate vegetation cover		Vegetation type and density	Evidence, which has been certified by an appropriately qualified person, that the vegetation type and density of species in rehabilitated areas are suited to the soil composition, slope, aspect, climate and post mining grazing land use.
				Evidence, which has been certified by an appropriately qualified person, that the variety of vegetation species and their density in rehabilitated areas is comparable to reference sites.
			Foliage cover	Evidence which has been certified by an appropriately qualified person that: <ul style="list-style-type: none"> <li>• foliage and ground cover is comparable to reference sites;</li> <li>• minimum of 70% ground cover is present (or 50% if rocks, logs or other features of cover are present); and</li> </ul>

Environmental authority EPML00932713 – Isaac Plains Coal Mine

MINE DOMAIN	REHABILITATION GOAL	REHABILITATION OBJECTIVES	INDICATORS	COMPLETION CRITERIA
				<ul style="list-style-type: none"> <li>no bare surfaces &gt;20 m<sup>2</sup> in any area or &gt;10 m in length down any slope ≥3°.</li> </ul>
	Sustainable land use	Soil properties support the nominated post mining grazing land use	Topsoil and subsoil support the proposed vegetation and land use	Evidence, which has been certified by an appropriately qualified person, that soil properties (e.g. pH, salinity, nutrient content, sodium content) and soil characteristics (e.g. surface roughness, infiltration capacity) support the post mining grazing land use.
Evidence which has been certified by an appropriately qualified person that topsoil has been respread to a suitable depth in rehabilitated areas to sustain the post mining grazing land use.				
		Establish self-sustaining grazing vegetation	Plant regeneration	Evidence which has been certified by an appropriately qualified person, that species in rehabilitated areas show evidence of flowering, viable seed setting, germination and emergence, and will continue to do so for the foreseeable future.
Presence of key plant species			Evidence, which has been certified by an appropriately qualified person, that the vegetation in rehabilitated areas includes the presence of species suitable and complimentary to the post-mining land use, and are at a density and composition comparable to reference sites.	
Density of key plant species				
Composition of key plant species				
Abundance of declared plants (weeds) identified through inspection	Evidence, which has been certified by an appropriately qualified person, that abundance of			

## Environmental authority EPML00932713 – Isaac Plains Coal Mine

MINE DOMAIN	REHABILITATION GOAL	REHABILITATION OBJECTIVES	INDICATORS	COMPLETION CRITERIA
			Actions taken to eradicate plants declared under local or State legislation	declared weeds are no greater than reference sites and are adequately controlled on the site. Evidence which has been certified by an appropriately qualified person, that pest animals are adequately controlled on the site.
		Agricultural Cattle Grazing	Land is suitable for ongoing sustained cattle grazing	Evidence, which has been certified by an appropriately qualified person, that rehabilitated areas meet the following percentage breakdown of the land suitability classification for cattle grazing as defined by the Guideline for Agricultural Land Evaluation in Queensland (State Department of Queensland 2013), or any subsequent version, and will continue to sustain these suitability classifications for the foreseeable future: <ul style="list-style-type: none"> <li>Class 4 = 100%.</li> </ul>
			Grazing Function	The areas has demonstrated an ability to recover from significant disturbance (e.g. slashing, grazing, fire) by re-establishing target covers.
			Stock access to water	Certification by an appropriately qualified person that all water sources in the rehabilitated areas provide water suitable for stock and have an EC $\leq 7800\mu\text{S/cm}$ .

**END OF ENVIRONMENTAL AUTHORITY**



# Riparian Monitoring Program Ecological Report



**ecosm.com.au**

**ISAAC PLAINS EAST PROJECT  
EPBC ACT BASELINE RIPARIAN MONITORING**

**Stanmore Coal**

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**June 2018**

## Disclaimer

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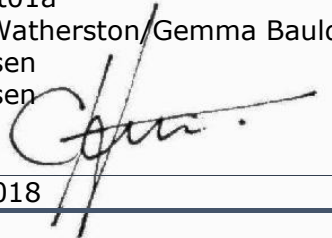
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## Document History and Status

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Document version:	18017_Rpt01a
Author(s):	Meredith Watherston/Gemma Bauld
Reviewed by:	Chris Hansen
Approved by:	Chris Hansen
Signed :	
Date issued:	26 June 2018

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## Contents

1	Introduction .....	1
1.1	Description of the riparian monitoring area .....	1
1.2	Objectives .....	1
2	Methodology .....	3
2.1	Field methods .....	3
2.1.1	Timing .....	3
2.1.2	Vegetation assessment sites .....	3
2.1.3	Habitat quality assessment plots .....	4
2.1.4	Co-ordinate system and map datum .....	6
2.1.5	Climatic conditions .....	6
2.2	Habitat mapping .....	6
2.3	Habitat quality scoring .....	7
2.3.1	Site ecological condition .....	7
2.3.2	Site context .....	7
2.3.3	Habitat indices .....	8
3	Monitoring results and discussion .....	9
3.1	Vegetation mapping .....	9
3.2	Habitat mapping .....	9
3.2.1	Squatter Pigeon .....	9
3.2.2	Greater Glider .....	10
3.2.3	Ornamental Snake .....	10
3.2.4	Koala .....	10
3.3	Site condition .....	11
3.4	Site context .....	11
3.5	Species habitat indices .....	12
4	Overall habitat quality scores and future monitoring .....	16
4.1	Ongoing monitoring .....	17
5	References .....	19

## List of Tables

Table 1:	Habitat quality plots measured per assessment unit .....	5
Table 2:	Attributes assessed within habitat quality plots .....	5
Table 3:	Monthly rainfall (mm) for Moranbah prior to and following the survey .....	6
Table 4:	Regional ecosystems in the riparian monitoring area .....	9
Table 5:	Habitat quality scores for each of the habitat quality plots in the riparian monitoring area .....	11
Table 6:	Species habitat index scoring for the Squatter Pigeon .....	12
Table 7:	Species habitat index scoring for the Greater Glider .....	13
Table 8:	Species habitat index scoring for the Ornamental Snake .....	14
Table 9:	Species habitat index scoring for the Koala .....	15
Table 10:	Habitat quality scores for each species .....	16
Table 11:	Proposed monitoring program for the riparian monitoring area .....	17

## List of Figures

Figure 1:	Location of the Isaac Plains East Project riparian monitoring area ..	22
Figure 2:	Location of habitat quality plots .....	23
Figure 3:	Field-validated regional ecosystem mapping .....	24
Figure 4:	Assessment units .....	25
Figure 5:	Squatter Pigeon (southern) habitat mapping .....	26
Figure 6:	Greater Glider habitat mapping .....	27
Figure 7:	Ornamental Snake habitat mapping .....	28
Figure 8:	Koala habitat mapping .....	29

## Appendices

- Appendix A: Breakdown of habitat quality scores for each fauna species in the riparian monitoring area
- Appendix B: Photo monitoring points in the riparian monitoring area

## Symbols and Abbreviations

*	(Preceding a plant species name) plant species not native to Australia
AU	Assessment units
BAMM	Biodiversity Assessment and Mapping Methodology
BoM	Bureau of Meteorology
BPA	Biodiversity Planning Assessment
DBH	Diameter at breast height
DES	(Queensland) Department of Environment and Science
DSITI	(Queensland) Department of Science, Information Technology and Innovation
EHP	Former (Queensland) Department of Environment and Heritage Protection
EMZ	Environmental management zone
GIS	Geospatial information systems
GPS	Global positioning system
ha	Hectares
HQ	Habitat Quality
km	Kilometres
OMP	Offset Management Plan
QEOP	Queensland Environmental Offset Policy
RE	Regional Ecosystem as defined under the Queensland Vegetation Management Regulation 2000

## Glossary

Term	Definition
Benchmark condition	Benchmark condition describes the standard or typical condition of a particular RE in an undisturbed condition and is determined from an average value from mature and long undisturbed reference of 'Best on Offer' sites (Eyre et al. 2011). Benchmarks are developed by the EHP for various vegetation communities, but not all at this stage.
Bioregion	A geographically distinct biological region, which is a reporting unit for assessing the status of native ecosystems and their level of protection. Australia is divided into 89 bioregions. Bioregions form part of the regional ecosystem classification code system. The study area is located in the Northern Bowen Basin sub-region of the Brigalow Belt Bioregion.
Broad vegetation group	Broad vegetation groups were developed by the Queensland Herbarium to group vegetation communities at a high level, and are included in the regional ecosystem spatial dataset.
High value regrowth	Non-remnant regrowth vegetation that has not been cleared within the last 15 years.
Riparian monitoring area	The riparian monitoring area is that conditioned by the Commonwealth Department of the Environment and Energy in their approval for the Isaac Plains East project (EPBC 2016/7827) and shown on Figure 1.
Region	The local area surrounding the riparian monitoring area, including the landscape within 25 km of the riparian monitoring area.
Regional ecosystem	A vegetation community within a bioregion that is consistently associated with a particular combination of geology, landform and soils.
Remnant vegetation	Defined under the Queensland <i>Vegetation Management Act 1999</i> as, woody vegetation that has not been cleared or vegetation that has been cleared but where the dominant canopy has >70% of the height and >50% of the cover relative to the undisturbed height and cover of that stratum and is dominated by species characteristic of the vegetation's undisturbed canopy.

## 1 Introduction

In 2018 the Isaac Plains East (IPE) mining leases and the Department of Environment and Energy (DoEE) *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) approvals were granted allowing the extension of the life of the Isaac Plains Complex (IPC). As outlined in condition 9 of the approval, prior to commencement of the action, ecological surveys are required to determine the extent (in hectares) and habitat condition for four EPBC Act listed threatened species in the riparian area. The four EPBC Act listed species are:

- Greater Glider (*Petauroides volans*)
- Koala (*Phascolarctos cinereus*)
- Ornamental Snake (*Denisonia maculata*)
- Squatter Pigeon (southern) (*Geophaps scripta scripta*).

These baseline surveys will allow for ongoing monitoring of habitat for the four listed species, to identify potential impacts to habitat condition as a result of the project, particularly potential post-mining draw down.

### 1.1 Description of the riparian monitoring area

The riparian monitoring area is located within the non-operational areas of the Isaac Plains Complex, as well as within Burton Coal and Fitzroy Australia Resources tenements. The riparian monitoring area is located approximately 170 km south-west of Mackay in central Queensland. The Kerlong and Carborough Ranges are located to the north-east and the region is part of the Northern Bowen Basin sub-region within the Brigalow Belt (North) Bioregion. Smoky Creek and its tributaries form the riparian monitoring area and are a sub-catchment of the Isaac River Catchment (Figure 1).

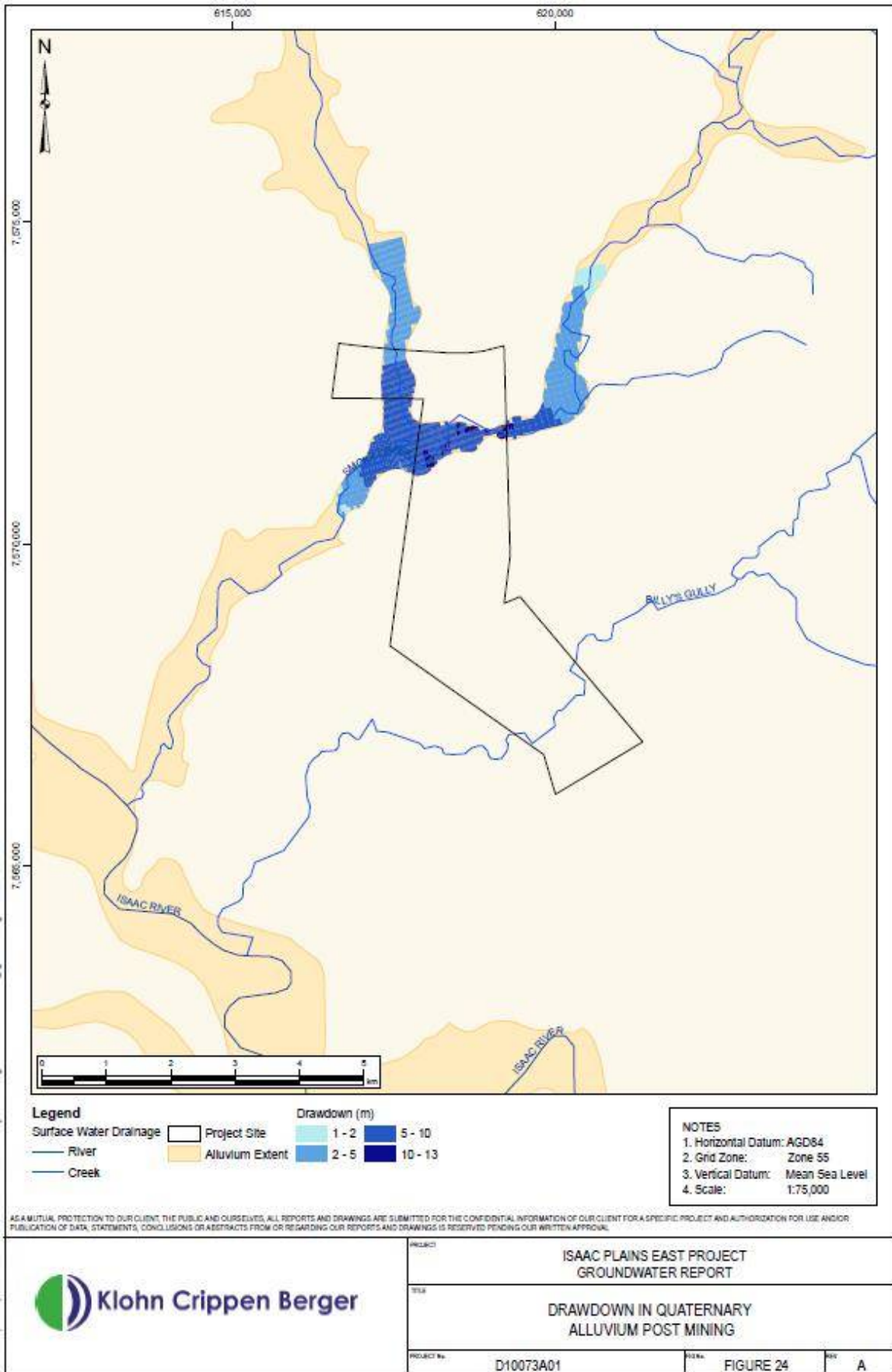
The riparian monitoring area was defined through post-mining modelling undertaken for the IPE Project and which is shown in Plate A.

### 1.2 Objectives

The purpose of this monitoring survey is to measure the baseline condition of vegetation communities within the riparian monitoring area during optimal conditions by installing a suitable number of habitat quality plots.

This baseline survey will also define the extent of habitat (in hectares) and habitat condition for each of the four listed threatened species being the Greater Glider, Koala, Ornamental Snake and Squatter Pigeon.





**Plate A: Post-mining drawdown modelling for Smoky Creek**

## 2 Methodology

### 2.1 Field methods

In order to determine the baseline condition of vegetation and habitat for the four listed threatened species within the riparian monitoring area the field methods involved two components:

1. validating and mapping remnant vegetation and habitat areas by undertaking a number of vegetation assessment sites throughout the riparian monitoring area
2. establishing assessment units in which a suitable number of habitat quality plots are installed and which can then be used to undertake habitat quality scoring.

Assessment units (AUs) are relatively homogenous and defined by a distinct RE.

#### 2.1.1 Timing

Two ecologists undertook the ecological monitoring of the 2018 riparian monitoring area over four days between and including 17 and 20 April 2018. A number of survey sites undertaken as part of previous studies for the IPE project were used to supplement this assessment.

#### 2.1.2 Vegetation assessment sites

Field surveys were carried out in compliance with the *Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland Version 4.0* (Neldner et al. 2017). Vegetation validation, which has previously been undertaken for the IPE project area (Figures 1 and 2), was also used for portions of the riparian monitoring area that overlap. Assessment sites were performed throughout the riparian monitoring area so as to thoroughly assess the Queensland Government mapped remnant vegetation and allow habitat mapping for the four listed species.

The field validation and mapping was undertaken at a total of 11 secondary, 37 tertiary sites, 39 quaternary sites and 29 supplementary photo points (Figure 2). It is worth noting that 8 tertiary sites, 11 quaternary sites and 5 supplementary photo points were conducted outside but in close proximity to the riparian monitoring area.

Data recorded at each secondary site included:

- date and precise location (with reference to handheld GPS)
- soils, slope, aspect and landform observations
- ground-layer, mid-stratum and canopy species composition and abundance
- structural characteristics
- condition and disturbance of existing vegetation communities (including distribution of weed species)

- quantitative and qualitative species composition within a 1,000 m<sup>2</sup> quadrat, and documentation of ancillary species identified within the immediate area or during foot traverse
- basal area of vegetation (Bitterlich Stick methodology)
- photographs of the community (north, east, south, west, groundcover and soils).

Data recorded at each tertiary site included:

- date and precise location (with reference to handheld GPS)
- soils, slope, aspect and landform observations
- ground-layer, mid-stratum and canopy species composition and abundance
- structural characteristics
- basal area of vegetation (Bitterlich Stick methodology)
- condition and disturbance of existing vegetation communities (including distribution of weed species)
- photographs of the community.

Data recorded at each quaternary site included:

- date and precise location (with reference to handheld GPS)
- ground-layer, mid-stratum and canopy species composition and abundance
- structural characteristics of the ecologically dominant layer (EDL)
- condition
- limited photographs of the community.

Photographs of the vegetation within the assessment plot were taken at the ends of the plot (i.e. the 0 and 100 m mark), and in the directions of north (0°), east (90°), south (180°) and west (270°) at the centre of the plot (i.e. the 50 m mark). Photos of the groundcover intersected by the centreline tape and soils were also taken at the 50 m mark along the plot. Photo monitoring sites were also undertaken to capture supplementary field information or record a noteworthy landscape, vegetation or habitat feature. Relevant observations and a series of photos are taken at these sites.

### **2.1.3 Habitat quality assessment plots**

In addition to the survey sites described in Section 2.1.2, the 11 secondary sites were upgraded to habitat quality plots. The location of habitat quality plots were chosen to represent the primary REs and habitat within the riparian monitoring area and to provide the best chance of early detection of potential impacts on riparian areas, as a result of potential drawdown. Therefore, habitat quality plots focused on the riparian communities of RE 11.3.2 and 11.3.25, as these are considered most likely to show early evidence of impacts from potential drawdown.

RE 11.3.4 was too small to sample, however comprises the same broad vegetation group as RE 11.3.25 and therefore has been included with that RE in calculations.

**Table 1: Habitat quality plots measured per assessment unit**

Assessment Unit	RE	Area (ha)	Number of habitat quality plots
AU 1	11.3.2	8.0	1 (#5)
AU 2	11.3.4	0.5	0
	11.3.25	105.9	10 (# 1, 2, 3, 4, 6, 7, 8, 9, 10 and 11)
<b>Total</b>			<b>11</b>

Data recorded at these sites complied with the *Guide to Determining Terrestrial Habitat Quality – a toolkit for assessing land based offsets under the Queensland Environmental Offsets Policy, Version 1.2* (Habitat Quality Guide) (EHP 2017).

This guideline aligns with the requirements of the Commonwealth offset policy by determining an overall habitat quality score. Each habitat quality plot involved a 100 m x 50 m plot in which a series of attributes were recorded in accordance with the Habitat Quality Guide. Attributes recorded are outlined in Table 3 and are in addition to those recorded as part of the secondary survey methodology described in Section 2.1.2. The height of woody vegetation was measured using a laser rangefinder (hypsometer) and the diameter of large trees was measured at breast height (nominally 1.3 m above the ground) with a diameter at breast height (DBH) tape. The orientation of each habitat quality plot was also recorded.

**Table 2: Attributes assessed within habitat quality plots**

Sub Plot	Attributes
100 m transect	<ul style="list-style-type: none"> <li>▪ Tree canopy cover</li> <li>▪ Tree sub-canopy cover</li> <li>▪ Native shrub cover</li> </ul> Measured as percentage of living foliage cover that intercepts the transect line.
100 m x 50 m plot	<ul style="list-style-type: none"> <li>▪ Number of large eucalypt trees</li> <li>▪ Number of large non-eucalypt trees</li> <li>▪ Tree canopy height - median canopy height</li> <li>▪ Recruitment of woody perennial species in the ecologically dominant layer (EDL)</li> <li>▪ Native tree species richness - number of species present</li> </ul>
50 m x 20 m plot	<ul style="list-style-type: none"> <li>▪ Coarse woody debris - length of all logs &gt;10 cm diameter, 0.5 m in length</li> </ul>
50 m x 10 m plot	<ul style="list-style-type: none"> <li>▪ Native shrub, grass and forbs/other species richness</li> <li>▪ Non-native plant cover - cover of exotic species as a component of the overall vegetation cover</li> </ul>
1 m x 1 m quadrats	<ul style="list-style-type: none"> <li>▪ Native perennial grass cover</li> <li>▪ Organic litter cover</li> </ul>

Sub Plot	Attributes
	<ul style="list-style-type: none"> <li>▪ Native forbs and other species</li> <li>▪ Native shrubs (&lt;1 m in height)</li> <li>▪ Non-native grass</li> <li>▪ Non-native forbs and shrubs</li> </ul> <p>[Note: Not all of the above attributes are used in the Habitat Quality score. Assessing all attributes improves the reliability of cover estimates for the assessable attributes, namely native perennial grass cover and organic litter cover.]</p>

### 2.1.4 Co-ordinate system and map datum

Locations were recorded using the UTM coordinate system. All locations presented in this report are within zone 55K. The map datum used was WGS84.

### 2.1.5 Climatic conditions

Weather conditions during and leading up to the survey period were relatively dry and warm, with maximum day time temperatures reaching in the high 20s to mid-30s and night time temperatures in the mid-teens to low 20s at Moranbah Airport Weather Station (BoM 2018). Total rainfall for the region leading up to the field survey, was substantially less than average, except in October 2017 and February 2018, as shown in Table 4 below.

**Table 3: Monthly rainfall (mm) for Moranbah prior to and following the survey**

Month	2017							2018			
	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April
Average	22.1	18.0	25.0	9.1	35.7	69.3	103.9	103.8	100.7	55.4	36.4
Actual Rainfall Total 2017/2018	0.0	1.6	1.2	0.4	86.0	39.4	16.2	20.4	183.4	13.0	8.0

Source: BoM (Date accessed 10 May 2018)

## 2.2 Habitat mapping

Habitat mapping for each of the four listed species within the riparian monitoring area was undertaken using vegetation mapping in combination with the individual species habitat criteria applied as part of the IPE impact assessment (Ecological Survey & Management 2016), and which was assessed by the Commonwealth DoEE as part of the approval for the project.

## **2.3 Habitat quality scoring**

The field data recorded at each of the habitat quality plots for each AU was used in combination with geospatial information to determine a habitat quality score for habitat in the riparian monitoring area, using the methodology outlined in the Habitat Quality Guide.

### **2.3.1 Site ecological condition**

The attributes collected as part of each habitat quality plot will be used to populate the 10 ecological condition indicators required to compare each RE/AU against benchmark values and determine the habitat quality score in the Habitat Quality Guide:

- recruitment of woody perennial species
- native plant species richness - trees
- tree canopy height
- tree canopy cover
- shrub canopy cover
- native perennial grass cover
- organic litter
- large trees
- coarse woody debris
- weed cover (EHP 2017).

### **2.3.2 Site context**

The landscape context in which the AUs are located is also measured as part of developing the habitat quality score. The riparian monitoring area is located within a 'fragmented' landscape according to Figure 7 in the Habitat Quality Guide. The landscape scale attributes measured within the riparian monitoring area therefore included:

- size of the patch in which each AU is located
- connectedness of the riparian monitoring area by measuring the percentage of the perimeter of each AU that is connected with adjacent remnant vegetation
- context of each AU in terms of the percentage of remnant or cleared areas within a 1 km radius of each polygon in which a habitat quality plot is located
- proximity of the polygon, in which a habitat quality plot is located, to state, bioregional, regional or sub-regional corridors (terrestrial or riparian) (EHP 2017).

Landscape scale attributes were measured for each polygon, in which a habitat quality plot was located, by using the Queensland Government's Globe.

### **2.3.3 *Habitat indices***

The following habitat indices were assessed for each of the four species at each habitat quality plot in accordance with the Habitat Quality Guide:

- threats to species
- quality and availability of food and foraging habitat
- quality and availability of shelter
- species mobility capacity
- role of site location to species overall population in the state (EHP 2017).

It is noted, that while habitat mapping encompassed all communities that originate within the riparian monitoring area, only riparian REs, i.e. REs 11.3.2, 11.3.4 and 11.3.25, were used as part of the habitat quality scoring methodology.

### 3 Monitoring results and discussion

#### 3.1 Vegetation mapping

Six regional ecosystems (REs) have been mapped within the riparian monitoring area, including remnant and non-remnant areas as shown in Figure 3 and outlined in Table 4. Table 4 provides the area of each RE that originates within the riparian monitoring area, but may extend beyond the riparian monitoring area.

**Table 4: Regional ecosystems in the riparian monitoring area**

RE	Short Description (Queensland Herbarium 2018)	VM Act Status	Area (ha)
<b>Remnant</b>			
11.3.2	<i>Eucalyptus populnea</i> woodland on alluvial plains	Of concern	7.9
11.3.4	<i>Eucalyptus tereticornis</i> and/or <i>Eucalyptus</i> spp. woodland on alluvial plains	Of concern	0.5
11.3.25	<i>Eucalyptus camaldulensis</i> or <i>Eucalyptus tereticornis</i> open forest to woodland	Least concern	105.9
11.9.7a	<i>Eucalyptus populnea</i> on gently undulating to sloping plains	Of concern	8.5
11.8.11	<i>Dichanthium sericeum</i> grassland on Cainozoic igneous rocks	Of concern	4.5
<b>High value regrowth</b>			
11.9.5	<i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> open forest on fine-grained sedimentary rocks	Endangered	13.2
n/a	<i>Eucalyptus cambageana</i> regrowth not representing an RE	n/a	3.0

Note: Areas indicate total area of RE polygons that originate within the riparian monitoring area

#### 3.2 Habitat mapping

The majority of REs listed in Table 4 are considered to form habitat for one or more of the listed threatened fauna species; Greater Glider, Koala, Ornamental Snake and Squatter Pigeon. The habitat mapping undertaken as part of this baseline riparian monitoring draws on the mapping and habitat criteria developed for the IPE project to maintain consistency (Ecological Survey & Management 2016).

##### 3.2.1 Squatter Pigeon

Suitable habitat for the Squatter Pigeon is categorised as grassy woodland habitat in REs on land zones 3, 5 or 7, which are either: within 1 km of a permanent water body; or within 1 km of a Queensland Government mapped wetland or ≥3<sup>rd</sup> order stream. Smoky Creek is a 4<sup>th</sup> order stream and the western tributary is a 3<sup>rd</sup> order stream, therefore, REs 11.3.2, 11.3.4 and 11.3.25 along both watercourses are mapped as habitat on Figure 5. A total of 103.8 ha of Squatter Pigeon habitat is mapped within the riparian monitoring area.



### **3.2.2 Greater Glider**

The approved conservation advice for this species (TSSC 2016) indicates that taller, moist eucalypt forest with relatively old trees and abundant hollows and a diversity of eucalypt species is favoured by this species. Using this description and in consideration of the communities in which the Greater Glider was observed in the IPE study area and in other surveys conducted throughout Central Queensland, the riparian and alluvial communities are considered to provide suitable habitat for this species. These communities are considered to provide the greatest availability of large old hollow-bearing trees and provide the greatest connectivity with larger patches of remnant vegetation in the landscape.

Riparian and alluvial REs 11.3.2, 11.3.4 and 11.3.25 are mapped as habitat for the Greater Glider on Figure 6. There is 103.8 ha of this habitat for the Greater Glider within the riparian monitoring area.

### **3.2.3 Ornamental Snake**

Habitat mapping criteria outlined in the IPE Terrestrial Ecology Assessment for Ornamental Snake, includes:

- 'woodland or open forest habitat, which is included within any Queensland RE on Land Zone 4 and supports gilgai (melon-hole) mounds and depressions; or
- woodland or open forest habitat, which is included within any Queensland RE on land zone 3 or 4, or an area of mapped regrowth on land zone 3 or 4, which is within 200 m of the mapped wetland or a  $\geq 4^{\text{th}}$  order stream (as mapped by the Queensland Government) and supports an abundance of fallen logs ( $>30$  cm in diameter) of  $>10$  per 100 m x 100 m sample plot'.

Habitat for the Ornamental Snake was not previously mapped for the IPE project, however, for the purposes of this monitoring assessment and as a precautionary approach, habitat has assumed to be present within 200 m of Smoky Creek (a 4<sup>th</sup> order stream). Therefore, REs 11.3.2, 11.3.4 and 11.3.25 within 200 m of this watercourse is mapped as habitat for the Ornamental Snake and there is 75.9 ha of this habitat within the riparian monitoring area (Figure 7). There are no wetlands or gilgai within the riparian monitoring area.

### **3.2.4 Koala**

In line with the IPE project habitat mapping criteria, any forest or woodland containing species that are Koala food trees, or any shrubland with emergent Koala food trees (i.e. trees of any of the following genera: *Angophora*, *Corymbia*, *Eucalyptus*, *Lophostemon*, *Melaleuca*) is considered potential habitat for the Koala.

Therefore, REs 11.3.2, 11.3.4, 11.3.25, 11.9.7a, regrowth RE 11.9.5 (that contains emergent food trees) and a small patch of non-remnant Dawson River Gum (*Eucalyptus cambageana*) in the western portion of the riparian monitoring

area is considered to provide potential habitat for the Koala (Figure 8). There is 107.2 ha of Koala habitat within the riparian monitoring area.

The patch of RE 11.8.11 and two patches of regrowth RE 11.9.5, in the east, are not considered to provide potential habitat for this species, as these communities do not support emergent food trees.

### 3.3 Site condition

Data collected from each of the 11 habitat quality plots was compared with the corresponding bio-condition benchmarks for the corresponding REs. These benchmarks were sourced from the Queensland Government (DSITI 2016). The highest possible site condition score attainable, is a score of 80 in accordance with the Habitat Quality Guide (EHP 2017).

The overall ecological condition of the sampled vegetation types was found to be moderate. This was largely due to generally near or greater than 50% weed infiltration, less than 100% recruitment, generally low abundance of coarse woody debris and low perennial native grass cover. Large eucalypt trees were generally lacking throughout the habitat quality plots.

Habitat quality plots 6, 8 and 9 were of slightly better condition due to species richness and cover in the tree and shrub layers. Table 5 provides a summary of the ecological condition scores for each of the AUs in the riparian monitoring area. A detailed breakdown of the habitat quality scores for each of the AUs is presented in Appendix A.

Representative photos of each of the monitoring sites are provided in Appendix B.

**Table 5: Habitat quality scores for each of the habitat quality plots in the riparian monitoring area**

Parameters	Assessment Unit (AU)										
	1	2									
<b>Area (ha)</b>	<b>8.0</b>	<b>106.4</b>									
<b>RE</b>	11.3.2	11.3.25/11.3.4									
<b>BVG</b>	17a	16a/c									
<b>EEM Site</b>	<b>5</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>
<b>Site Condition Score</b>	44	58	55.5	57	58.5	69	61.5	66.5	63.5	56.5	61.5
<b>Site Context Score</b>	15	17	17	20	10	5	11	17	17	17	17

### 3.4 Site context

Most habitat quality plots are located within one polygon that extends along the majority of Smoky Creek and its tributary within the riparian monitoring area. However, there is some fragmentation of Smoky Creek, particularly by the Goonyella Branch Railway Line in the northern extent of the riparian monitoring area.

There is extensive clearing in the local landscape, i.e. within 10 km of the riparian monitoring area. This is evidenced in the patch size scores for each habitat quality plot, whereby all except plot 3 are located in patches less than 200 ha.

All habitat quality plots, except 5, achieve a connectedness score of only 0 or 2 due to the narrow width and therefore high perimeter to area ratio of riparian vegetation in the patches within which the plots are located. Habitat quality plot 5 (RE 11.3.2) achieves a score of 5 because it is almost wholly encompassed within riparian vegetation associated with a bend of Smokey Creek (RE 11.3.25) (Figure 3).

As with connectedness, all habitat quality plots, except 3 (RE 11.3.2), achieved a score of 0 or 2 with regard to context due to the extent of clearing that has occurred in the immediate region. Large patches of remnant vegetation occur to the north-east of the riparian monitoring area, which likely accounts for the higher score for plot 3 as it is the most north-easterly plot within the riparian monitoring area and closest to this larger remnant.

Smoky Creek is identified as a regional riparian corridor on the Queensland Globe and therefore, habitat quality plots located in this corridor (all except plots 6 and 7) score highly for ecological corridors (DES 2018).

A summary of scores for each of the habitat quality plots is provided in Table 5 and a full breakdown of the connectivity and context scores is provided in Appendix A. The highest attainable site context score for fragmented landscapes is a score of 26 in accordance with the Habitat Quality Guide (EHP 2017).

Distance from water is not applicable to the riparian monitoring area as it is located in a fragmented landscape according to the Habitat Quality Guide.

### 3.5 Species habitat indices

The following habitat indices (Tables 6-9) were applied to each of the four listed species based on:

- SPRAT Profiles, referral guidelines, Threatened Species Scientific Committee Conservation and Listing Advice
- field observations and data recorded during the monitoring survey
- assessment of the species as part of the IPE project Terrestrial Ecology Assessment
- geospatial and aerial photo analysis.

The highest attainable habitat index score is a score of 50 in accordance with the Habitat Quality Guide (EHP 2017).

**Table 6: Species habitat index scoring for the Squatter Pigeon**

Habitat Indices	Score	Rationale
1. Threat to species	15	There are few local or main roads in the region and vehicle movements are irregular. Predators are present in the landscape, but there is no evidence to suggest they are high in numbers or putting considerable pressure on the Squatter

Habitat Indices	Score	Rationale
		Pigeon.
2. Quality and availability of food and foraging habitat	5	The local landscape (i.e. within 10 km of the riparian monitoring area) has been largely cleared of native vegetation for cattle grazing, mining and exploration activities. Native habitat is predominantly confined to watercourses, although this species is known to use disturbed or partly modified areas (DoEE 2018a).
3. Quality and availability of shelter	5	Shelter habitat for the Squatter Pigeon is not well defined in the SPRAT Profile. This species shelters in nearby trees as described in the SPRAT Profile and requires a combination of open forest or woodlands habitats within close proximity (i.e. up to 3 km) to water sources. The riparian monitoring area would provide this when the watercourses support flowing or ponded water. However, these are ephemeral streams and do not provide a permanent water source.
4. Species mobility capacity	7	The Squatter Pigeon is a mobile bird, however, it is considered to be sedentary or locally nomadic (DoEE 2018a). It is thought to persist where food and water resources are available, but move through vegetated corridors in search of these resources when necessary. This species will largely keep within or in close proximity to wooded or remnant areas for protection from predators, but will move out into modified and degraded environments a short distance, e.g. (100 m) to forage (DoEE 2018a).
5. Role of site location to species overall population in the state	1	The riparian monitoring area is unlikely to be critical to the survival of the Squatter Pigeon as the species remains common in its northern distribution, the riparian monitoring area is unlikely to support an important population and it uses a range of habitats, included modified and degraded habitats, which are relatively common in the landscape (Ecological Survey & Management 2016).
<b>Total Score</b>	<b>33</b>	

**Table 7: Species habitat index scoring for the Greater Glider**

Habitat Indices	Score	Rationale
1. Threat to species	7	There are few main or local roads in the region, although clearing has likely resulted in narrowing of habitat areas and restricting habitat closely to riparian areas. They are thought to require native forests patches of at least 160 km <sup>2</sup> (TSSC 2016). Predators are present in the landscape, but there is no evidence to suggest they are high in numbers or putting considerable pressure on the Greater Glider.
2. Quality and availability of food and foraging habitat	1	The Greater Glider prefers taller montane, moist eucalypt forests with relatively old trees and abundant hollows and a diversity of eucalypt species (TSSC 2016). Riparian areas generally provide more fertile and higher productivity areas in a rural landscape and therefore are more likely to provide the taller, older, hollow-bearing and diversity of eucalypt species required by the Greater Glider. This type of habitat is highly restricted in the landscape and is usually thinned, selectively cleared or cleared to the high banks of watercourses, as is the case within the riparian monitoring area.
3. Quality and availability of shelter	1	Shelter habitat is defined in the Conservation Advice for the Greater Glider as tree hollows used during the day, and

Habitat Indices	Score	Rationale
		particularly large hollows in large, old trees (TSSC 2008). Due to the restricted nature of riparian habitat and remnant vegetation generally within the landscape, availability of this type of shelter is limited.
4. Species mobility capacity	4	While this is a mobile arboreal species, it is thought to have low dispersal ability and typically small home ranges of 1-4 ha. They are thought to have relatively low persistence in small forest fragments and disperse poorly across vegetation that is not native forest (TSSC 2016).
5. Role of site location to species overall population in the state	1	The riparian monitoring area is unlikely to be critical to the survival of the species as the population present is unlikely to be an important population and the riparian monitoring area does not provide a particularly unique, large or important area of habitat for this species.
<b>Total Score</b>	<b>14</b>	

**Table 8: Species habitat index scoring for the Ornamental Snake**

Habitat Indices	Score	Rationale
1. Threat to species	7	There is a moderate level of threat from vegetation clearing and fragmentation in the local area. Mining and petroleum exploration activities, involving clearing and track construction, occurs throughout the region, causing modification and fragmentation of habitat in the region. Cattle grazing is considered a potential threat to habitat areas, particularly during the wet season (DoEE 2018b). Predators are present in the landscape, but there is no evidence to suggest they are high in numbers or likely to be putting considerable pressure on the Ornamental Snake.
2. Quality and availability of food and foraging habitat	1	There is limited habitat availability for this species in the landscape and it is restricted to marginal riparian habitat that changes in abundance of microhabitat features in response to weather and particularly local and upstream rainfall events. There are no gilgai depressions or mounds in the riparian monitoring area or the IPE project area, which is identified in the <i>Draft referral guidelines for the nationally listed Brigalow Belt reptiles</i> , as known important habitat for this species (SEWPaC 2011).
3. Quality and availability of shelter	1	Shelter habitat is described as broadly for nationally listed Brigalow Belt reptiles as coarse woody debris, leaf litter, rocks or artificial materials on or in topsoil, cracks in alluvial clay soils (SEWPaC 2011). cracking clay soils in gilgai mounds are specifically described for the Ornamental Snake as refuge habitat (DoEE 2018b). While the riparian areas support some coarse woody debris, which varies in abundance depending on the extent of flood debris in the channels, there are no other substantial shelter micro-habitat features in the riparian monitoring area or IPE project area that would likely support this species.
4. Species mobility capacity	4	The Ornamental Snake is thought to disperse between suitable habitat areas, perhaps some kilometres. However, connectivity between gilgais and other suitable habitat is considered important for this species (SEWPaC 2011). Overall, the species' habitat requirements are fairly restrictive and dispersal is probably fairly limited.

<b>Habitat Indices</b>	<b>Score</b>	<b>Rationale</b>
5. Role of site location to species overall population in the state	1	Given the lack of gilgai or other prey supporting wetland habitat and marginal suitability of riparian areas as habitat for the Ornamental Snake in the riparian monitoring area or IPE project area, it is considered highly unlikely that the riparian monitoring area is critical to the species survival.
<b>Total Score</b>	<b>14</b>	

**Table 9: Species habitat index scoring for the Koala**

<b>Habitat Indices</b>	<b>Score</b>	<b>Rationale</b>
1. Threat to species	7	There is a moderate level of threat from the Goonyella Railway and local Broadlea Road. There is limited vegetation in the local area, which is mostly confined to the watercourses. Mining and petroleum exploration activities, involving clearing and track construction, occurs throughout the region, reducing availability of food trees and increasing irregular vehicle movements in the local area. Predators are present in the landscape, but there is no evidence to suggest they are high in numbers or putting considerable pressure on the Koala.
2. Quality and availability of food and foraging habitat	5	The local landscape (i.e. within 10 km of the riparian monitoring area) has been largely cleared of native vegetation for cattle grazing, mining and exploration activities. Habitat is predominantly confined to watercourses.
3. Quality and availability of shelter	5	The Koala referral guideline indicates shelter habitat is likely to be 'riparian environments and other areas with reliable soil moisture and fertility'. There is a moderate availability of shelter habitat within the riparian monitoring area and surrounding landscapes in the form of Smoky Creek, its tributary and more broadly, the Isaac River and its tributaries to the north, west and south of the riparian monitoring area.
4. Species mobility capacity	10	The Koala is considered to be a highly mobile species with large home ranges recorded between 8 - 135 ha depending on the location and the environment. The species is known to disperse up to 16 km in certain landscapes and several kilometres within largely cleared landscapes (DoEE 2018c).
5. Role of site location to species overall population in the state	1	The riparian monitoring area has the potential to provide habitat critical to the survival of the species as outlined in the IPE Project Terrestrial Ecology Assessment report. This is because, although the species has not been recorded as part of the project, it is highly likely to occur and the riparian monitoring area provides connectivity with large tracts of habitat in the surrounding landscape, there are a diversity of potential food trees present and the riparian areas provide potential refuge habitat for the Koala (Ecological Survey & Management 2016).
<b>Total Score</b>	<b>28</b>	

## 4 Overall habitat quality scores and future monitoring

Detailed habitat quality scoring spreadsheets have been included with this report, for each of the four listed species using the Habitat Quality Guide methodology. Scores have been calculated for each species for each of the two assessment units as well as for individual habitat quality plots.

A summary of scores is provided in Table 10. A detailed breakdown of the condition and context scores is provided in Appendix A. Habitat scoring is lowest for the Ornamental Snake and Greater Glider, most likely to due to their relatively low mobility and dispersal capability and the narrow and sparse nature of micro-habitat habitat features within the riparian corridors.

**Table 10: Habitat quality scores for each species**

Assessment unit	AU 1	AU 2									
RE	11.3.2	11.3.25/11.3.4									
Habitat Quality Plot	5	1	2	3	4	6	7	8	9	10	11
<b><i>Squatter Pigeon</i></b>											
Habitat Quality Score (measured)	92	108	105.5	110	101.5	107	105.5	116.5	113.5	106.5	111.5
Assessment unit habitat quality score (out of 10)	<b>5.90</b>	<b>6.96</b>									
<b><i>Greater Glider</i></b>											
Habitat Quality Score (measured)	73	89	86.5	91	82.5	88	86.5	87.5	94.5	87.5	92.5
Assessment unit habitat quality score (out of 10)	<b>4.68</b>	<b>5.74</b>									
<b><i>Ornamental Snake</i></b>											
Habitat Quality Score (measured)	73	89	86.5	91	82.5	88	86.5	87.5	94.5	87.5	92.5
Assessment unit habitat quality score (out of 10)	<b>4.68</b>	<b>5.74</b>									
<b><i>Koala</i></b>											
Habitat Quality Score (measured)	87	103	100.5	105	96.5	102	100.5	111.5	108.5	101.5	106.5
Assessment unit habitat quality score (out of 10)	<b>5.58</b>	<b>6.64</b>									

#### 4.1 Ongoing monitoring

Habitat quality scoring for each of the species is useful to gain a simplistic and overall appraisal of habitat quality within the riparian area. However, measuring ecological condition parameters will be most useful in identifying slight changes to condition that may provide early signs of decline. This would allow time for more intensive monitoring if necessary and investigation of potential causes of decline in condition.

Site context may change drastically as a result of actions off site and as part other projects, and so may not be particular useful for measuring potential effects of drawdown. Habitat indices are unlikely to improve substantially in the short to medium term but may decline also as a result of habitat clearing nearby. Therefore, habitat indices are also not particularly useful for measuring potential effects of drawdown should they occur.

Effects of drawdown in particular are likely to be most evident in parameters such as recruitment of woody perennial species, tree canopy cover (i.e. being influenced by dieback of the canopy) and number of trees per hectare (i.e. also being influenced by dieback). Coarse woody debris may also indicate mortality of larger trees and dieback, although, coarse woody debris in riparian areas is also subject to flooding, and therefore less reliable.

The following monitoring regime is proposed and should be revised should mining activities change from that conditioned as part of EPBC Act approval EPBC 2016/7827, or modelling indicate change in potential drawdown depth and extent.

Plate A indicates areas of predicted greatest drawdown from the IPE project and therefore monitoring of habitat quality plots within these areas should be more frequent. Habitat quality monitoring should follow the Habitat Quality Guide methodology described in this baseline report and use the 11 habitat quality plots established as part of this baseline monitoring event. Each monitoring event should be undertaken in the post-wet season to replicate baseline conditions as far as possible and to capture data during what should be the most favourable floristic conditions.

Table 11 outlines the proposed monitoring regime for the life of the EPBC Act approval, i.e. until 1 November 2040.

**Table 11: Proposed monitoring program for the riparian monitoring area**

HQ Plots	Year										
	2020	2022	2024	2026	2028	2030	2032	2034	2036	2038	2040
2, 7, 8, 9, 10, 11	●	●	●	●	●	●	●	●	●	●	●
1, 3, 4, 5, 6	●	●			●			●			●

In addition to the habitat quality monitoring described in this report and Table 11, additional on-site management monitoring should be undertaken quarterly, using photo monitoring points to identify significant and rapid changes to



vegetation in between habitat quality monitoring events. These should be undertaken by the site environmental advisor, who should have background in environmental monitoring, including simple vegetation monitoring.

## 5 References

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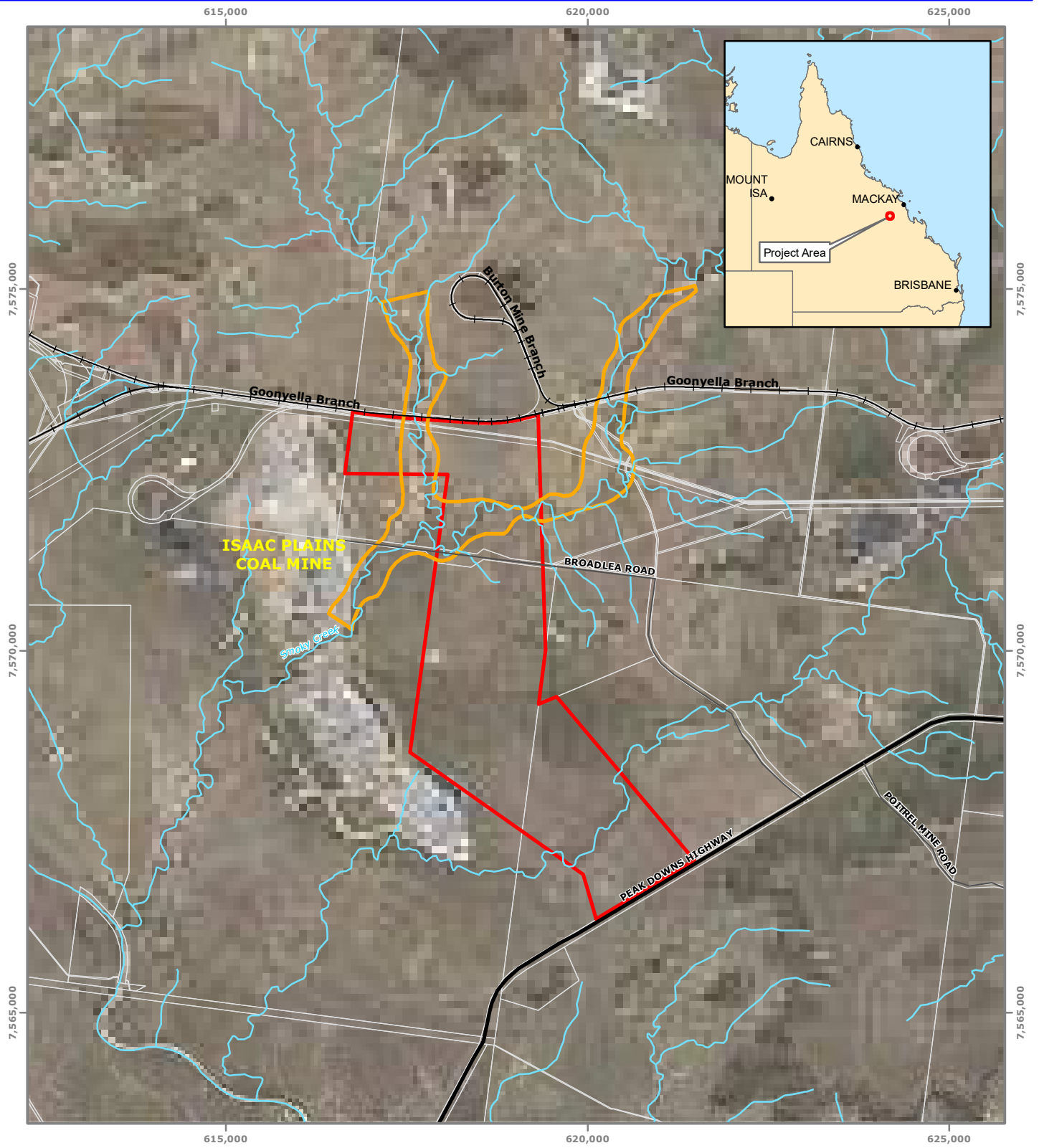
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## Figures



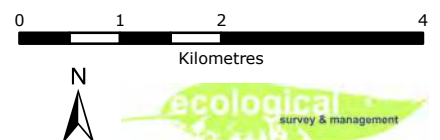
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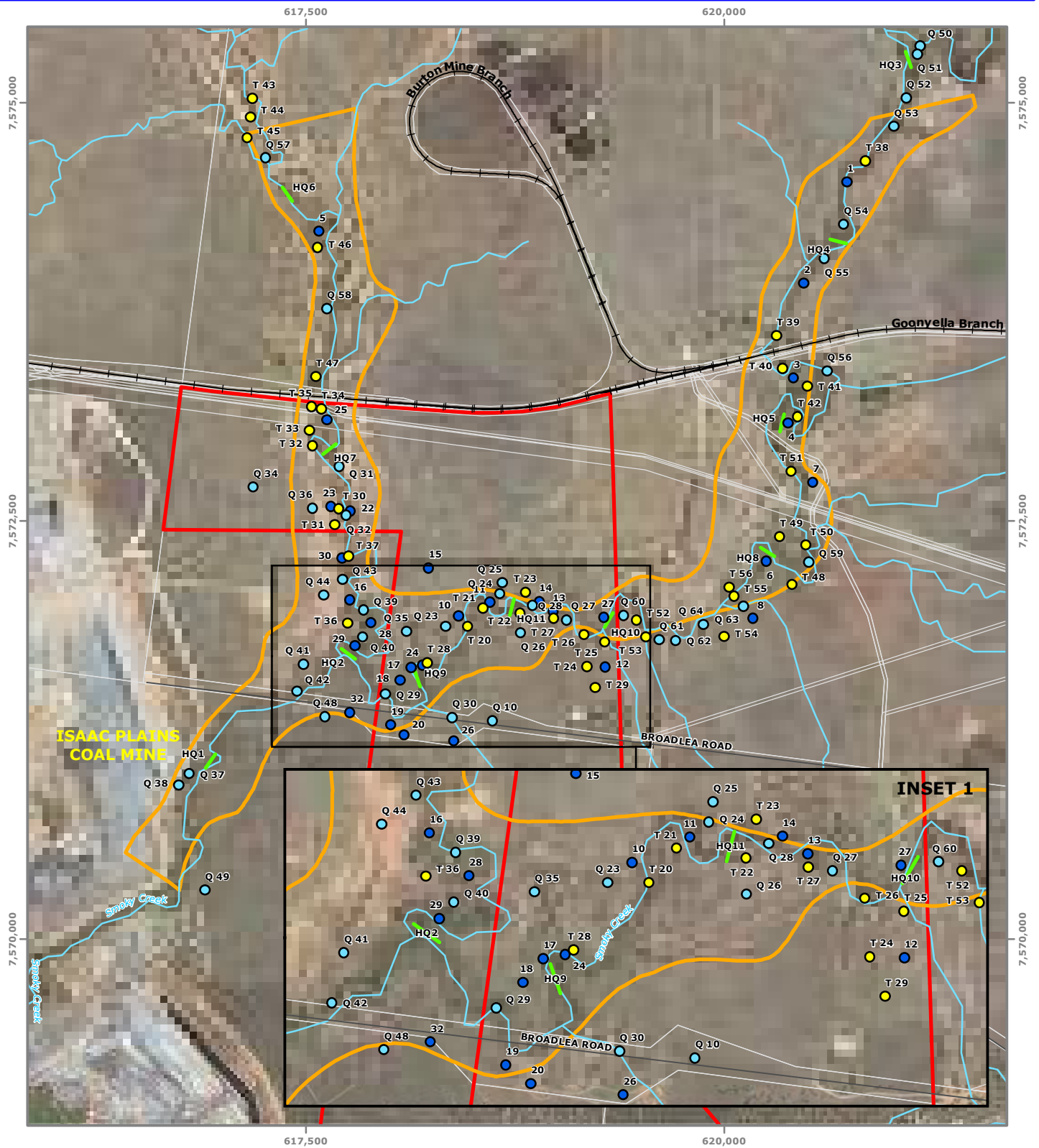
- Project Site
- Riparian Monitoring Area
- Highway
- Street/Local Road
- Railway
- Vegetation Management Act Watercourse
- Cadastral Boundary

**Figure 1 : Location of the Isaac Plains East Project riparian monitoring area**

Isaac Plains East Project EPBC Act Baseline Riparian Monitoring

Map Number: 18017\_01\_B  
 Date: 06 June 2018  
 Map Projection: GDA 1994 MGA Zone 55  
 Imagery: Digital Globe  
 Data: Roads, Watercourse, DCDB - (c)DNRM 2016





**Legend**

- Project Site
- Riparian Monitoring Area
- Street/Local Road
- Railway
- Vegetation Management Act Watercourse
- Cadastral Boundary

**Vegetation Assessment Sites**

- Tertiary Assessment Site
- Quaternary Assessment Site
- Quaternary Assessment Site (Photo Point)
- Habitat Quality Plots

Note: Survey site numbering is not consecutive

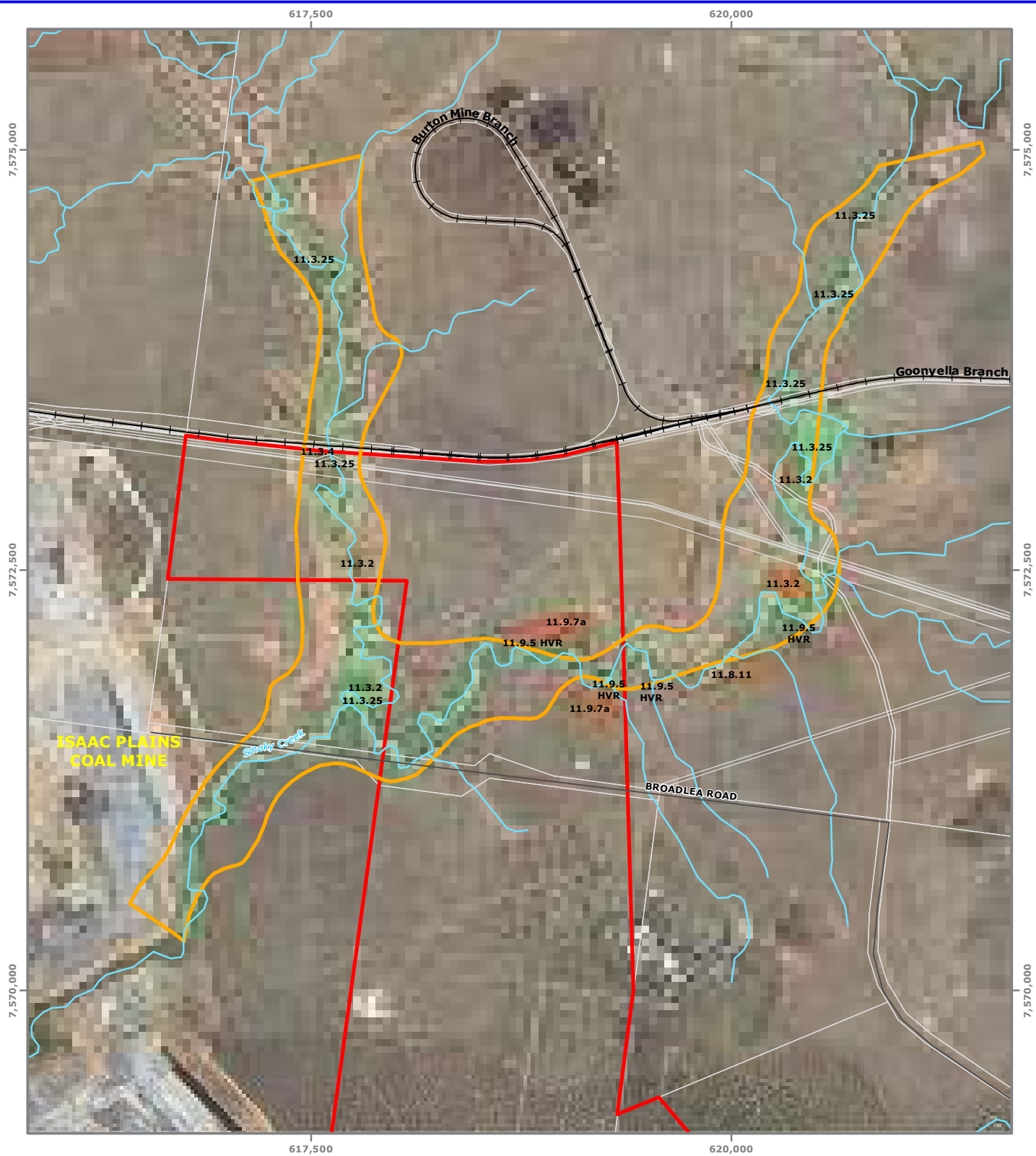
**Figure 2 : Location of habitat quality plots**

Isaac Plains East Project EPBC  
Act Baseline Riparian Monitoring

Map Number: 18017\_02\_B  
Date: 06 June 2018  
Map Projection: GDA 1994 MGA Zone 55  
Imagery: Digital Globe  
Data: Roads, Watercourse, DCDB - (c)DNRM 2016

0 250 500 1,000 1,500  
Metres

N



**Legend**

- Project Site
- Riparian Monitoring Area
- Street/Local Road
- Railway
- Vegetation Management Act Watercourse
- Cadastral Boundary

**Remnant Vegetation**

- Of concern
- Least concern

**High Value Regrowth**

- Endangered

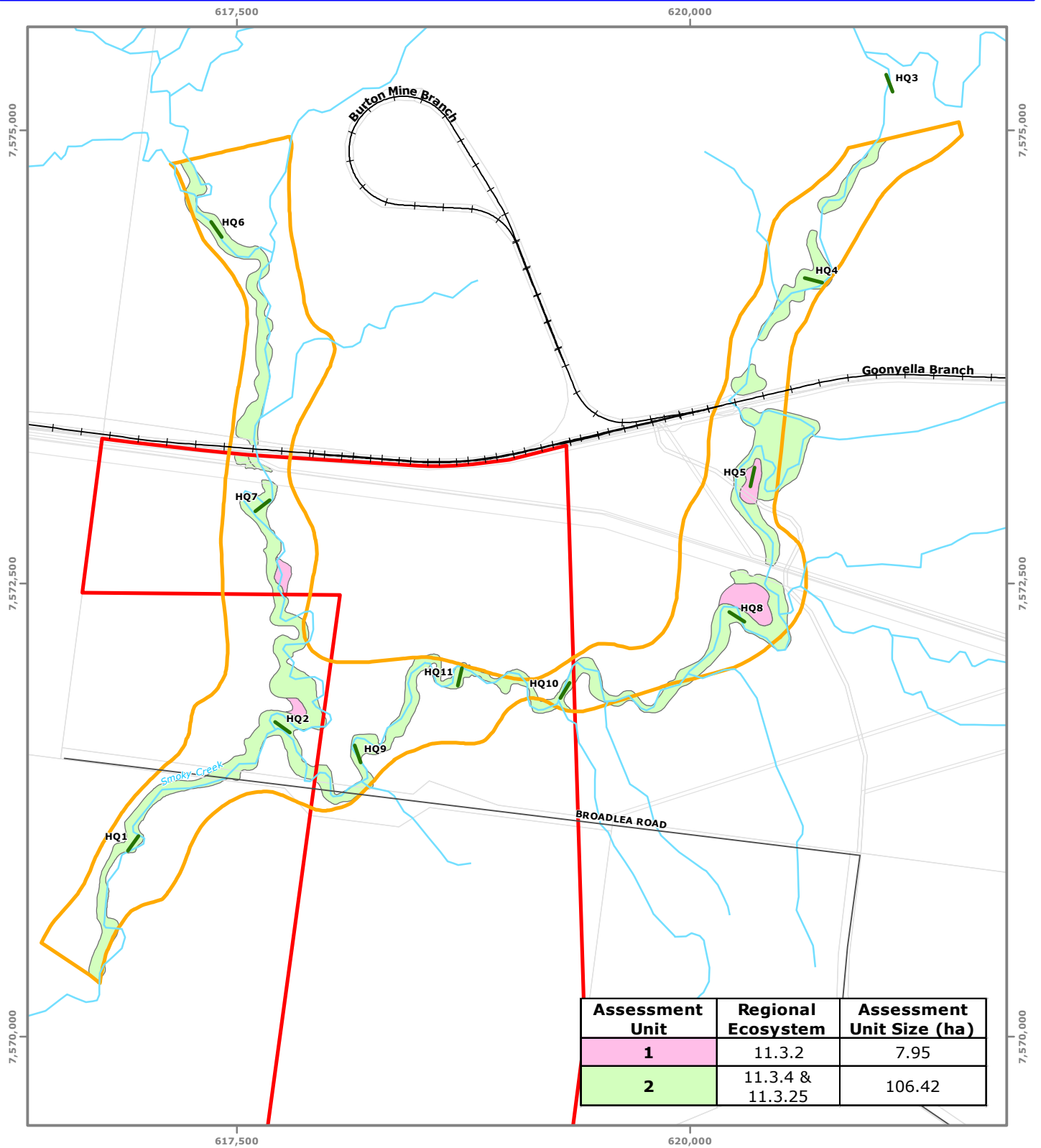
**Figure 3 : Field-validated regional ecosystem mapping**

Isaac Plains East Project EPBC  
Act Baseline Riparian Monitoring

Map Number: 18017\_03\_B  
 Date: 06 June 2018  
 Map Projection: GDA 1994 MGA Zone 55  
 Imagery: Digital Globe  
 Data: Roads, Watercourse, DCDB - (c)DNRM 2018

0    250    500    1,000    1,500  
 Metres

N



**Legend**

- Project Site
- Riparian Monitoring Area
- Street/Local Road
- Railway
- Vegetation Management Act Watercourse
- Cadastral Boundary
- Habitat Quality Plots

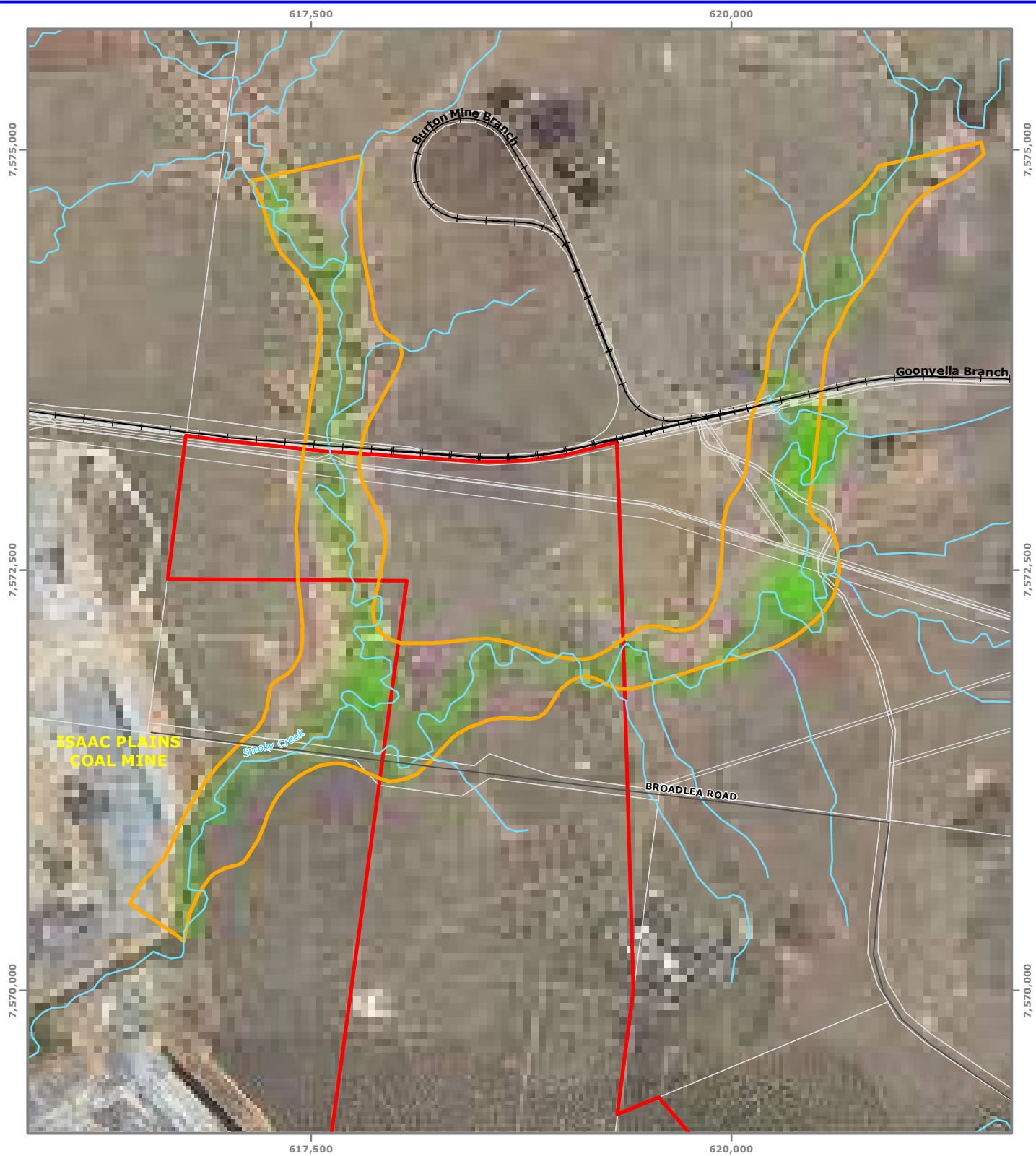
**Figure 4 : Assessment units**

Isaac Plains East Project EPBC Act Baseline Riparian Monitoring

Map Number: 18017\_04\_E  
 Date: 21 June 2018  
 Map Projection: GDA 1994 MGA Zone 55  
 Data: Roads, Watercourse, DCDB - (c)DNRM 2018







**Legend**

- Project Site
- Riparian Monitoring Area
- Street/Local Road
- Railway
- Vegetation Management Act Watercourse
- Cadastral Boundary

**Habitat Mapping**

- Squatter Pigeon (southern) (*Geophaps scripta scripta*) – Vulnerable (EPBC Act and NC Act)

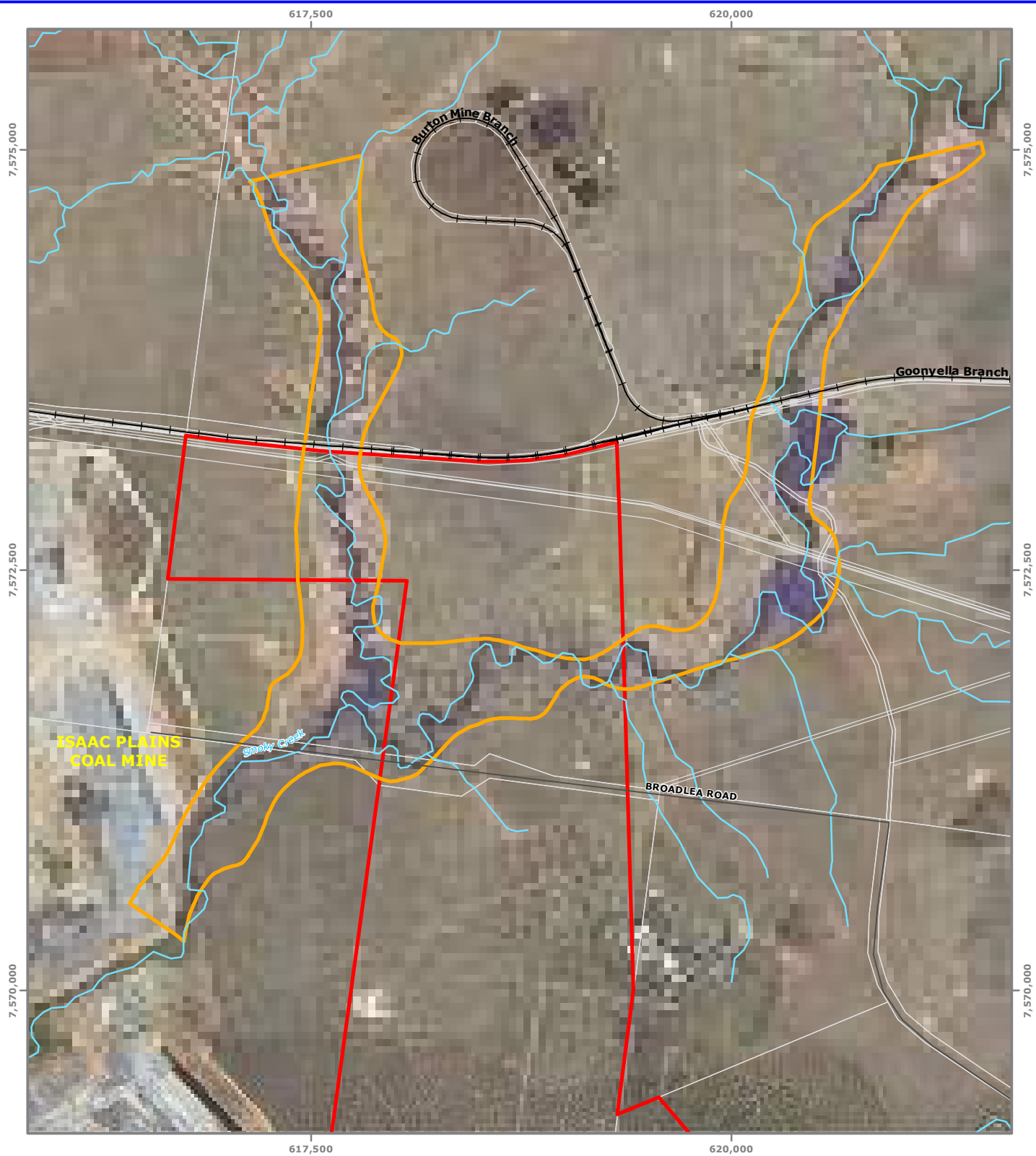
**Figure 5 : Squatter Pigeon (southern) habitat mapping**

Isaac Plains East Project EPBC Act Baseline Riparian Monitoring

Map Number: 18017\_05\_B  
Date: 06 June 2018  
Map Projection: GDA 1994 MGA Zone 55  
Imagery: Digital Globe  
Data: Roads, Watercourse, DCDB - (c)DNRM 2018

0 250 500 1,000 1,500  
Metres

N



- Legend**
- Project Site
  - Riparian Monitoring Area
  - Street/Local Road
  - + Railway
  - Vegetation Management Act Watercourse
  - Cadastral Boundary
- Habitat Mapping**
- Greater Glider (*Petauroides volans*) – Vulnerable (EPBC Act and NC Act)

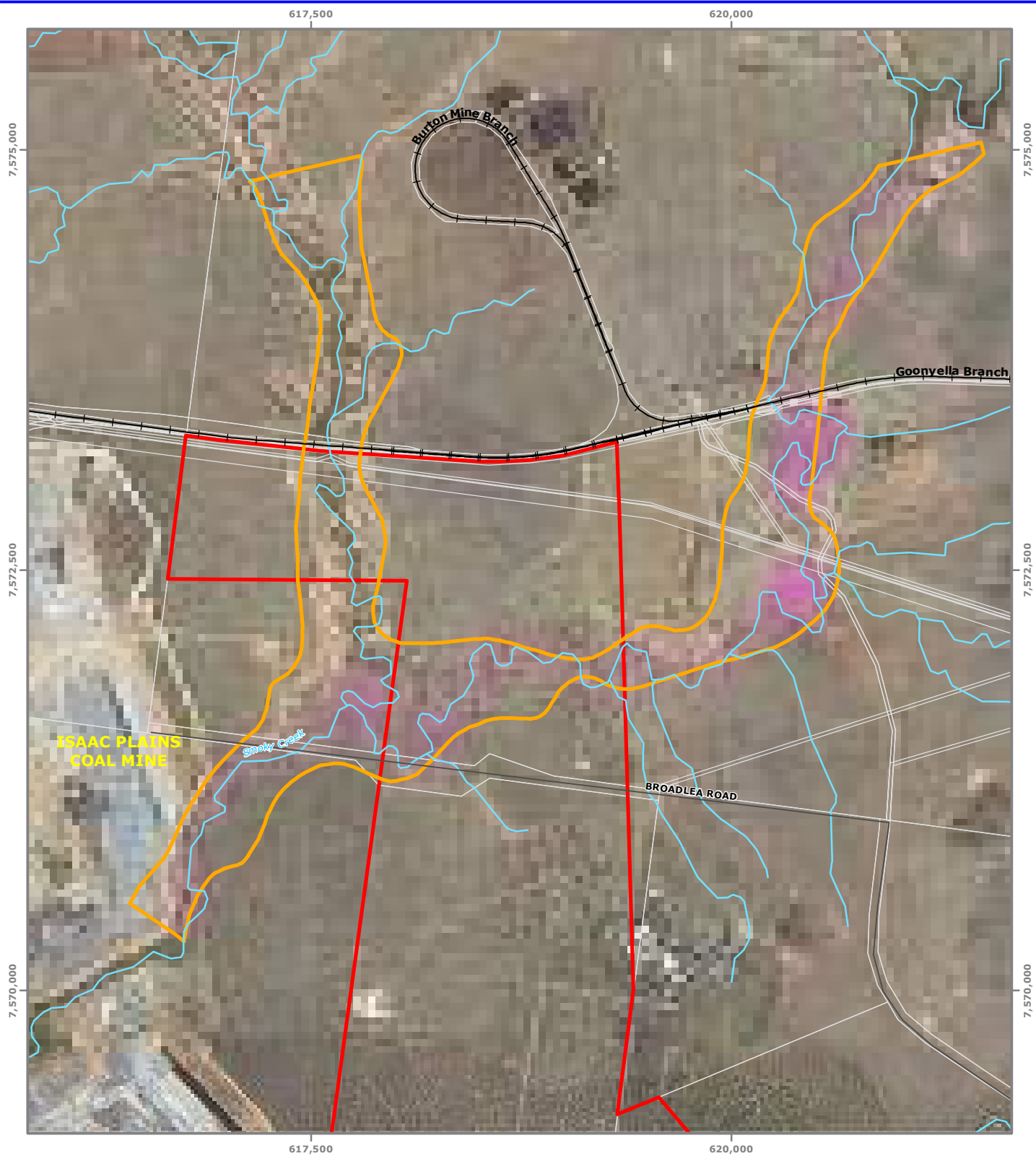
**Figure 6 : Greater Glider habitat mapping**

Isaac Plains East Project EPBC Act Baseline Riparian Monitoring

Map Number: 18017\_06\_B  
 Date: 06 June 2018  
 Map Projection: GDA 1994 MGA Zone 55  
 Imagery: Digital Globe  
 Data: Roads, Watercourse, DCDB - (c)DNRM 2016

0 250 500 1,000 1,500  
 Metres

N



**Legend**

- Project Site
- Riparian Monitoring Area
- Street/Local Road
- Railway
- Vegetation Management Act Watercourse
- Cadastral Boundary

**Habitat Mapping**

- Ornamental Snake (*Denisonia maculata*) – Vulnerable (EPBC Act and NC Act)

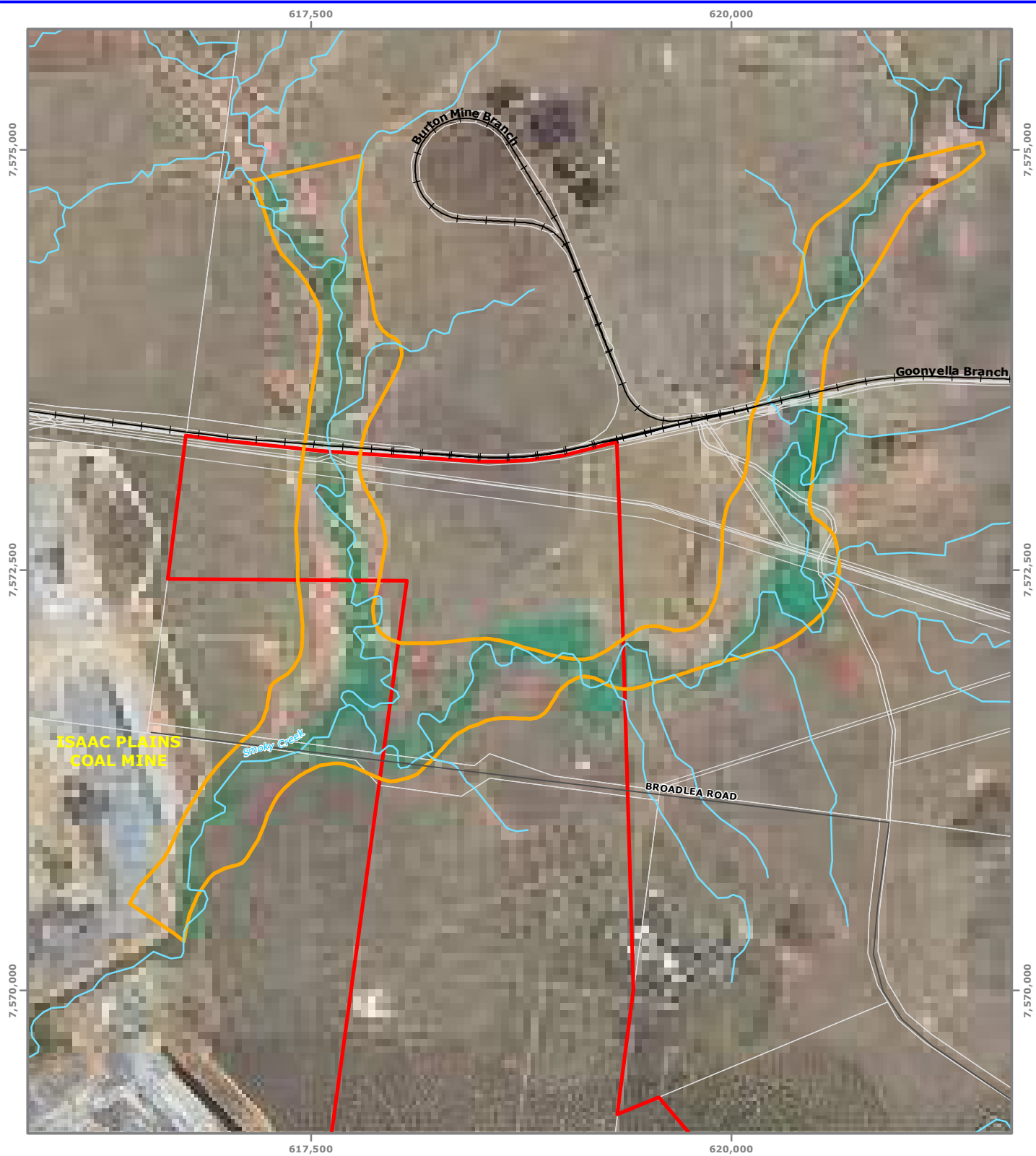
**Figure 7 : Ornamental Snake habitat mapping**

Isaac Plains East Project EPBC Act Baseline Riparian Monitoring

Map Number: 18017\_07\_B  
 Date: 06 June 2018  
 Map Projection: GDA 1994 MGA Zone 55  
 Imagery: Digital Globe  
 Data: Roads, Watercourse, DCDB - (c)DNRM 2016

0 250 500 1,000 1,500  
 Metres

N



**Legend**

- Project Site
- Riparian Monitoring Area
- Street/Local Road
- + Railway
- Vegetation Management Act Watercourse
- Cadastral Boundary

**Habitat Mapping**

- Koala (*Phascolarctos cinereus*) - Vulnerable (EPBC Act and NC Act)

**Figure 8 : Koala habitat mapping**

Isaac Plains East Project EPBC Act Baseline Riparian Monitoring

Map Number: 18017\_08\_A  
 Date: 06 June 2018  
 Map Projection: GDA 1994 MGA Zone 55  
 Imagery: Digital Globe  
 Data: Roads, Watercourse, DCDB - (c)DNRM 2018

0 250 500 1,000 1,500  
Metres

N

## **Appendix A**

Breakdown of habitat quality scores  
for each fauna species in the riparian monitoring area

### Habitat quality scoring for Squatter Pigeon

Assessment Unit		1 (Squatter Pigeon)		
Habitat Quality Plot		5		
Area of assessment unit (ha)		7.9		
Regional Ecosystem	11.3.2	11.3.2		
BVG (1M)	17a	17a		
Ecological Condition Indicator	Benchmark	Field Value	% of Bench.	Score
1. Recruitment of woody perennial species (%)	100	100.0	1.0	5
2. Native plant species richness - Trees (No.)	2	3.0	1.5	5
3. Shrubs (No.)	2	8.0	4.0	5
4. Grasses (No.)	9	6.0	0.7	2.5
5. Forbs and Other (No.)	17	14.0	0.8	2.5
6. Tree canopy height (m)	18	18.4	1.0	5
7. Tree canopy cover (%)	40	12.5	0.3	2
8. Shrub canopy cover (%)	2	15.9	7.9	3
9. Native perennial grass cover (%)	35	13.8	0.4	1
10. Organic litter (%)	30	10.1	0.3	3
11. Large Euc. trees/ha (40cm dbh)	22	6.0	0.3	5
11. Large Non-Euc trees/ha (0cm dbh)	0	0.0	0.0	0
12. Coarse woody debris (m/ha)	307	325.0	1.1	5
13. Non-native plant cover (%)	0	69.0	69.0	0
<b>Site Condition Score</b>		<b>44</b>		
1. Size of patch (Fragmented)	n/a	20	-	2
2. Connectedness (Fragmented)	n/a	97	-	5
3. Context (Fragmented)	n/a	16	-	2
4. Distance from water (Intact)	n/a	n/a	-	0
5. Ecological Corridors	n/a	Within (whole or part)	-	6
<b>Site Context Score:</b>		<b>15</b>		

Assessment Unit		2 (Squatter Pigeon)																													
Habitat Quality Plot		1			2			3			4			6			7			8			9			10			11		
Assessment Unit Area (ha)		106.4																													
Regional Ecosystem	11.3.25	11.3.25			11.3.25			11.3.25			11.3.25			11.3.25			11.3.25			11.3.25			11.3.25			11.3.25					
BVG (1M)		16a			16a			16a			16a			16a			16a			16a			16a			16a					
Ecological Condition Indicator	Bench-mark	Field Value	% of Bench.	Score	Field Value	% of Bench.	Score	Field Value	% of Bench.	Score	Field Value	% of Bench.	Score	Field Value	% of Bench.	Score	Field Value	% of Bench.	Score	Field Value	% of Bench.	Score	Field Value	% of Bench.	Score	Field Value	% of Bench.	Score	Field Value	% of Bench.	Score
1. Recruitment of woody perennial species (%)	100	50.0	0.5	3	75.0	0.8	3	50.0	0.5	3	75.0	0.8	3	50.0	0.5	3	75.0	0.8	3	66.0	0.7	3	75.0	0.8	3	50.0	0.5	3	50.0	0.5	3
2. Native plant species richness - Trees (No.)	4	3.0	0.8	2.5	7.0	1.8	5	2.0	0.5	2.5	5.0	1.3	5	7.0	1.8	5	5.0	1.3	5	6.0	1.5	5	6.0	1.5	5	3.0	0.8	2.5	7.0	1.8	5
3. Shrubs (No.)	2	7.0	3.5	5	9.0	4.5	5	10.0	5.0	5	9.0	4.5	5	14.0	7.0	5	14.0	7.0	5	6.0	3.0	5	10.0	5.0	5	6.0	3.0	5	12.0	6.0	5
4. Grasses (No.)	8	4.0	0.5	2.5	2.0	0.3	2.5	1.0	0.1	0	2.0	0.3	2.5	9.0	1.1	5	6.0	0.8	2.5	4.0	0.5	2.5	3.0	0.4	2.5	1.0	0.1	0	4.0	0.5	2.5
5. Forbs and Other (No.)	12	26.0	2.2	5	17.0	1.4	5	7.0	0.6	2.5	11.0	0.9	5	13.0	1.1	5	21.0	1.8	5	17.0	1.4	5	14.0	1.2	5	17.0	1.4	5	12.0	1.0	5
6. Tree canopy height (m)	23	22.8	1.0	5	17.9	0.8	5	23.0	1.0	5	19.2	0.8	5	23.4	1.0	5	20.0	0.9	5	21.3	0.9	5	24.9	1.1	5	24.0	1.0	5	22.5	1.0	5
7. Tree canopy cover (%)	22	16.4	0.7	5	59.4	2.7	3	13.6	0.6	5	40.8	1.9	5	14.5	0.7	5	29.5	1.3	5	30.2	1.4	5	40.4	1.8	5	13.1	0.6	5	53.7	2.4	3
8. Shrub canopy cover (%)	1	38.0	38.0	3	45.7	45.7	3	18.7	18.7	3	17.7	17.7	3	10.0	10.0	3	16.5	16.5	3	31.3	31.3	3	23.0	23.0	3	2.4	2.4	3	30.1	30.1	3
9. Native perennial grass cover (%)	12	0.0	0.0	0	1.4	0.1	1	0.0	0.0	0	44.0	3.7	5	5.1	0.4	1	0.0	0.0	0	15.5	1.3	5	0.0	0.0	0	0.9	0.1	0	0.4	0.0	0
10. Organic litter (%)	15	26.4	1.8	5	41.9	2.8	3	32.6	2.2	3	36.1	2.4	3	23.6	1.6	5	49.3	3.3	3	24.6	1.6	5	38.6	2.6	3	4.9	0.3	3	36.1	2.4	3
11. Large Euc. trees/ha (49cm dbh)	14	3.0	0.2	5	6.0	0.4	5	2.0	0.1	5	4.0	0.3	5	7.0	0.5	5	3.0	0.2	5	5.0	0.4	5	10.0	0.7	10	1.0	0.1	5	11.0	0.8	10
11. Large Non-Euc trees/ha (29cm dbh)	7	19.0	2.7	15	4.0	0.6	10	41.0	5.9	15	4.0	0.6	10	13.0	1.9	15	13.0	1.9	15	14.0	2.0	15	15.0	2.1	15	42.0	6.0	15	10.0	1.4	15
12. Coarse woody debris (m/ha)	375	50.0	0.1	2	170.0	0.5	2	275.0	0.7	5	160.0	0.4	2	130.0	0.3	2	210.0	0.6	5	35.0	0.1	0	145.0	0.4	2	400.0	1.1	5	162.5	0.4	2
13. Non-native plant cover (%)	0	51.0	51.0	0	50.0	50.0	3	47.0	47.0	3	61.1	61.1	0	23.1	23.1	5	59.1	59.1	0	47.0	47.0	3	69.3	69.3	0	51.0	51.0	0	79.8	79.8	0
<b>Site Condition Score</b>		<b>58</b>			<b>55.5</b>			<b>57</b>			<b>58.5</b>			<b>69</b>			<b>61.5</b>			<b>66.5</b>			<b>63.5</b>			<b>56.5</b>			<b>61.5</b>		
1. Size of patch (Fragmented)	n/a	143	-	7	143	-	7	524	-	10	6	-	2	28	-	5	143	-	7	143	-	7	143	-	7	143	-	7	143	-	7
2. Connectedness (Fragmented)	n/a	20	-	2	20	-	2	4	-	0	0	-	0	1	-	0	20	-	2	20	-	2	20	-	2	20	-	2	20	-	2
3. Context (Fragmented)	n/a	11	-	2	11	-	2	32	-	4	25	-	2	4	-	0	11	-	2	11	-	2	11	-	2	11	-	2	11	-	2
4. Distance from water (Intact)	n/a	n/a	-	0	n/a	-	0	n/a	-	0	n/a	-	0	n/a	-	0	n/a	-	0	n/a	-	0	n/a	-	0	n/a	-	0	n/a	-	0
5. Ecological Corridors	n/a	With-in	-	6	With-in	-	6	With-in	-	6	With-in	-	6	Not within	-	0	Not within	-	0	With-in	-	6	With-in	-	6	With-in	-	6	With-in	-	6
<b>Site Context Score:</b>		<b>17</b>			<b>17</b>			<b>20</b>			<b>10</b>			<b>5</b>			<b>11</b>			<b>17</b>			<b>17</b>			<b>17</b>			<b>17</b>		

### Habitat quality scoring for Greater Glider

Assessment Unit		1 (Greater Glider)		
Habitat Quality Plot		5		
Area of assessment unit (ha)		7.9		
Regional Ecosystem	11.3.2	11.3.2		
BVG (1M)	17a	17a		
Ecological Condition Indicator	Benchmark	Field Value	% of Bench.	Score
1. Recruitment of woody perennial species (%)	100	100.0	1.0	5
2. Native plant species richness - Trees (No.)	2	3.0	1.5	5
3. Shrubs (No.)	2	8.0	4.0	5
4. Grasses (No.)	9	6.0	0.7	2.5
5. Forbs and Other (No.)	17	14.0	0.8	2.5
6. Tree canopy height (m)	18	18.4	1.0	5
7. Tree canopy cover (%)	40	12.5	0.3	2
8. Shrub canopy cover (%)	2	15.9	7.9	3
9. Native perennial grass cover (%)	35	13.8	0.4	1
10. Organic litter (%)	30	10.1	0.3	3
11. Large Euc. trees/ha (40cm dbh)	22	6.0	0.3	5
11. Large Non-Euc trees/ha (0cm dbh)	0	0.0	0.0	0
12. Coarse woody debris (m/ha)	307	325.0	1.1	5
13. Non-native plant cover (%)	0	69.0	69.0	0
<b>Site Condition Score</b>		<b>44</b>		
1. Size of patch (Fragmented)	n/a	20	-	2
2. Connectedness (Fragmented)	n/a	97	-	5
3. Context (Fragmented)	n/a	16	-	2
4. Distance from water (Intact)	n/a	n/a	-	0
5. Ecological Corridors	n/a	Within (whole or part)	-	6
<b>Site Context Score:</b>		<b>15</b>		



Assessment Unit		2 (Greater Glider)																													
Habitat Quality Plot		1			2			3			4			6			7			8			9			10			11		
Assessment Unit Area (ha)		106.4																													
Regional Ecosystem	11.3.25	11.3.25			11.3.25			11.3.25			11.3.25			11.3.25			11.3.25			11.3.25			11.3.25			11.3.25			11.3.25		
BVG (1M)		16a			16a			16a			16a			16a			16a			16a			16a			16a			16a		
Ecological Condition Indicator	Bench-mark	Field Value	% of Bench.	Score	Field Value	% of Bench.	Score	Field Value	% of Bench.	Score	Field Value	% of Bench.	Score	Field Value	% of Bench.	Score	Field Value	% of Bench.	Score	Field Value	% of Bench.	Score	Field Value	% of Bench.	Score	Field Value	% of Bench.	Score	Field Value	% of Bench.	Score
1. Recruitment of woody perennial species (%)	100	50.0	0.5	3	75.0	0.8	3	50.0	0.5	3	75.0	0.8	3	50.0	0.5	3	75.0	0.8	3	66.0	0.7	3	75.0	0.8	3	50.0	0.5	3	50.0	0.5	3
2. Native plant species richness - Trees (No.)	4	3.0	0.8	2.5	7.0	1.8	5	2.0	0.5	2.5	5.0	1.3	5	7.0	1.8	5	5.0	1.3	5	6.0	1.5	5	6.0	1.5	5	3.0	0.8	2.5	7.0	1.8	5
3. Shrubs (No.)	2	7.0	3.5	5	9.0	4.5	5	10.0	5.0	5	9.0	4.5	5	14.0	7.0	5	14.0	7.0	5	6.0	3.0	5	10.0	5.0	5	6.0	3.0	5	12.0	6.0	5
4. Grasses (No.)	8	4.0	0.5	2.5	2.0	0.3	2.5	1.0	0.1	0	2.0	0.3	2.5	9.0	1.1	5	6.0	0.8	2.5	4.0	0.5	2.5	3.0	0.4	2.5	1.0	0.1	0	4.0	0.5	2.5
5. Forbs and Other (No.)	12	26.0	2.2	5	17.0	1.4	5	7.0	0.6	2.5	11.0	0.9	5	13.0	1.1	5	21.0	1.8	5	17.0	1.4	5	14.0	1.2	5	17.0	1.4	5	12.0	1.0	5
6. Tree canopy height (m)	23	22.8	1.0	5	17.9	0.8	5	23.0	1.0	5	19.2	0.8	5	23.4	1.0	5	20.0	0.9	5	21.3	0.9	5	24.9	1.1	5	24.0	1.0	5	22.5	1.0	5
7. Tree canopy cover (%)	22	16.4	0.7	5	59.4	2.7	3	13.6	0.6	5	40.8	1.9	5	14.5	0.7	5	29.5	1.3	5	30.2	1.4	5	40.4	1.8	5	13.1	0.6	5	53.7	2.4	3
8. Shrub canopy cover (%)	1	38.0	38.0	3	45.7	45.7	3	18.7	18.7	3	17.7	17.7	3	10.0	10.0	3	16.5	16.5	3	31.3	31.3	3	23.0	23.0	3	2.4	2.4	3	30.1	30.1	3
9. Native perennial grass cover (%)	12	0.0	0.0	0	1.4	0.1	1	0.0	0.0	0	44.0	3.7	5	5.1	0.4	1	0.0	0.0	0	15.5	1.3	5	0.0	0.0	0	0.9	0.1	0	0.4	0.0	0
10. Organic litter (%)	15	26.4	1.8	5	41.9	2.8	3	32.6	2.2	3	36.1	2.4	3	23.6	1.6	5	49.3	3.3	3	24.6	1.6	5	38.6	2.6	3	4.9	0.3	3	36.1	2.4	3
11. Large Euc. trees/ha (49cm dbh)	14	3.0	0.2	5	6.0	0.4	5	2.0	0.1	5	4.0	0.3	5	7.0	0.5	5	3.0	0.2	5	5.0	0.4	5	10.0	0.7	10	1.0	0.1	5	11.0	0.8	10
11. Large Non-Euc trees/ha (29cm dbh)	7	19.0	2.7	15	4.0	0.6	10	41.0	5.9	15	4.0	0.6	10	13.0	1.9	15	13.0	1.9	15	14.0	2.0	15	15.0	2.1	15	42.0	6.0	15	10.0	1.4	15
12. Coarse woody debris (m/ha)	375	50.0	0.1	2	170.0	0.5	2	275.0	0.7	5	160.0	0.4	2	130.0	0.3	2	210.0	0.6	5	35.0	0.1	0	145.0	0.4	2	400.0	1.1	5	162.5	0.4	2
13. Non-native plant cover (%)	0	51.0	51.0	0	50.0	50.0	3	47.0	47.0	3	61.1	61.1	0	23.1	23.1	5	59.1	59.1	0	47.0	47.0	3	69.3	69.3	0	51.0	51.0	0	79.8	79.8	0
<b>Site Condition Score</b>		<b>58</b>			<b>55.5</b>			<b>57</b>			<b>58.5</b>			<b>69</b>			<b>61.5</b>			<b>66.5</b>			<b>63.5</b>			<b>56.5</b>			<b>61.5</b>		
1. Size of patch (Fragmented)	n/a	143	-	7	143	-	7	524	-	10	6	-	2	28	-	5	143	-	7	143	-	7	143	-	7	143	-	7	143	-	7
2. Connectedness (Fragmented)	n/a	20	-	2	20	-	2	4	-	0	0	-	0	1	-	0	20	-	2	20	-	2	20	-	2	20	-	2	20	-	2
3. Context (Fragmented)	n/a	11	-	2	11	-	2	32	-	4	25	-	2	4	-	0	11	-	2	11	-	2	11	-	2	11	-	2	11	-	2
4. Distance from water (Intact)	n/a	n/a	-	0	n/a	-	0	n/a	-	0	n/a	-	0	n/a	-	0	n/a	-	0	n/a	-	0	n/a	-	0	n/a	-	0	n/a	-	0
5. Ecological Corridors	n/a	With-in	-	6	With-in	-	6	With-in	-	6	With-in	-	6	Not within	-	0	Not within	-	0	With-in	-	6	With-in	-	6	With-in	-	6	With-in	-	6
<b>Site Context Score:</b>		<b>17</b>			<b>17</b>			<b>20</b>			<b>10</b>			<b>5</b>			<b>11</b>			<b>17</b>			<b>17</b>			<b>17</b>			<b>17</b>		

### Habitat quality scoring for Ornamental Snake

Assessment Unit		1 (Ornamental Snake)		
Habitat Quality Plot		5		
Area of assessment unit (ha)		7.9		
Regional Ecosystem	11.3.2	11.3.2		
BVG (1M)	17a	17a		
Ecological Condition Indicator	Benchmark	Field Value	% of Bench.	Score
1. Recruitment of woody perennial species (%)	100	100.0	1.0	5
2. Native plant species richness - Trees (No.)	2	3.0	1.5	5
3. Shrubs (No.)	2	8.0	4.0	5
4. Grasses (No.)	9	6.0	0.7	2.5
5. Forbs and Other (No.)	17	14.0	0.8	2.5
6. Tree canopy height (m)	18	18.4	1.0	5
7. Tree canopy cover (%)	40	12.5	0.3	2
8. Shrub canopy cover (%)	2	15.9	7.9	3
9. Native perennial grass cover (%)	35	13.8	0.4	1
10. Organic litter (%)	30	10.1	0.3	3
11. Large Euc. trees/ha (40cm dbh)	22	6.0	0.3	5
11. Large Non-Euc trees/ha (0cm dbh)	0	0.0	0.0	0
12. Coarse woody debris (m/ha)	307	325.0	1.1	5
13. Non-native plant cover (%)	0	69.0	69.0	0
<b>Site Condition Score</b>		<b>44</b>		
1. Size of patch (Fragmented)	n/a	20	-	2
2. Connectedness (Fragmented)	n/a	97	-	5
3. Context (Fragmented)	n/a	16	-	2
4. Distance from water (Intact)	n/a	n/a	-	0
5. Ecological Corridors	n/a	Within (whole or part)	-	6
<b>Site Context Score:</b>		<b>15</b>		

Assessment Unit		2 (Ornamental Snake)																																
Habitat Quality Plot		1			2			3			4			6			7			8			9			10			11					
Assessment Unit Area (ha)		106.4																																
Regional Ecosystem	11.3.25	11.3.25			11.3.25			11.3.25			11.3.25			11.3.25			11.3.25			11.3.25			11.3.25			11.3.25			11.3.25					
BVG (1M)	16a	16a			16a			16a			16a			16a			16a			16a			16a			16a			16a					
Ecological Condition Indicator	Bench-mark	Field Value	% of Bench.	Score	Field Value	% of Bench.	Score	Field Value	% of Bench.	Score	Field Value	% of Bench.	Score	Field Value	% of Bench.	Score	Field Value	% of Bench.	Score	Field Value	% of Bench.	Score	Field Value	% of Bench.	Score	Field Value	% of Bench.	Score	Field Value	% of Bench.	Score			
1. Recruitment of woody perennial species (%)	100	50.0	0.5	3	75.0	0.8	3	50.0	0.5	3	75.0	0.8	3	50.0	0.5	3	75.0	0.8	3	66.0	0.7	3	75.0	0.8	3	50.0	0.5	3	50.0	0.5	3			
2. Native plant species richness - Trees (No.)	4	3.0	0.8	2.5	7.0	1.8	5	2.0	0.5	2.5	5.0	1.3	5	7.0	1.8	5	5.0	1.3	5	6.0	1.5	5	6.0	1.5	5	3.0	0.8	2.5	7.0	1.8	5			
3. Shrubs (No.)	2	7.0	3.5	5	9.0	4.5	5	10.0	5.0	5	9.0	4.5	5	14.0	7.0	5	14.0	7.0	5	6.0	3.0	5	10.0	5.0	5	6.0	3.0	5	12.0	6.0	5			
4. Grasses (No.)	8	4.0	0.5	2.5	2.0	0.3	2.5	1.0	0.1	0	2.0	0.3	2.5	9.0	1.1	5	6.0	0.8	2.5	4.0	0.5	2.5	3.0	0.4	2.5	1.0	0.1	0	4.0	0.5	2.5			
5. Forbs and Other (No.)	12	26.0	2.2	5	17.0	1.4	5	7.0	0.6	2.5	11.0	0.9	5	13.0	1.1	5	21.0	1.8	5	17.0	1.4	5	14.0	1.2	5	17.0	1.4	5	12.0	1.0	5			
6. Tree canopy height (m)	23	22.8	1.0	5	17.9	0.8	5	23.0	1.0	5	19.2	0.8	5	23.4	1.0	5	20.0	0.9	5	21.3	0.9	5	24.9	1.1	5	24.0	1.0	5	22.5	1.0	5			
7. Tree canopy cover (%)	22	16.4	0.7	5	59.4	2.7	3	13.6	0.6	5	40.8	1.9	5	14.5	0.7	5	29.5	1.3	5	30.2	1.4	5	40.4	1.8	5	13.1	0.6	5	53.7	2.4	3			
8. Shrub canopy cover (%)	1	38.0	38.0	3	45.7	45.7	3	18.7	18.7	3	17.7	17.7	3	10.0	10.0	3	16.5	16.5	3	31.3	31.3	3	23.0	23.0	3	2.4	2.4	3	30.1	30.1	3			
9. Native perennial grass cover (%)	12	0.0	0.0	0	1.4	0.1	1	0.0	0.0	0	44.0	3.7	5	5.1	0.4	1	0.0	0.0	0	15.5	1.3	5	0.0	0.0	0	0.9	0.1	0	0.4	0.0	0			
10. Organic litter (%)	15	26.4	1.8	5	41.9	2.8	3	32.6	2.2	3	36.1	2.4	3	23.6	1.6	5	49.3	3.3	3	24.6	1.6	5	38.6	2.6	3	4.9	0.3	3	36.1	2.4	3			
11. Large Euc. trees/ha (49cm dbh)	14	3.0	0.2	5	6.0	0.4	5	2.0	0.1	5	4.0	0.3	5	7.0	0.5	5	3.0	0.2	5	5.0	0.4	5	10.0	0.7	10	1.0	0.1	5	11.0	0.8	10			
11. Large Non-Euc trees/ha (29cm dbh)	7	19.0	2.7	15	4.0	0.6	10	41.0	5.9	15	4.0	0.6	10	13.0	1.9	15	13.0	1.9	15	14.0	2.0	15	15.0	2.1	15	42.0	6.0	15	10.0	1.4	15			
12. Coarse woody debris (m/ha)	375	50.0	0.1	2	170.0	0.5	2	275.0	0.7	5	160.0	0.4	2	130.0	0.3	2	210.0	0.6	5	35.0	0.1	0	145.0	0.4	2	400.0	1.1	5	162.5	0.4	2			
13. Non-native plant cover (%)	0	51.0	51.0	0	50.0	50.0	3	47.0	47.0	3	61.1	61.1	0	23.1	23.1	5	59.1	59.1	0	47.0	47.0	3	69.3	69.3	0	51.0	51.0	0	79.8	79.8	0			
<b>Site Condition Score</b>		<b>58</b>			<b>55.5</b>			<b>57</b>			<b>58.5</b>			<b>69</b>			<b>61.5</b>			<b>66.5</b>			<b>63.5</b>			<b>56.5</b>			<b>61.5</b>					
1. Size of patch (Fragmented)	n/a	143	-	7	143	-	7	524	-	10	6	-	2	28	-	5	143	-	7	143	-	7	143	-	7	143	-	7	143	-	7			
2. Connectedness (Fragmented)	n/a	20	-	2	20	-	2	4	-	0	0	-	0	1	-	0	20	-	2	20	-	2	20	-	2	20	-	2	20	-	2			
3. Context (Fragmented)	n/a	11	-	2	11	-	2	32	-	4	25	-	2	4	-	0	11	-	2	11	-	2	11	-	2	11	-	2	11	-	2			
4. Distance from water (Intact)	n/a	n/a	-	0	n/a	-	0	n/a	-	0	n/a	-	0	n/a	-	0	n/a	-	0	n/a	-	0	n/a	-	0	n/a	-	0	n/a	-	0			
5. Ecological Corridors	n/a	With-in	-	6	With-in	-	6	With-in	-	6	With-in	-	6	Not within	-	0	Not within	-	0	With-in	-	6	With-in	-	6	With-in	-	6	With-in	-	6	With-in (whole or part)	-	6
<b>Site Context Score:</b>		<b>17</b>			<b>17</b>			<b>20</b>			<b>10</b>			<b>5</b>			<b>11</b>			<b>17</b>			<b>17</b>			<b>17</b>			<b>17</b>					

### Habitat quality scoring for Koala

Assessment Unit		1 (Koala)		
Habitat Quality Plot		5		
Area of assessment unit (ha)		7.9		
Regional Ecosystem	11.3.2	11.3.2		
BVG (1M)	17a	17a		
Ecological Condition Indicator	Benchmark	Field Value	% of Bench.	Score
1. Recruitment of woody perennial species (%)	100	100.0	1.0	5
2. Native plant species richness - Trees (No.)	2	3.0	1.5	5
3. Shrubs (No.)	2	8.0	4.0	5
4. Grasses (No.)	9	6.0	0.7	2.5
5. Forbs and Other (No.)	17	14.0	0.8	2.5
6. Tree canopy height (m)	18	18.4	1.0	5
7. Tree canopy cover (%)	40	12.5	0.3	2
8. Shrub canopy cover (%)	2	15.9	7.9	3
9. Native perennial grass cover (%)	35	13.8	0.4	1
10. Organic litter (%)	30	10.1	0.3	3
11. Large Euc. trees/ha (40cm dbh)	22	6.0	0.3	5
11. Large Non-Euc trees/ha (0cm dbh)	0	0.0	0.0	0
12. Coarse woody debris (m/ha)	307	325.0	1.1	5
13. Non-native plant cover (%)	0	69.0	69.0	0
<b>Site Condition Score</b>		<b>44</b>		
1. Size of patch (Fragmented)	n/a	20	-	2
2. Connectedness (Fragmented)	n/a	97	-	5
3. Context (Fragmented)	n/a	16	-	2
4. Distance from water (Intact)	n/a	n/a	-	0
5. Ecological Corridors	n/a	Within (whole or part)	-	6
<b>Site Context Score:</b>		<b>15</b>		

Assessment Unit		2 (Koala)																													
Habitat Quality Plot		1			2			3			4			6			7			8			9			10			11		
Assessment Unit Area (ha)		106.4																													
Regional Ecosystem	11.3.25	11.3.25			11.3.25			11.3.25			11.3.25			11.3.25			11.3.25			11.3.25			11.3.25			11.3.25					
BVG (1M)	16a	16a			16a			16a			16a			16a			16a			16a			16a			16a					
Ecological Condition Indicator	Bench-mark	Field Value	% of Bench.	Score	Field Value	% of Bench.	Score	Field Value	% of Bench.	Score	Field Value	% of Bench.	Score	Field Value	% of Bench.	Score	Field Value	% of Bench.	Score	Field Value	% of Bench.	Score	Field Value	% of Bench.	Score	Field Value	% of Bench.	Score			
1. Recruitment of woody perennial species (%)	100	50.0	0.5	3	75.0	0.8	3	50.0	0.5	3	75.0	0.8	3	50.0	0.5	3	75.0	0.8	3	66.0	0.7	3	75.0	0.8	3	50.0	0.5	3	50.0	0.5	3
2. Native plant species richness - Trees (No.)	4	3.0	0.8	2.5	7.0	1.8	5	2.0	0.5	2.5	5.0	1.3	5	7.0	1.8	5	5.0	1.3	5	6.0	1.5	5	6.0	1.5	5	3.0	0.8	2.5	7.0	1.8	5
3. Shrubs (No.)	2	7.0	3.5	5	9.0	4.5	5	10.0	5.0	5	9.0	4.5	5	14.0	7.0	5	14.0	7.0	5	6.0	3.0	5	10.0	5.0	5	6.0	3.0	5	12.0	6.0	5
4. Grasses (No.)	8	4.0	0.5	2.5	2.0	0.3	2.5	1.0	0.1	0	2.0	0.3	2.5	9.0	1.1	5	6.0	0.8	2.5	4.0	0.5	2.5	3.0	0.4	2.5	1.0	0.1	0	4.0	0.5	2.5
5. Forbs and Other (No.)	12	26.0	2.2	5	17.0	1.4	5	7.0	0.6	2.5	11.0	0.9	5	13.0	1.1	5	21.0	1.8	5	17.0	1.4	5	14.0	1.2	5	17.0	1.4	5	12.0	1.0	5
6. Tree canopy height (m)	23	22.8	1.0	5	17.9	0.8	5	23.0	1.0	5	19.2	0.8	5	23.4	1.0	5	20.0	0.9	5	21.3	0.9	5	24.9	1.1	5	24.0	1.0	5	22.5	1.0	5
7. Tree canopy cover (%)	22	16.4	0.7	5	59.4	2.7	3	13.6	0.6	5	40.8	1.9	5	14.5	0.7	5	29.5	1.3	5	30.2	1.4	5	40.4	1.8	5	13.1	0.6	5	53.7	2.4	3
8. Shrub canopy cover (%)	1	38.0	38.0	3	45.7	45.7	3	18.7	18.7	3	17.7	17.7	3	10.0	10.0	3	16.5	16.5	3	31.3	31.3	3	23.0	23.0	3	2.4	2.4	3	30.1	30.1	3
9. Native perennial grass cover (%)	12	0.0	0.0	0	1.4	0.1	1	0.0	0.0	0	44.0	3.7	5	5.1	0.4	1	0.0	0.0	0	15.5	1.3	5	0.0	0.0	0	0.9	0.1	0	0.4	0.0	0
10. Organic litter (%)	15	26.4	1.8	5	41.9	2.8	3	32.6	2.2	3	36.1	2.4	3	23.6	1.6	5	49.3	3.3	3	24.6	1.6	5	38.6	2.6	3	4.9	0.3	3	36.1	2.4	3
11. Large Euc. trees/ha (49cm dbh)	14	3.0	0.2	5	6.0	0.4	5	2.0	0.1	5	4.0	0.3	5	7.0	0.5	5	3.0	0.2	5	5.0	0.4	5	10.0	0.7	10	1.0	0.1	5	11.0	0.8	10
11. Large Non-Euc trees/ha (29cm dbh)	7	19.0	2.7	15	4.0	0.6	10	41.0	5.9	15	4.0	0.6	10	13.0	1.9	15	13.0	1.9	15	14.0	2.0	15	15.0	2.1	15	42.0	6.0	15	10.0	1.4	15
12. Coarse woody debris (m/ha)	375	50.0	0.1	2	170.0	0.5	2	275.0	0.7	5	160.0	0.4	2	130.0	0.3	2	210.0	0.6	5	35.0	0.1	0	145.0	0.4	2	400.0	1.1	5	162.5	0.4	2
13. Non-native plant cover (%)	0	51.0	51.0	0	50.0	50.0	3	47.0	47.0	3	61.1	61.1	0	23.1	23.1	5	59.1	59.1	0	47.0	47.0	3	69.3	69.3	0	51.0	51.0	0	79.8	79.8	0
<b>Site Condition Score</b>		<b>58</b>			<b>55.5</b>			<b>57</b>			<b>58.5</b>			<b>69</b>			<b>61.5</b>			<b>66.5</b>			<b>63.5</b>			<b>56.5</b>			<b>61.5</b>		
1. Size of patch (Fragmented)	n/a	143	-	7	143	-	7	524	-	10	6	-	2	28	-	5	143	-	7	143	-	7	143	-	7	143	-	7	143	-	7
2. Connectedness (Fragmented)	n/a	20	-	2	20	-	2	4	-	0	0	-	0	1	-	0	20	-	2	20	-	2	20	-	2	20	-	2	20	-	2
3. Context (Fragmented)	n/a	11	-	2	11	-	2	32	-	4	25	-	2	4	-	0	11	-	2	11	-	2	11	-	2	11	-	2	11	-	2
4. Distance from water (Intact)	n/a	n/a	-	0	n/a	-	0	n/a	-	0	n/a	-	0	n/a	-	0	n/a	-	0	n/a	-	0	n/a	-	0	n/a	-	0	n/a	-	0
5. Ecological Corridors	n/a	With-in	-	6	With-in	-	6	With-in	-	6	With-in	-	6	Not within	-	0	Not within	-	0	With-in	-	6	With-in	-	6	With-in	-	6	With-in	-	6
<b>Site Context Score:</b>		<b>17</b>			<b>17</b>			<b>20</b>			<b>10</b>			<b>5</b>			<b>11</b>			<b>17</b>			<b>17</b>			<b>17</b>					

## **Appendix B**

Photo monitoring points in the riparian monitoring area

## Habitat quality plot 1



Plate B-01: HQP 1, 0 m - looking along plot



Plate B-02: HQP 1, 100 m - looking along plot



Plate B-03: HQP 1, 50 m - looking north



Plate B-04: HQP 1, 50 m - looking east



Plate B-05: HQP 1, 50 m - looking south



Plate B-06: HQP 1, 50 m - looking west



Plate B-07: HQP 1, 50 m - ground cover

## Habitat quality plot 2



Plate B-08: HQP 2, 0 m - looking along plot



Plate B-09: HQP 2, 100 m - looking along plot



Plate B-10: HQP 2, 50 m - looking north



Plate B-11: HQP 2, 50 m - looking east



Plate B-12: HQP 2, 50 m - looking south



Plate B-13: HQP 2, 50 m - looking west



Plate B-14: HQP 2, 50 m - ground cover



### Habitat quality plot 3



Plate B-15: HQP 3, 0 m - looking along plot



Plate B-16: HQP 3, 100 m - looking along plot



Plate B-17: HQP 3, 50 m - looking north



Plate B-18: HQP 3, 50 m - looking east



Plate B-19: HQP 3, 50 m - looking south



Plate B-20: HQP 3, 50 m - looking west



Plate B-21: HQP 3, 50 m - ground cover

## Habitat quality plot 4



Plate B-22: HQP 4, 0 m - looking along plot



Plate B-23: HQP 4, 100 m - looking along plot



Plate B-24: HQP 4, 50 m - looking north



Plate B-25: HQP 4, 50 m - looking east



Plate B-26: HQP 4, 50 m - looking south



Plate B-37: HQP 4, 50 m - looking west



Plate B-28: HQP 4, 50 m - ground cover

## Habitat quality plot 5



Plate B-29: HQP 5, 0 m - looking along plot



Plate B-30: HQP 5, 100 m - looking along plot



Plate B-31: HQP 5, 50 m - looking north



Plate B-32: HQP 5, 50 m - looking east



Plate B-33: HQP 5, 50 m - looking south



Plate B-34: HQP 5, 50 m - looking west



Plate B-35: HQP 5, 50 m – soils

## Habitat quality plot 6



Plate B-36: HQP 6, 0 m - looking along plot



Plate B-37: HQP 6, 100 m - looking along plot



Plate B-38: HQP 6, 50 m - looking north



Plate B-39: HQP 6, 50 m - looking east



Plate B-40: HQP 6, 50 m - looking south



Plate B-41: HQP 6, 50 m - looking west



Plate B-42: HQP 6, 50 m - ground cover

## Habitat quality plot 7



Plate B-43: HQP 7, 0 m - looking along plot



Plate B-44: HQP 7, 100 m - looking along plot



Plate B-45: HQP 7, 50 m - looking north



Plate B-46: HQP 7, 50 m - looking east



Plate B-47: HQP 7, 50 m - looking south



Plate B-48: HQP 7, 50 m - looking west



Plate B-49: HQP 7, 50 m - ground cover

### Habitat quality plot 8



Plate B-50: HQP 8, 0 m - looking along plot



Plate B-51: HQP 8, 100 m - looking along plot



Plate B-52: HQP 8, 50 m - looking north



Plate B-53: HQP 8, 50 m - looking east



Plate B-54: HQP 8, 50 m - looking south



Plate B-55: HQP 8, 50 m - looking west



Plate B-56: HQP 8, 50 m - ground cover

## Habitat quality plot 9



Plate B-57: HQP 9, 0 m - looking along plot



Plate B-58: HQP 9, 100 m - looking along plot



Plate B-59: HQP 9, 50 m - looking north



Plate B-60: HQP 9, 50 m - looking east



Plate B-61: HQP 9, 50 m - looking south



Plate B-62: HQP 9, 50 m - looking west



Plate B-63: HQP 9, 50 m - ground cover

## Habitat quality plot 10



Plate B-64: HQP 10, 0 m - looking along plot



Plate B-65: HQP 10, 100 m - looking along plot



Plate B-66: HQP 10, 50 m - looking north



Plate B-67: HQP 10, 50 m - looking east



Plate B-68: HQP 10, 50 m - looking south



Plate B-69: HQP 10, 50 m - looking west



Plate B-70: HQP 10, 50 m - ground cover



## Habitat quality plot 11



Plate B-71: HQP 11, 0 m - looking along plot



Plate B-72: HQP 11, 100 m - looking along plot



Plate B-73: HQP 11, 50 m - looking north



Plate B-74: HQP 11, 50 m - looking east



Plate B-75: HQP 11, 50 m - looking south



Plate B-76: HQP 11, 50 m - looking west



Plate B-77: HQP 11, 50 m - ground cover