FA EPBC Report – Coal Mine

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Appendix FA EPBC Report (Mine)

FA.1 Executive Summary

FA.1.1 Overview

Hancock Prospecting Pty Ltd (HPPL) (the Proponent) is proposing to develop the Alpha Coal Project (the Project), a 30 million tonnes per annum (Mtpa) product open-cut thermal coal mine to target the seams in the Upper Permian coal measures of the Galilee Basin, Queensland, Australia. The Project will be supported by the development of a standard gauge, single track, non-electrified, 495 kilometre (km) long railway line for the purposes of transporting processed coal from the Alpha coal mine to the Port of Abbot Point in Bowen for export. An Environmental Impact Statement (EIS) for the Alpha Coal Project (Issue 3, November 2010) (HPPL, 2010) was prepared and made available for public comment and review from 5 November 2010 to 20 December 2010. In response to submissions received and changes to the Project Description a Supplementary EIS (SEIS) report has been prepared.

This Environmental Protection and Biodiversity Conservation *(*EPBC) report is an update of the report presented as part of the EIS and captures changes that have arisen through the SEIS process including discussions with the Department of Sustainability, Environment, Water, People and Communities (SEWPaC) and to fulfil the Terms of Reference (TOR) for the Project. This report discusses the Matters of National Environmental Significance (MNES) that relate to the Alpha Coal Project EIS (Mine) and are listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The TOR describes the Project as the mine, rail and port facilities, plus supply water and power supply utilities. The Alpha Coal EIS addresses only the mine and rail components as the remaining aspects are subject to separate environmental approvals and are not included. Furthermore, the port environmental process is being managed by North Queensland Bulk Ports Corporation and, as such, the EPBC referral submitted by Hancock in November 2008 has not been included as part of the EIS or this report. Following discussions with SEWPaC it was agreed to present the EPBC related information for the mine and the rail components of the Project in two separate reports. This report relates to the mine component of the Project only.

To describe the existing environmental values of the mine area in terms of the presence of EPBC-listed species, a combination of desktop assessments and seasonal field surveys were conducted. The desktop assessment comprised a review of relevant literature and database searches. Flora and fauna surveys were conducted to obtain ecological information relevant to the Project and to ground-truth results from desktop assessments. The result was a list of EPBC-listed species that may occur on the Project site.

The presence/absence data obtained from these assessments was then utilised in a mapping study which applied DERM data to describe the potential habitat available to the EPBC-listed species that may occur in the Project study area. This habitat was overlaid with potential direct and indirect impact footprints and the area of potential habitat potentially impacted was calculated, provided and discussed. The significance of these impacts was then assessed in relation to the amount of available habitat in the region of the Project in conjunction with the mitigation measures and management strategies proposed for the Project.

*FA.1.1.1*EPBC Values

Database searches indicated the potential presence of 1 flora species of conservation significance listed under the EPBC Act. This species was considered to have a low likelihood of being present within the Alpha Coal Project (Mine) site (the Project area). No EPBC Act listed threatened ecological communities (TECs) were identified from the combined desktop and field assessments.

Review of database searches indicated the potential presence of 10 fauna species of conservation significance listed under the EPBC Act. Of these, 5 were considered to have a moderate likelihood of being present within the project site and 4, a low likelihood of presence. The remaining 1 EPBC Act listed threatened fauna species was recorded from the field surveys of the project site, the southern squatter pigeon (*Geophaps scripta scripta*). This species is listed as Vulnerable under the EPBC Act. A total of 36 Migratory species listed under the EPBC Act were identified during the combined desktop and field survey effort.

*FA.1.1.2*Management and Mitigation Measures

Proposed avoidance and mitigation measures to reduce the Project direct and indirect impact to MNES are presented (or referenced) in this report. Based on a quantitative analysis of overlaid 'high value potential habitat' for the 11 threatened species likely to occur in the Project study area, the total direct impact to 'high value potential habitat' is 10,201 ha (1.52% of habitat extent in the landscape) and the total indirect impact to 'high value potential habitat' is 2,896 ha (<0.01% of habitat extent in the regional landscape). This impact, when compared to habitat availability in the regional landscape, and in combination with the proposed management and mitigation measures, is not likely to significantly impact MNES.

The conservative approach used in the modelling process to assist with quantification of potential impacts has allowed for an assessment of the significance of impacts to MNES to be undertaken. Where unavoidable impacts cannot be mitigated (i.e. vegetation clearing and associated loss of habitat) an Offsets Strategy for the Alpha Coal Project will be developed in consultation with the Queensland Department of Environment and Resource Management (DERM), Queensland Department of Employment, Economic Development and Innovation (DEEDI) and SEWPAC, giving consideration to relevant state and Commonwealth policies relating to offsets. This package will include planned ongoing studies to further refine and review the habitat mapping, including additional model validation as well as assessment of additional site specific information. This is detailed within Volume 2 (Appendix X) of this SEIS for the preliminary Offsets Strategy.

The implementation of monitoring and reporting requirements will further allow impacts to fauna, flora and vegetation communities to be minimised, or that improvements to procedures and processes can be implemented to further minimise impacts. This process will result in the reduction of potential impacts from the Alpha Coal Project on MNES.

FA.2 Introduction

Following Proponent discussions with SEWPaC it was agreed to present the EPBC related information for the mine and the rail components of the Project in two separate reports. This report relates to the mine component of the Alpha Coal Project only and from here forth in the report will be referred to here forth as “the Report”.

FA.2.1 Project Overview

The Proponent, through its wholly owned subsidiary company, Hancock Coal Pty Ltd (HCPL) is proposing to develop the Alpha Coal Project (Mine) (the Project), a 30 million tonne per annum (Mtpa) product open-cut thermal coal mine to target the seams in the Upper Permian coal measures of the Galilee Basin, Queensland, Australia. The coal mine will be supported by privately owned and operated rail and port infrastructure facilities. At the Project site the coal will be mined, washed and conveyed to a train load-out facility where it will be transported approximately 495 kilometres (km) to the east coast of Australia to the port facility of Abbot Point for export.

An Environmental Impact Statement (EIS) for the Alpha Coal Project (Issue 3, November 2010) (HPPL, 2010) was prepared and made available for public comment and review from 5 November 2010 to 20 December 2010. In response to submissions received and changes to the Project Description a Supplementary EIS (SEIS) report has been prepared. This report has been prepared and updated accordingly to capture changes that have arisen through the SEIS process, i.e. changes attributed to the Project Description amendments, additional studies conducted and submission responses.

The SEIS fulfils the Terms of Reference (TOR) for the Project per the EPBC Referral submitted in 2008 for Alpha Coal Project Mine and Rail Development (EPBC 2008/4648), and discusses the MNES that relate to the Alpha Coal Project EIS and are listed under the EPBC Act.

The TOR describes the Project as the mine, rail and port facilities, plus supply water and power supply utilities. The Alpha Coal EIS addresses only the mine and rail components as the remaining aspects are subject to separate environmental approvals.

FA.2.1.1 Coal Mine and Associated Infrastructure

The coal mine will be a new open-cut thermal coal mine. The mine is located within Mining Lease Application (MLA) 70426. The open-cut coal mine is proposed to produce 30 million tonnes per annum (Mtpa) of thermal coal for the export market. The scheduled life of mine (LOM) is 30 years with sufficient Joint Ore Reserves Committee (JORC) compliant resources to potentially extend the Project life beyond 30 years.

The Project consists of six open-cut pits (totalling approximately 24 km in total strike length) in a north to south direction along the centre of MLA 70426. The overburden will be removed by truck and shovel, in-pit crushing and conveying, excavators and dragline operations. The overburden will be initially stockpiled in out-of-pit spoil emplacement areas and then used to backfill the open-cut pits. The coal will be mined by excavators and transported by truck operations. Raw coal will pass through one of two run-of-mine (ROM) facilities where it will be reduced in size for further processing at the coal handling and processing plant (CHPP).

Sized raw coal will be transferred from the ROM facilities via conveyors to the multi-module CPP, where it will be washed. All of the coal resource mined will be processed to produce a 9.5% ash export thermal product. A tailings dam, known as a tailings storage facility (TSF), is required for the fine rejects (also known as tailings). The coarse rejects from the CHPP will be placed in designated locations within the open-cut pit spoil dumps.

The mine infrastructure will include:

- Main workshop, warehouse, administration buildings, training and emergency services building, tyre bay, light vehicle workshop, and bucket repair shop;
- Train load out (TLO) facility and rail loop;
- Raw water dams and environment dams;
- Construction and main accommodation villages;
- Mine access road;
- Landfill;
- Quarry/borrow pits;
- Fuel, oil, and explosives storage facilities;
- Creek diversions, drainage channels and levee bunds;
- Water and wastewater systems;
- Water treatment plant and sewerage treatment plant;
- Electrical systems; and
- Communication systems.

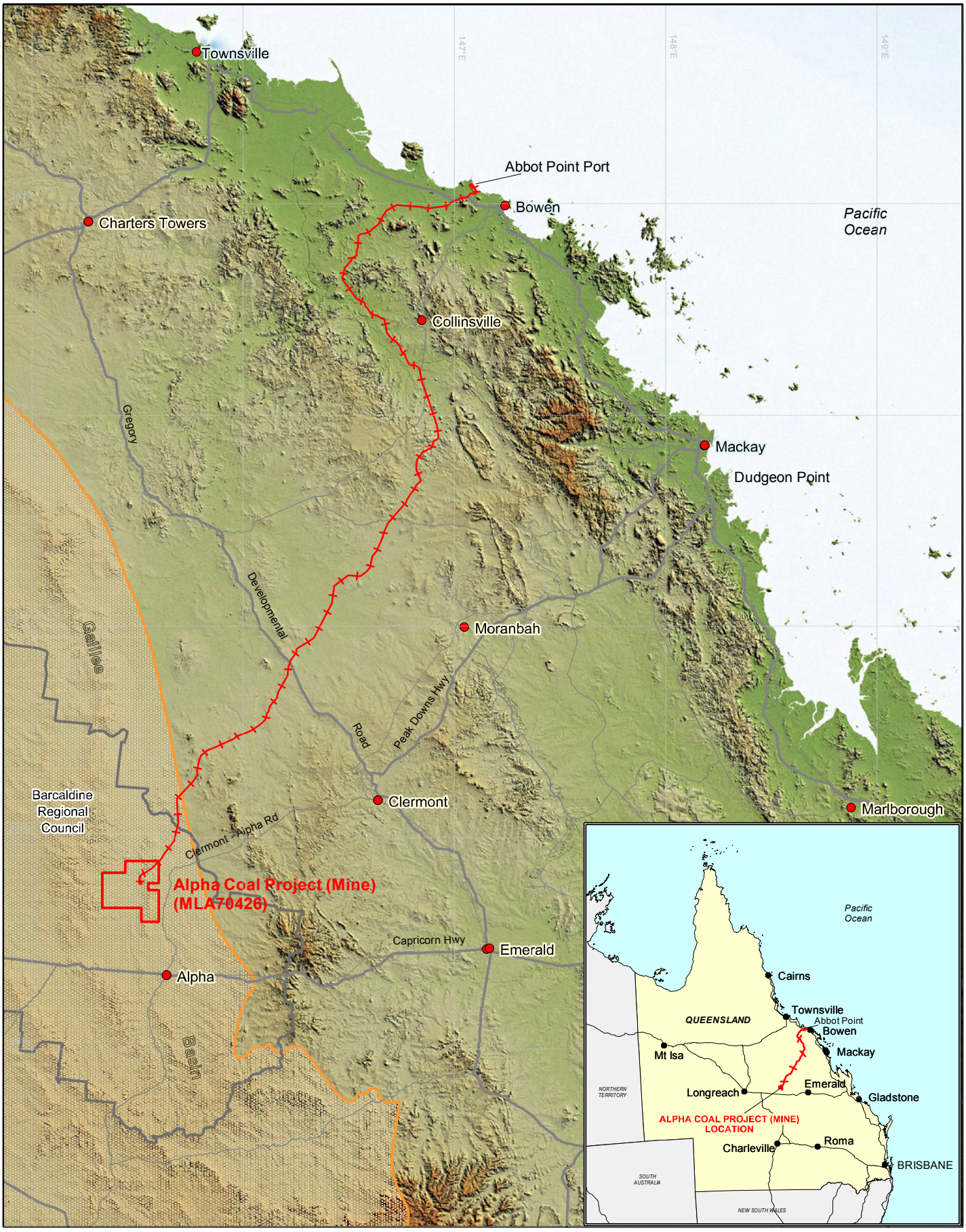
Figure FA-1 illustrates the location of all the above key components of the Project including the six open-cut pits, referred to as Pits 1-6. Mining will commence at the eastern side of each pit and proceed in a westerly direction. Mining operations will commence in each pit as soon as practicable following receipt of the Mining Lease and ramp up to full production at the earliest opportunity. This will result in simultaneous mining operations in all six open-cut pits along a north-south mining strike length of approximately 24 km.

FA.2.1.2 Location

The location of the mine was selected primarily on the basis of the existence of an economical coal reserve, however environmental, community and geotechnical factors were also considered in determining the method and extent of extraction.

The Project is located in the Galilee Basin, Queensland, Australia. The Project is 130 km south-west of Clermont and approximately 360 km south-west of Mackay. The nearest residential area to the Project is the township of Alpha, located approximately 50 km south of the Project. Access to the mining lease is from Degulla Road north of the Capricorn Highway at Alpha.

Refer to Figure FA-1 for the Regional Project Location.



Mining Lease Application (MLA70426) Boundary

Barcaldine Regional Council Boundary

Alpha Coal Project Railway Corridor

Source: See Copyright Details below and for full disclosure Please Refer to the SEIS ***Volume 2, Appendix B***

0 25 50km

Scale 1:2 000 000 (A4)

Datum: GDA94, MGA Zone55

N W E S

HANCOCK PROSPECTING PTY LTD

Alpha Coal Project
Supplementary Environmental Impact Statement

REGIONAL PROJECT LOCATION

Job Number	4262 6680
Revision	A
Date	25-03-2011

Figure: FA.1

File No: 42626680-g-2028.wor

FA.2.1.3 Construction

Construction stage activities will occur once the Mining Lease (ML) has been granted. The construction period is approximately 24 months. Within this time frame the following activities are proposed:

- Mine operational equipment will be delivered, constructed and commissioned;
- Mine infrastructure will be constructed such as site administration buildings, workshops, water management infrastructure, roads, accommodation, hardstands, draglines, electrical and communication systems, etc; and
- The initial modules of the CHPP will be constructed and commissioned.

Coal mining activities are detailed in Volume 2, Section 2.4.1 of the Alpha Coal Project EIS. Any changes to the Project description are presented in Volume 2, Appendix C of the Alpha Coal Project SEIS.

Throughout the LOM, infrastructure construction, maintenance, demobilisation or decommissioning activities will be undertaken. As mining advances, infrastructure such as internal roads and additional water management infrastructure will be constructed, relocated or upgraded as required in order to fulfil operational requirements.

The construction stage has three components:

- Site preparation;
- Civil works; and
- Mine infrastructure areas and CHPP construction.

Construction stage activities will occur during daylight hours, seven days a week. Some activities may require to be conducted over a continuous 24 hr period; these may include but are not limited to:

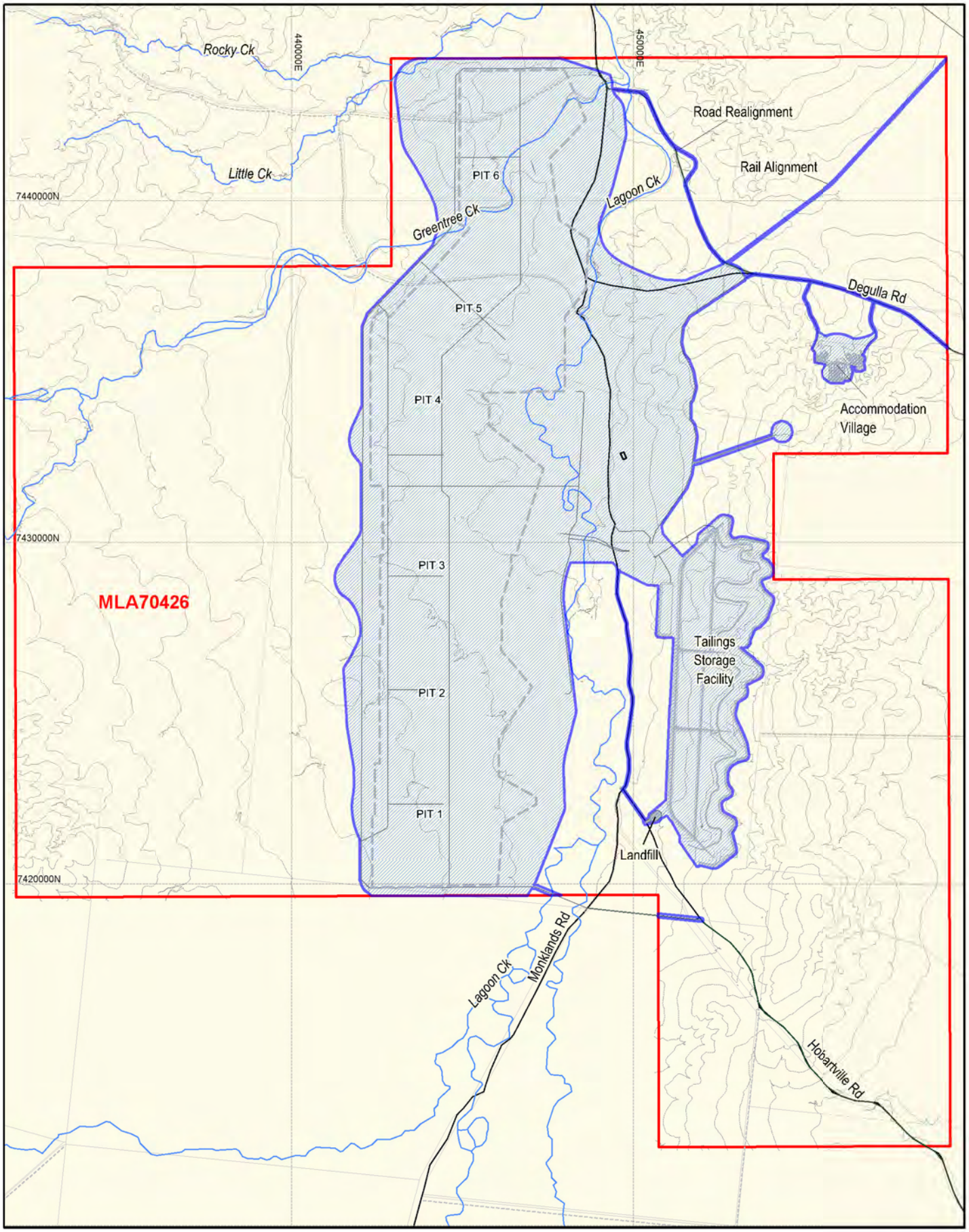
- Deliveries of materials, plant and equipment;
- Concrete batching and pouring;
- Electrical installation;
- Building fit-out; and
- Plant and equipment commissioning.

Due to the close vicinity to Lagoon Creek all critical infrastructure are to be located at least 0.5 m above the predicted 1 in 3,000 year flood inundation level. This is in excess of the general requirement for immunity from the Q100 flood inundation level.

*FA.2.1.4*Site Clearance

Site clearance will include vegetation clearing, topsoil stripping and stockpiling, bulk earthworks and temporary drainage and water runoff management works. Site clearance will be staged to minimise the time of exposure of disturbed areas and degradation of topsoil. Plant and equipment involved in site clearance activities will include, but not be limited to excavators, dozers, scrapers, graders, and water carts. All site vehicles and equipment will be properly serviced and maintained.

Refer to Figure FA-2 for the Project Disturbance Area.



Contour (10m interval)
Pit Outline
Mining Lease Application (MLA70426) Boundary
Project Disturbance Area

Source: See Copyright Details below and for full disclosure Please Refer to the SEIS ***Volume 2, Appendix B***

0 2 4Km
Scale 1:150,000 (A4)
Datum: GDA94, MGA Zone55

N W E S

HANCOCK PROSPECTING PTY LTD
Alpha Coal Project
Supplementary Environmental Impact Statement

ALPHA COAL PROJECT (MINE) DISTURBANCE AREA

Job Number | 4262 6680
Revision | A
Date | 25-03-2011

Figure: FA.2

File No: 42626680-g-2027.wor

FA.2.1.5 Project Operations

Following construction, operational activities will be ramped-up over five years reaching full production of approximately 42 Mtpa of ROM coal or 30 Mtpa of product coal.

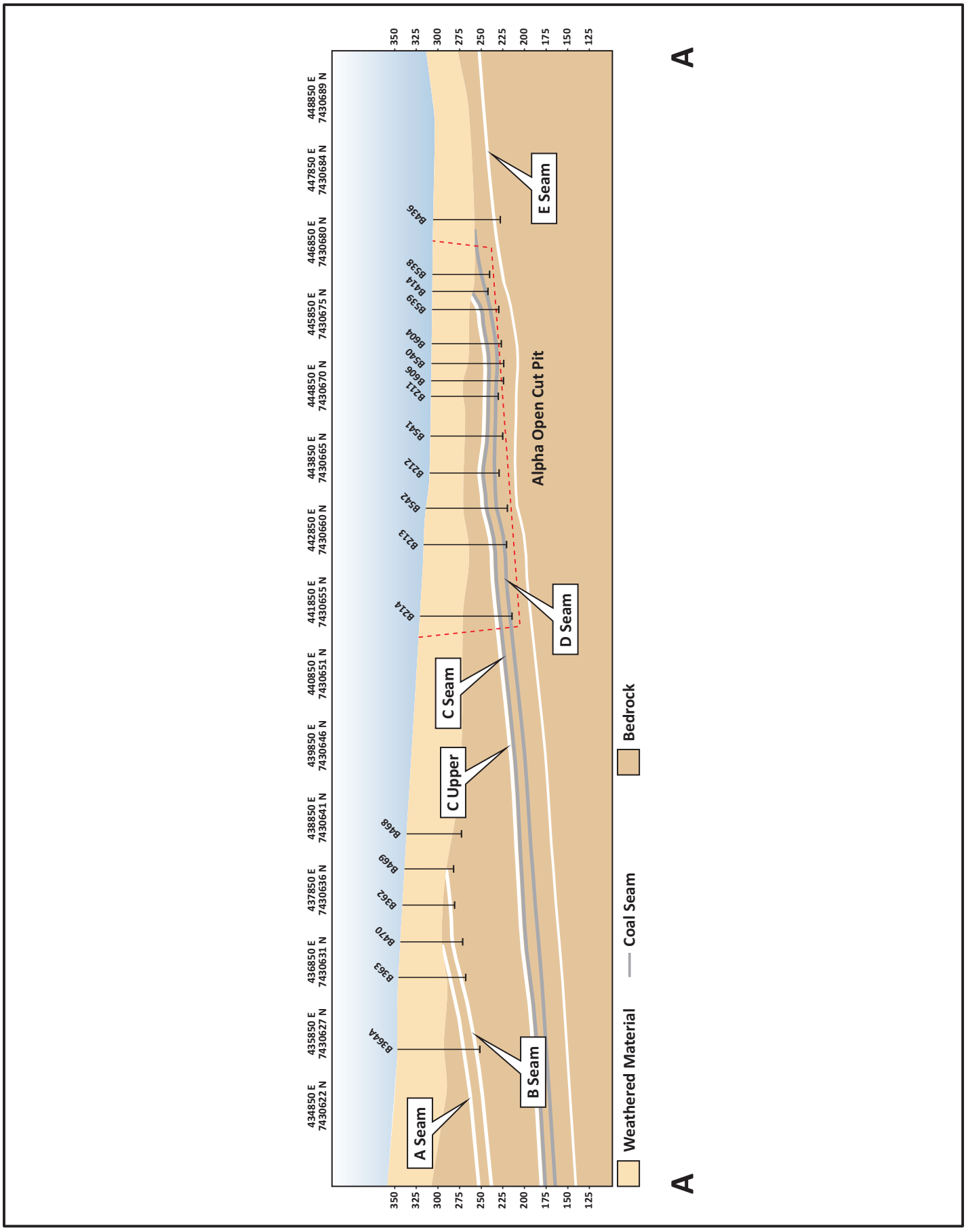
The operational phase of the Project and the associated mine plan have been based on the following criteria:

- A staged build-up to a target production rate of 30 Mtpa;
- 100% export thermal coal product from the C and D coal seams (refer to Figure FA-3);
- A LOM of 30 years;
- 80% of scheduled reserves to be in the proven or probable JORC Reserves category; and
- An owner-operator mining scenario.

The proposed CHPP operates via two remote ROM facilities that convey crushed raw coal to a multi-module single stage Dense Medium Cyclone (DMC)/Reflux Classifier plant. Automated stacking and reclaim facilities are provided including an automated train load-out bin. Tailings are disposed initially in an out-of-pit TSF (first 5 years). During this first five years a decision to either place the remaining tailings in pit or continue in an out of pit location will be determined. Coarse rejects disposal involves conveying to a remote bin and trucking to a designated reject dump (in- and out-of-pit). There is potential for an automated reject handling system in the future.

The following principal design objectives were considered when designing the operation of the CHPP:

- The CHPP facility will be designed to produce 30 Mtpa export thermal coal;
- The CHPP facility will be constructed over a period of four years to meet production requirements;
- The CHPP facility will be designed for a 30 year LOM, operating 24 hours per day, seven days per week, up to 7 200 hours per year;
- The CHPP facility will be based on a safe, economical, durable and functional design suitable for heavy duty mining application; and
- The CHPP facility will be designed to minimise water and power consumption.



Source: See Copyright Details below and for full disclosure Please Refer to the EIS ***Volume 2, Appendix B***

Datum: GDA94, MGA Zone55

HANCOCK PROSPECTING PTY LTD

Alpha Coal Project
Supplementary Environmental Impact Statement

ALPHA COAL PROJECT (MINE)
GEOLOGICAL WEST TO EAST CROSS-SECTION THROUGH MINE LEASE APPLICATION (MLA 70426)

Job Number	4262 6680
Revision	A
Date	25-03-2011

Figures: FA.3

File No: 42626680-g-2029.cdr

FA.2.1.5.1 Coal Resource Base and Mine Life

The Alpha coal deposit and the adjacent Kevin's Corner deposit are situated within the Galilee Basin in Central Queensland, Australia. The Galilee Basin is of Palaeozoic to Triassic age and overlays the older Drummond Basin (early to middle Palaeozoic age). The basin is approximately 480 km long and extends from the town of Tambo in the south to Pentland in the north. There are five recognised coal seams in the Alpha lease areas designated (in descending stratigraphical order) as A, B, C, D and E (Figure FA-3). Seams A through D are considered to be economically recoverable via open-cut mining. The seams dip slightly to the west by approximately 0.5° and are believed to be relatively free of faults.

In general, seams include numerous thin parting bands, particularly Seam B. Seam thicknesses vary in multiple directions but range from less than one metre (Seam C at sub-crop) to up to eight metres thick (Seam B). Overburden depth varies from a minimum of 50 m upwards. The Alpha deposit has been separated into two distinct development areas. Each provides access to a pair of seams. Seams A and B sub-crop in the western area, while the deeper Seams C and D sub-crop in the eastern area. The primary use for this coal is expected to be in export thermal applications. The mine is anticipated to be in full production by year 5 of operations.

FA.2.2 Report Purpose

This purpose of this report is to assess the potential impacts of proposed development of the Alpha Coal Mine and its associated infrastructure (the Project) on MNES. The eight MNES protected under the EPBC Act, are:

- World heritage properties;
- National heritage places;
- Wetlands of international importance (listed under the Ramsar Convention);
- Listed threatened species and ecological communities;
- Migratory species protected under international agreements;
- Commonwealth marine areas;
- The Great Barrier Reef Marine Park; and
- Nuclear actions (including uranium mines).

Under the EPBC Act, actions that have, or are likely to have, a significant impact on a MNES, require approval from the Australian Government Minister for SEWPaC. On 21 November 2008, the proponent referred the project to the Commonwealth Government for a decision as to whether the project constitutes a ‘controlled action’ under the EPBC Act (Referral No. 2008/4648). On 13 January 2009, the proposed development of the Project was determined to be a controlled action under the EPBC Act due to the likely potential impacts on MNES. The relevant controlling provisions under the EPBC Act were determined as being:

- Section 12 and 15A (World Heritage Properties)
- Section 15B and 15C (National Heritage Places)
- Sections 18 and 18A (Listed threatened species and ecological communities);
- Sections 20 and 20A (Listed migratory species).

The terms of reference (TOR) prepared by the Queensland Coordinator-General and Commonwealth Government for the Project's environment impact statement (EIS) requires that this report “should

bring together assessments of impacts on MNES in other chapters (e.g. water resources, flora and fauna, cultural heritage, cumulative impacts) and produce a standalone assessment in a format suited for assessment under the EPBC Act." This report has been prepared to address the TOR for the Project that relate to MNES and facilitate the SEWPaC's assessment of the Project against the listed controlling provisions.

In order to provide as accurate an assessment as possible, habitat modeling and mapping has been undertaken for those EPBC Act-listed threatened flora and fauna species and threatened ecological communities identified through EIS and SEIS studies as being of relevance to the Project (Mine). This mapping exercise has included the identification of potential habitat for these species both within the mine study area and the surrounding landscape. Additionally, potential impacts (direct and indirect) to these species and/or threatened ecological communities (TECs) have been quantified spatially. The results from this study facilitate the formulation of accurate management and mitigation protocols, as well as provide a starting point for which an offsets strategy can be developed for the project (Volume 2, Appendix X of the Alpha Coal Project SEIS).

Discussions with SEWPaC established the most appropriate methods to utilise for the enhancement of this assessment including an increase in the detail surrounding EPBC values and the potential impacts. For a more detailed overview of the methods applied in this assessment, see Section FA.4 of this report.

The layout of this report is as follows:

- **Section FA.3: Overview of the MNES of relevance to the Project**
- **Section FA.4: Terrestrial Flora and Fauna Assessment Methodology**
    - Overview of methodologies undertaken in EIS and SEIS to evaluate these MNES
    - Outcomes of likelihood of occurrence assessment – threatened flora, fauna and TECs of relevance to the mine study area
    - Habitat modelling and mapping methodology (including validation and assumptions)
- **Section FA.5: Flora and Fauna Assessment Results**
- **Section FA.6:Assessment of Impacts to EPBC Act-listed Flora, TECs and Fauna**
    - Description of potential impacting processes (direct and indirect)
    - Quantification of area of habitat impacted (direct and indirect)
    - Proposed mitigation and management strategies to avoid/minimise/reduce identified impacts
- **Section FA.7: Aquatic Flora, Fauna and Stygofauna Assessment Summary**
    - Description of methodologies undertaken in EIS and SEIS to evaluate these MNES
    - Outcomes of likelihood of occurrence assessment – threatened flora, fauna and TECs of relevance to the mine study area
    - Proposed mitigation and management strategies to avoid/minimise/reduce identified impacts
- **Section FA.8: Great Artisan Basin Impact Assessment**
- **Section FA.9: Great Barrier Reef Marine Park Assessment**
- **Section FA.10: Summary and Conclusion – Alpha Coal Project (Mine) Impacts to MNES**
- **Section FA.11: References**
- **Appendix FA.A: Species Fact Sheets and Habitat Mapping**

FA.3 Matters of National Environmental Significance relevant to the Project

This section summarises the MNES that are relevant and potentially impacted by the Project. Terrestrial and freshwater environments and EPBC-listed species are discussed. Table FA-1 lists MNES that are relevant to the Project, identified through desktop review and survey effort. Greater detail relating to each can be found below in sections FA3.1 to FA3.7 Details of the studies undertaken relating to MNES (flora and fauna) that are potentially impacted by the Project can be found in Sections FA.4 to FA.7.

Table FA-1 EPBC Act Matters of National Environmental Significance for mine study area

Category	Matters of National Environmental Significance
World Heritage Properties	The Great Barrier Reef World heritage Area is situated approximately 500 km east of the Project Mine site. **Controlling provision determined.**
National Heritage places	The Great Barrier Reef World heritage Area is situated approximately 500 km east of the Project Mine site. **Controlling provision determined.**
Wetlands of international importance (Ramsar Wetlands)	Not applicable but within same catchment as Ramsar Site Coongie Lakes.Not applicable but within same catchment as Ramsar Site Shoalwater and Corio Bays area
Threatened species and ecological communities	**Threatened ecological communities (TECs)** • 5 communities identified from database searches; • None were considered as potentially occurring on site as none of their constituent RE's were identified on site (Also refer to Section FA 5.) • No TECs identified during desktop studies. **Threatened flora species** • 21 species identified from the original desktop study as potentially occurring on the site or in the region. • Only 1 species was considered to have a low likelihood of occurring on the Project site: king bluegrass (*Dicanthium queenslandicum*) after a detailed analysis of habitat requirements, their range of habitation and a revised database search in a more accurate geographic region; • No species recorded on site during field surveys (Refer to Section FA.5.) **Threatened fauna species** • 28 species identified from the original desktop study as potentially occurring on the site or in the region, , reduced to 10 • 10 of these species have either a low or moderate likelihood of being present on the Project site after a detailed analysis of habitat requirements, their range of habitation and a revised database search in a more accurate geographic region; • 1 species was recorded on the site: squatter pigeon (*Geophaps scripta scripta*), (refer to Section FA.5.) **Controlling Provision determined.**
Migratory species	• 36 migratory or marine bird species were found within the mine study area. **Controlling Provision determined.**
Commonwealth marine areas	The Great Barrier Reef is situated approximately 500 km east of the Project site. No controlling provisions were determined however the Project was determined a controlled provision under World Heritage Properties and National Heritage places (see above).
The Great Barrier Reef Marine Park	The Great Barrier Reef is situated approximately 500 km east of the Project site. No controlling provisions were determined however the Project was determined a controlled provision under World Heritage Properties and National Heritage places (see above).
Nuclear Actions	Not applicable to this Project

FA.3.1 World Heritage Properties

The Great Barrier Reef Marine Park World Heritage Area is the world's largest World heritage property extending over 2,000 km and covering an area of 348,000 km^2. It is composed of extensive areas of seagrass, mangroves, sandy and muddy seabed communities, inter-reefal areas, deep oceanic waters and island communities (SEWPaC, 2011). A controlling provision was identified in relation to the project's location near the Great Barrier Reef Marine World Heritage Area. The potential impacts from dust and sediment released from the Proponents mining activities are considered low due to the mines distance from the GBRMP (over 500 km), the existence of water storage structures (major dams) between the mine and the coast and the erosion control measures that will be implemented for the mine.

FA.3.2 National Heritage Places

The Great Barrier Reef Marine Park (GBRMP) is the only National Heritage place applicable to the Project. A controlling provision was identified in relation to the project's location to the GBRMP.

FA.3.3 Wetlands of international importance (Ramsar Wetlands)

The Project site lies within the same catchment areas as the Ramsar Coongie Lakes site and Shoalwater and Corio Bays site. However, due to the mine's distance away from these wetlands, no impacts are expected and no controlling provisions were identified.

FA.3.4 Threatened species and ecological communities

The results of the EPBC Act Protected Matters Search Tool database search identified the following five EPBC Act listed Threatened Ecological Communities (TECs) as potentially being present within the mine study area:

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

However, as none of these threatened ecological communities or any of their constituent Regional Ecosystems were identified during field surveys as being present on the Project site, the likelihood of the TEC's being present on site was considered 'Unlikely'.

Initial database searches indicated that 21 EPBC Act listed flora species may potentially occur on site. In an effort to strengthen conclusions, a detailed analysis of habitat requirements and the range of habitation of the indicated species, as well as a revised database search in a more accurate geographic region (See Section FA4.1.1) were then conducted. As a result of this additional investigation, 1 species was considered to have a low likelihood of occurring on the Project site. No EPBC-listed threatened flora species were identified during field surveys of the mine study area.

Initial database searches indicated that 28 EPBC-listed fauna species as potentially occurring on the Project site. In an effort to strengthen conclusions, a detailed analysis of habitat requirements and the range of habitation of the indicated species, as well as a revised database search in a more accurate geographic region (See Section FA4.1.1) were then conducted. As a result of this additional

investigation, 9 species were considered to have a low or moderate likelihood of occurring on the Project site and during field surveys 1 of these species, the squatter pigeon (*Geophaps scripta scripta*) which is listed as Vulnerable under the EPBC Act, was confirmed on site.

More detail relating to the results of the flora and fauna assessment can be found below in Section FA.5.

FA.3.5 Migratory Species

The results of the combined desktop and field surveys indicated a total of 36 migratory species potentially occurring on site, 24 of which were confirmed.

Habitat mapping was not undertaken for each individual migratory species. The rationale for this decision was two-fold:

- Habitat mapping for EPBC Act-listed threatened fauna species is considered likely to also capture habitat for migratory species (including woodland birds, wetland birds and aquatic reptiles). For example, potential habitat mapped for the squatter pigeon (southern) is likely to capture potential habitat for woodland migratory bird species. Potential habitat mapped for the Australian painted snipe is likely to capture potential habitat for migratory birds associated with aquatic habitats (i.e. wetlands, rivers, farm dams etc.). Mitigation measures and habitat offsets for threatened species are thus likely to apply to migratory species also.
- Desktop studies and field observations did not indicate that any 'important habitat' for EPBC Act-listed migratory species, as defined in the Commonwealth's *Significant Impact Guidelines 1.1 – Matters of National Environmental Significance* (DEWHA (now SEWPAC), 2009b) occurs in the mine study area.

Further detail and a list of the migratory species can be found in section FA.5.1.1.

FA.3.6 Commonwealth Marine Areas/ Great Barrier Reef Marine Park

The GBRMP, which lies approximately 500 km to the east of the Project, is the closest Commonwealth marine area. No controlling provisions were determined however the Project was determined a controlled provision of MNES under World Heritage Properties and National Heritage places.

FA.3.7 Other Protected Areas

A review of the Queensland Department of Environment and Resource Management (DERM) Environmentally Sensitive Areas (ESA) mapping for the Project site indicated the existence of two protected areas, the Cudmore Resources Reserve and Cudmore National Park, to the north west of the site. Resources Reserves and National parks are protected and managed under the *Nature Conservation Act 1992* (NC Act).

The Project site may provide important landscape linkages between ESAs such as the Cudmore Resources Reserve and surrounding habitats. Habitat connectivity involves the linkages of habitats, species, communities and ecological processes. Smaller and more isolated habitat patches will have fewer species compared to large patches. Wildlife corridors are systems of linear habitat which enhance the connectivity of wildlife populations between the habitats they utilise and support ecological processes at a variety of spatial and temporal scales.

FA.4 Terrestrial Flora and Fauna Assessment Methodology

FA.4.1 Introduction

This section details the survey methodology employed to describe the existing ecological values of the mine study area. All ecological surveys were conducted by appropriately qualified ecologists, the qualifications and experience of which can be found in Volume 5, Appendix B of the Alpha Coal Project EIS.

FA.4.1.1 Revised Desktop Assessment

In an effort to strengthen the initial results of this assessment on MNES, we have refined the DERM Wildlife Online database search area originally used in the Project EIS. The original search area was the Central Highlands Regional Council jurisdiction. This area was both excessively large producing disproportionate results, as well as geographically incorrect as it did not include the Project footprint within its boundary.

The revised search encompassed a 100km buffer surrounding the Alpha Mine Lease Area 70426, using coordinates 22.75046, 145.989507; -22.753652, 146.963474; -23.656973, 146.963228; 23.653639, 145.982694 for the four corners of the search area. As a result of this revision, the species list being assessed within this report was revised and the results of the assessment are more accurate.

While the Wildlife Online search did require revision, the Protected Matters Report (as presented in the EIS) has been retained as it encompassed an area that closely mirrors the revised Wildlife Online search area.

FA.4.2 Flora Assessment Methodology

To describe the existing terrestrial flora environmental values of the Project area, a combination of desktop assessments and seasonal field surveys were conducted. The desktop assessment comprised a review of relevant literature and database searches. Flora field surveys were conducted to obtain ecological information relevant to the Project and to ground-truth results from desktop assessments.

This section is based upon the findings of the following document presented in the Alpha Coal Project EIS:

- AustralAsian Resource Consultants (AARC) (2010a). Alpha Coal Project, Flora and Fauna Assessment. Prepared for Hancock Prospecting Pty Ltd. September 2010.

The surveys were designed to capture seasonal variations in flora assemblages, and covered both the wet and dry seasons.

FA.4.2.1 Desktop Assessment

Initial desktop methods involved a review of aerial photography and Regional Ecosystem (RE) maps of the Project site to gain an overall perspective of the vegetation distribution within the Project site and surrounds.

Following this initial review, the following databases were searched for historical records of flora within the mine study area and broader adjacent areas:

- EPBC Act Protected Matters Search Tool:
  - This database provides general guidance on MNES and other matters protected by the EPBC Act for a nominated area.

- Search area encompassed a 100 km buffer surrounding a point at coordinates -23.24,146.46
- Data retrieved 8 June 2010.

- Wildlife Online Database - (DERM, 2009b):
  - This database uses records collected from previous surveys, including the Queensland Museum surveys as well as records from the public. While screening of data occurs, some misidentifications are possible.
  - The initial search area encompassed the Central Highlands Regional Council jurisdiction. This data was retrieved 11 Feb 2009.
  - Upon review, for the production of this report, the search was repeated within a revised search area 100 km x 100 km, surrounding the Mine Study Area. The coordinates of the revised search area are 22.75046, 145.989507; -22.753652, 146.963474; -23.656973, 146.963228; 23.653639, 145.982694
- HERBREC Searches: This database provides information including taxon names and specimen data.

*FA.4.2.2*Field Survey

Accessible areas of the Project site were broadly surveyed from a vehicle prior to the detailed planning of field survey methods. Initial vehicle surveys allowed for the targeting of habitats potentially occupied by MNES, and enabled survey transects to be located in areas that maximised the sampling of representative vegetation types and habitats on the Project site.

Eight flora surveys were undertaken across the mine study area and surrounding areas between June 2008 and June 2010. These site visits included both wet and dry season surveys as detailed in Table FA-2.

Table FA-2 Details of site visits and environmental conditions between 2008 and 2010

Site visit	Field Days	Rainfall during and prior to each field survey (mm)	Temperature range (ºC)
25/06/2008 — 01/07/2008	7	12.8	3 – 25
08/10/2008 — 13/10/2008	5	54.4	17 – 34
04/03/2009 — 11/03/2009	7	216.9	18 – 33
28/09/2009 — 05/10/2009	8	1.4	9 – 35
23/11/2009 — 09/12/2009	16	61.4	15 – 40
15/03/2010 — 23/03/2010	8	338.7	17 – 30
12/04/2010 — 20/04/2010	8	237.2	15 – 32
22/06/2010 — 30/06/2010	8	17.6	13 - 25

FA.4.2.2.1 Overall Field Survey Approach

The flora field survey involved a baseline study of the mine study area using standard floristic survey methods. Methods used were in accordance with the Queensland Herbariums Methodology for Survey and Mapping of Regional Ecosystems (REs) and Vegetation Communities in Queensland (Version 3.1).

The Queensland Herbarium Methodology describes the following levels of sampling which were used in the field surveys:

- Secondary – Consists of 20 x 50 metres (m) plots. Data recorded in these transects includes a list of all species observed from all the major layers of vegetation. Species that fall outside the plot but are typical of the community are also listed. In addition, relative abundance for individual species in each strata is recorded, including density and foliage projection cover and height for the tree and shrub layers;
- Quaternary or observation sites – These plots include Global Positioning System (GPS) location, the dominant species in the characteristic layer, with some landform and structural data. An intuitive classification of the vegetation is also recorded. These plots are commonly used in the ground truthing of mapping previously completed for the local area.

Field data collected using this methodology is compatible with the Queensland Herbarium CORVEG database.

FA.4.2.2.2 Verification of Mapped Regional Ecosystems

A comprehensive vegetation survey was undertaken across the mine study area in order to confirm the current RE mapping sourced from the Queensland Herbarium. The following methods were used:

- A number of secondary transects in each vegetation type were selected and a detailed floristic inventory of the dominant and associated woody plants (i.e. trees and shrubs) was undertaken. Secondary plots were positioned in vegetation representative of the community as a whole;
- In addition to the secondary transects, a number of quaternary transects were surveyed in order to assist with the mapping of REs;
- An assessment of the condition of the vegetation type with regard to quality and conservation value was undertaken at each transect; and
- The preparation of RE maps was undertaken through the use of aerial photographs, geological maps and ground truthing.

All dominant plants representative of each vegetation community were identified using a number of taxonomic keys and other reference material. All REs were described in accordance with the Regional Ecosystem Descriptions Database (REDD). The use of the terms ‘Remnant’ and ‘Non-remnant Vegetation’ were as per the VM Act. For any plant species that could not be identified in the field, a sample was collected and sent to the Queensland Herbarium for verification.

FA.4.2.2.3 Survey for Species of Conservation Significance

Targeted searches during field surveys for species of conservation significance were undertaken upon identification of suitable habitat. This specific search involved the use of methods discussed in the NSW *Threatened Species Survey and Assessment: Guidelines for developments and activities (working draft)* (Department of Environment and Conservation, 2004).

The method outlined in the Department of Environment and Conservation (2004) guidelines that was used in this survey was the Random Meander Technique, which was adapted from Cropper (1993). As its name suggests, this technique involves traversing areas of suitable habitat in no set pattern whilst searching for the particular plant species. If there was any uncertainty in identifying the species, a voucher specimen was collected for confirmation by the Queensland Herbarium.

FA.4.2.2.4 Flora Transects Surveyed

A total of 51 transects were conducted as shown in Figure FA-4. Transects were located in habitats that were targeted due to the potential occurrence of species of conservation significance, as well as in areas that were thought to maximise the sampling of representative vegetation types and habitats on the Project site.

Flora transects were surveyed in each of the communities that had been identified within the Project site. In addition to transects surveyed, incidental observations of flora species were recorded together with notes on their associated vegetation community. Areas of disturbance such as roadsides, dams and creek crossings were also investigated for a number of different species, particularly invasive weeds.

When habitat suitable for a species of conservation significance was located, a specific survey of that species was undertaken. This survey was consistent with the NSW Threatened Species Survey and Assessment Guidelines (Department of Environment and Conservation 2004); given such survey guidelines are currently unavailable in Queensland.

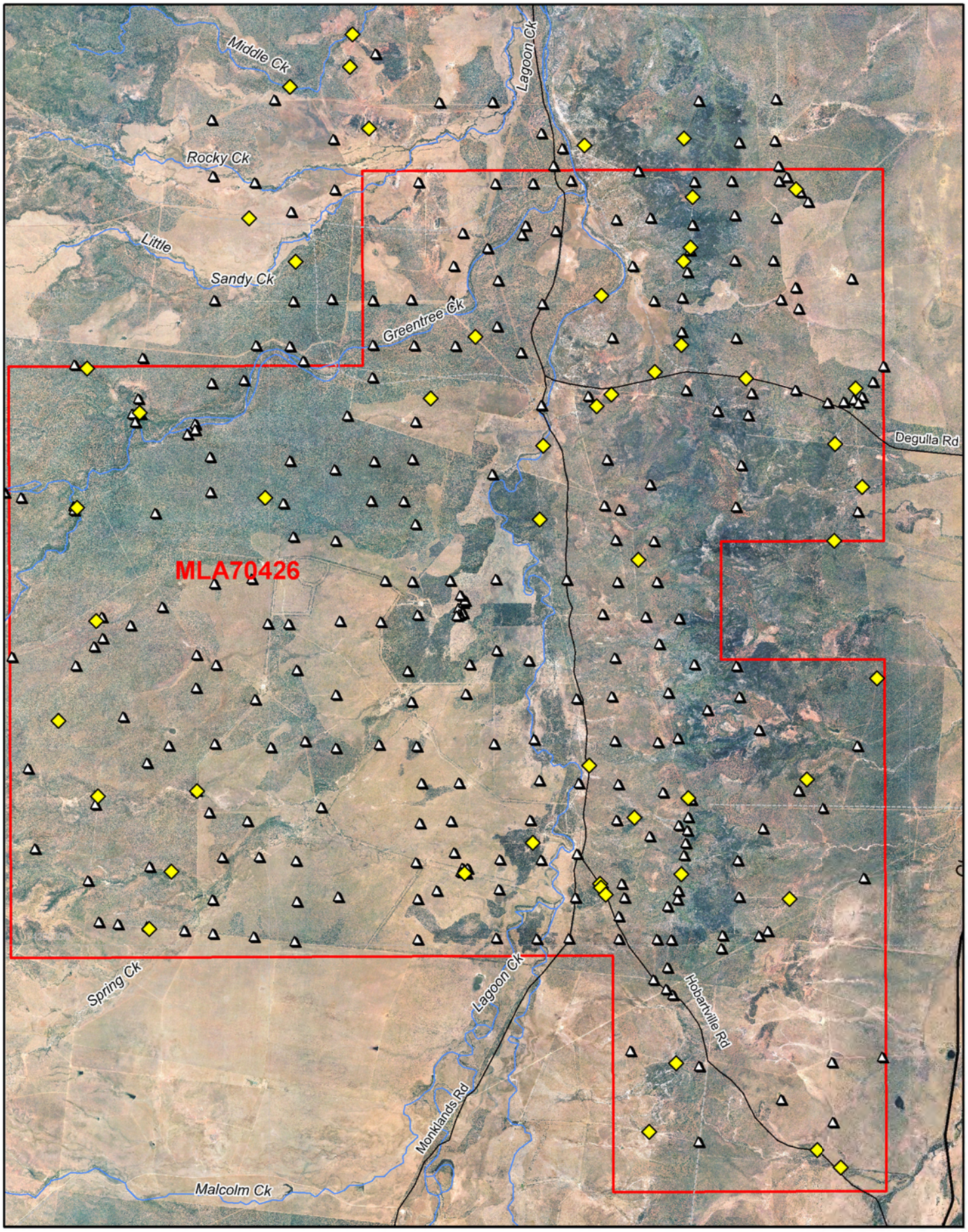
FA.4.2.3 Likelihood of Occurrence of Listed Flora

To better enable the assessment and mapping of potential impacts posed by the Project, the following categories were assigned to EPBC listed flora species based on their likelihood of occurrence on the Project site:

- Unlikely to occur;
- Low likelihood of occurring;
- Moderate likelihood of occurring; and
- High potential of occurring.

These categories were determined by:

- Undertaking further database searches to assess species recorded in areas located near the Project;
- Assessing information from published field guides and from internet sites (such as SPRAT and Birds Australia) for currently known species distributions;
- Assessing habitat availability and climatic conditions on site during field surveys;
- Assessing habitat integrity during field surveys;
- Assessing the presence of predatory feral animal populations that may impact upon species' presence during field surveys; and
- Accounting for the cryptic nature of species listed in the database searches and the limitations of identifying such species during the field surveys.



Mining Lease Application (MLA70426) Boundary

Secondary Transect Sites

Quaternary Transect Sites

Source: See Copyright Details below and for full disclosure Please Refer to the SEIS ***Volume 2, Appendix B***

0 2 4Km

Scale 1:160 000 (A4)

Datum: GDA94, MGA Zone55

N W E S

HANCOCK PROSPECTING PTY LTD

Alpha Coal Project
Supplementary Environmental Impact Statement

ALPHA COAL PROJECT (MINE) DISTRIBUTION OF FLORA TRANSECT LOCATIONS MINE STUDY AREA

Job Number | 4262 6680
Revision | A
Date | 25-03-2011

Figure: FA.4

File No: 42626680-g-2030.wor

FA.4.3 Fauna Assessment Methodology

To describe the existing environmental terrestrial fauna values of the study area a combination of desktop assessments and seasonal field surveys were conducted. The desktop assessment comprised a review of relevant literature and database searches. Fauna surveys were conducted to obtain ecological information relevant to the Project and to ground truth results from desktop assessments.

The fauna sampling methodology for the Project site was based on 'standard survey' techniques that are used to sample terrestrial and aquatic vertebrate fauna. Sampling of fauna was conducted primarily along transects established in each of the major vegetation communities.

At each of the standard trapping sites the following survey methods were used:

- Habitat assessment;
- Pitfall trapping;
- Elliott trapping;
- Ultrasonic bat detection (Anabat);
- Funnel trapping;
- Spotlighting; and
- Active searching.

FA.4.3.1 Desktop Assessment

The following databases were searched for historical records of fauna within the mine study area and broader adjacent areas:

- EPBC Act Protected Matters Search Tool:
  - This database provides general guidance on MNES and other matters protected by the EPBC Act for a nominated area.
  - Search area encompassed a 100 km buffer surrounding a point at coordinates -23.24,146.46
  - Data retrieved 8 June 2010.
- Wildlife Online Database - (DERM, 2009b):
  - This database uses records collected from previous surveys, including the Queensland Museum surveys as well as records from the public. While screening of data occurs, some misidentifications are possible.
  - Initial search area encompassed the Central Highlands Regional Council jurisdiction. This data was retrieved 11 Feb 2009.
  - Upon review for the production of this report, the search was repeated within a revised search area 100 km x 100 km, surrounding the Mine Study Area. The coordinates of the revised search area are 22.75046, 145.989507; -22.753652, 146.963474; -23.656973, 146.963228; 23.653639, 145.982694
- Birdata Atlas of Australian Birds: This database documents the distribution and relative abundance of birds throughout Australia.

FA.4.3.2 Field Survey

Eight site visits to conduct fauna assessments across the mine study area and surrounding areas were undertaken between June 2008 and June 2010. The site visits included both wet and dry season surveys as detailed in above in Section 4.2.2.

A total of thirty-six fauna transect sites were established on and surrounding the mine study area. Each site was subject to trapping regimes of up to four consecutive nights for pitfall traps and five consecutive nights for all other traps. Locations of these fauna transects are shown in Figure FA-5 below.

Fauna transects were established across the range of vegetation communities present on the mine study area. Fauna transect sites outside the mine study area were utilised in this fauna assessment, as habitat types are synonymous with habitat on the mine study area. Also, most fauna species identified are mobile and have the ability to inhabit habitat inside and outside the MLA. A combination of pitfall lines, funnel, cage, Elliot traps and Anabat recordings were used to assess the presence and abundance of species at these locations. Active searching and bird surveys were undertaken to supplement data from the transect sites. Transects were positioned to maximise the potential for sampling all wildlife present by targeting the full range of habitat types present on and surrounding the mine study area.

Brief descriptions of the techniques employed at each transect to survey fauna occurring on and surrounding the mine study area is provided below.

FA.4.3.2.1 Elliott trapping

Type A Elliott traps were used to target small ground-dwelling mammals inhabiting the mine study area and surrounding areas. Traps were baited with a mixture of rolled oats, honey, peanut butter and vanilla essence. Elliott traps were positioned in two rows at each transect, approximately 100 m apart, with each trap separated by approximately 10 metres. The overall survey effort (combining each field survey) was 1,709 Elliot trap nights.

FA.4.3.2.2 Pitfall trapping

A pitfall trap-line was established at all primary transects to target small ground-dwelling fauna (reptilian, mammalian and amphibian). Each line consisted of a 20 centimetre (cm) tall wire-mesh drift fence running along the ground and crossing the middle of five 20 litre buckets buried flush with the soil surface. The bottoms of drift fences were buried slightly to guide target species towards a bucket. A small amount of soil, leaf litter and water (soaked into a sponge) was placed in the bottom of each bucket to provide shelter and moisture for captured wildlife. The overall survey effort was 400 pitfall trap nights.

FA.4.3.2.3 Funnel trapping

Funnel traps were employed to catch medium and large-sized terrestrial, diurnal snakes and some of the widely foraging, medium-sized skinks, dragon and arboreal geckos, which are able to climb out of pitfall traps. Funnel traps were placed at the end of each drift fence at the pitfall trap-lines and along fallen timber at secondary trap sites. Total funnel trap effort for all surveys was 293 trap nights.

FA.4.3.2.4 Cage trapping

Cage traps are mostly useful for capturing medium sized fauna that are unlikely to be caught in pit and funnel traps. The overall survey effort for cage trapping was 209 trap nights.

FA.4.3.2.5 Micro-bat surveying

Micro-bats (Microchiropterans) form an extremely diverse group of wildlife and the identification of individual species requires the use of specialised survey methods due to the superficial similarity of many species, their small size, and largely inaudible calls.

In order to navigate and hunt at night micro-bats use high frequency echolocation calls, most of which are above the frequency range audible to humans (i.e. ultrasound). These echolocation calls provide an opportunity to unobtrusively survey and identify micro-bats through the use of a specialised electronic bat call recorder called Anabat. The Anabat was utilised throughout surveys, recording micro-bat calls at each vegetation community. This method therefore represents a broad census technique which facilitates the detection of a broad suite of micro-bats which utilise the mine study area and surrounding areas. Recordings were sent to an expert Anabat call analyst (Mr. Greg Ford – Toowoomba, Queensland) for species identification. The overall Anabat survey effort was 45 nights.

FA.4.3.2.6 Bird surveying

A dedicated search for diurnal birds using a standardised survey technique (2ha for 20 minutes) was conducted visually and aurally on mornings and afternoons of the survey in the immediate vicinity of each fauna transect. In addition, opportunistic diurnal searches were also conducted on foot in areas considered likely to have high avian diversity (e.g. vegetated creek lines, dams), or to contain cryptic or threatened bird species.

FA.4.3.2.7 Spotlighting

Spotlighting was carried out at night in various sections of the mine study area and surrounding areas in an attempt to observe nocturnal wildlife not likely to be detected by other survey methods, such as owls and arboreal mammals. Two spotlighting techniques were employed:

Walk searches: Various habitats surrounding and within the mine study area were selected for spotlighting on foot, especially those considered likely to have high wildlife diversity or to contain cryptic or threatened species. These areas were randomly traversed by two ecologists equipped with spotlights and binoculars. Where possible rock fissures, bark crevices and tree hollows were investigated. A slow walking speed (approximately 1 km per hour) was maintained to facilitate intensive listening and thorough visual searching. While this technique improves the likelihood of detecting small cryptic species, it is a time-consuming activity that does not permit the coverage of large areas. The total spotlight hours undertaken on foot within and surrounding the mine study area was 67 hours.

Vehicle searches: Spotlighting was also conducted from a slow-moving vehicle where established roads/tracks permitted driving through areas considered likely to have high wildlife diversity or to contain cryptic or threatened species. A 55 watt 12 volt spotlight was used to scan roadside vegetation for arboreal and ground-dwelling wildlife. An advantage of this survey technique is the efficiency with which large areas can be covered, although small cryptic species can be easily overlooked. A total of 48 hours of vehicle spotlighting was undertaken throughout the course of all surveys.

FA.4.3.2.8 Habitat searching

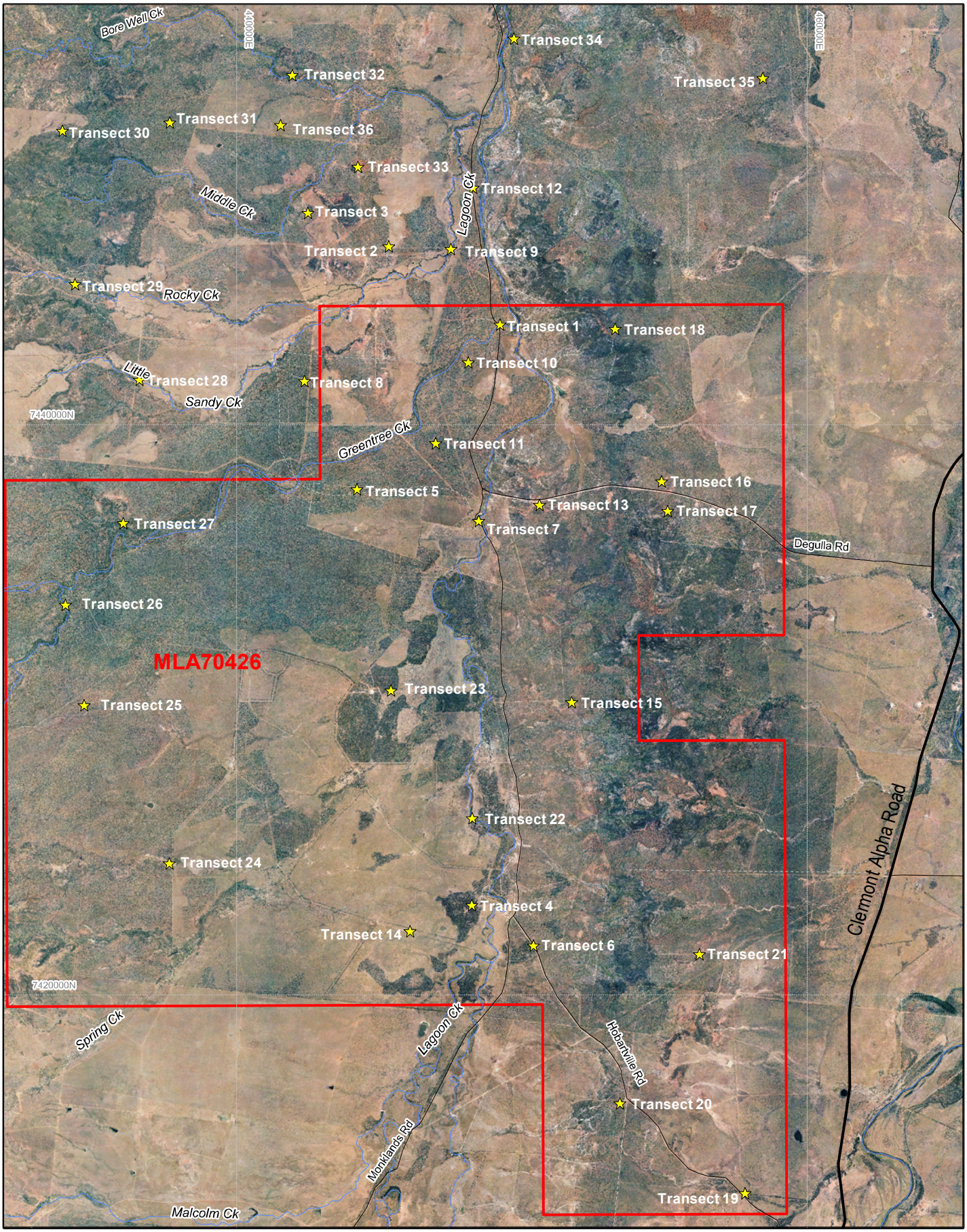
To further enhance the likelihood of detecting small cryptic species, opportunistic diurnal searches of likely micro-habitats were conducted at each transect and in other selected areas surrounding the mine study area. Searches involved the rolling of rocks and logs, rustling through leaf litter, and the peeling back of exfoliating bark from standing trees. Observed animals were caught where possible to aid positive species identification.

FA.4.3.2.9 Scat/Track searching

At each transect location a search of the immediate area was conducted for evidence of the presence of cryptic wildlife species through the identification of obvious tracks, scats and other signs of occupation (for example, tree trunk scratchings).

FA.4.3.2.10 Incidental recordings

Throughout the survey period numerous wildlife species were observed or heard within the mine study area during the course of routine activities, such as setting and checking trap-lines, or driving between transects. Where required, a closer inspection of detected wildlife was carried out to ensure positive species identification. All incidental observations were recorded and appropriate notes made on the surrounding habitat.



Mining Lease Application (MLA70426) Boundary

Fauna Transect Sites

Source: See Copyright Details below and for full disclosure Please Refer to the SEIS ***Volume 2, Appendix B***

0 2 4Km

Scale 1:180 000 (A4)

Datum: GDA94, MGA Zone55

N W E S

HANCOCK PROSPECTING PTY LTD

Alpha Coal Project
Supplementary Environmental Impact Statement

ALPHA COAL PROJECT (MINE)
DISTRIBUTION OF FAUNA TRANSECT LOCATIONS MINE STUDY AREA

Job Number	4262 6680
Revision	A
Date	25-03-2011

Figure: FA.5

File No: 42626680-g-2031.wor

FA.4.3.3 Likelihood of Occurrence of Listed Fauna

The following categories were assigned to the identified species based on their likelihood of occurrence to enable the assessment and mapping of potential impacts posed by the Project:

- Unlikely to occur;
- Low likelihood of occurring;
- Moderate likelihood of occurring; and
- High potential of occurring.

These categories were determined by:

- Undertaking further database searches to assess species recorded in areas located near the Project;
- Assessing information from published field guides and from internet sites (such as SPRAT and Birds Australia) for currently known species distributions;
- Assessing habitat availability and climatic conditions on site during field surveys;
- Assessing habitat integrity during field surveys;
- Assessing the presence of predatory feral animal populations that may impact upon species' presence during field surveys; and
- Accounting for the cryptic nature of species listed in the database searches and the limitations of identifying such species during the field surveys.

FA.4.4 Species Mapping Methodology

A habitat modelling and mapping methodology was developed to spatially depict, assess and quantified, the direct and indirect impacts to the EPBC Act-listed flora and fauna species potentially occurring in the mine study area region. The methodology for modelling and mapping threatened species habitat, involved the identification of species-specific habitat criteria which were input into a model that identified potential habitat. The model was underpinned by amended Queensland vegetation (i.e. Regional Ecosystem) mapping.

A variety of sources were consulted in the development of the species-specific habitat criteria. The Queensland Department of Environment and Resource Management (DERM) Essential Habitat factors for individual species were reviewed where these were available – these factors relate to habitat features associated with individual species listed under the Queensland Nature Conservation Act 1992 (NC Act), for which Essential Habitat is mapped. Essential Habitat factors (where available) that were input into the habitat model included REs and altitude. Where Essential Habitat factors were not available, REs were selected based on knowledge of the species' broad habitat preferences, and in consideration of the REs associated with species with similar habitat preferences.

The DERM Biodiversity Planning Assessments (BPA) for the Brigalow Belt and Desert Uplands bioregions were reviewed as part of the habitat model development. BPAs (and associated mapping and geospatial data) identify landscape scale biodiversity features at varying levels of significance (local, regional, state / low – very high). The mapping methodology is underpinned by DERM's remnant vegetation (i.e. RE) mapping, and based upon the DERM Biodiversity Assessment and Mapping Methodology. Expert panel reports provide information on the landscape-scale values of bioregions, and in some instance identify bioregional priority taxa. Such that an indication of the 'value' of mapped vegetation units (i.e. mapped RE polygons) could be ascertained (in lieu of assessing the

value of habitats in the broader study area), two BPA criteria were input into the habitat model. These are described in Table FA-3 below.

Table FA-3 BPA Criteria used in Habitat Model

BPA Criterion	Description
Criteria F – Ecosystem Diversity	This criterion describes habitat complexity, based on the number and size of ecosystems and wetlands present in an area (Queensland Environmental Protection Agency (EPA) (now DERM, 2002). The concepts of 'richness' (number of different ecosystems) and 'evenness' (relative abundance of ecosystems) are considered when attributing an Ecosystem Diversity rating to a particular area (EPA, 2002). By way of example, areas with high Ecosystem Diversity typically have relatively many REs and ecotones (EPA, 2002). Simpson's Diversity Index is used to determine Ecosystem Diversity (EPA, 2002). Ecosystem Diversity is rated as: Low, Medium, High or Very High for individual remnant vegetation units (i.e. RE polygons).
Criteria G – Context and Connection	This criterion is based upon the extent to which a mapped RE polygon incorporates or buffers other ecologically noteworthy areas (i.e. other remnant vegetation units and/or wetlands/waterways) (EPA, 2002). With respect to connection, remnant vegetation units that are connected to other REs are considered to be more representative of biodiversity, contribute more to a habitat network (i.e. connectivity) and exhibit greater resilience to disturbance (EPA, 2002). The extent to which an RE incorporates/buffers/connects to other mapped vegetation and/or wetlands/waterways determines its BPA (Criteria G) rating: Low, Medium, High or Very High for individual remnant vegetation units (i.e. RE polygons).

In addition to the Essential Habitat factors and BPA criteria, the habitat model considered proximity to mapped waterways (i.e. rivers, streams, wetlands), where this was considered to be an important habitat feature.

The outputs of the model allowed for four potential habitat categories to be mapped:

- 'Confirmed habitat';
- 'High value potential habitat';
- 'Low value potential habitat'; and
- 'Generally not suitable as habitat'.

Where confirmed records of a species were available (based on EIS/SEIS records and/or historic (publically-available) point records), a 5 km buffer about the locality was selected as 'confirmed habitat'.

For the 'potential habitat' categories the primary mapping criterion (filter) was Queensland DERM RE mapping (Version 6.0b) (amended based on field observations at selected locations). Subsequent criteria used to value habitat varied by species, and included:

- Ecosystem Diversity (Criteria F) and Context and Connection (Criteria G) rating (of mapped RE polygon (as selected via primary filter)) – these values were extracted from the Queensland DERM Biodiversity Planning Assessment mapping for the Project study area;
- Proximity of RE polygon to water sources (natural and artificial) – proximity varied by species depending on degree of association with water;
- Altitude (species-specific information acquired from DERM Essential Habitat factors database, where available); and

- Where the primary criterion (i.e. REs attributed to individual species) did not occur, or where available information on species' distribution indicated lack of presence, RE polygons (or non-remnant patches) were mapped as 'generally not suitable'.

Habitat mapping was undertaken at two scales:

- Regional scale: a map displaying the Project area and surrounding landscape, with all four habitat categories mapped across the landscape; and
- Mine study area ('local') scale: a map series displaying 'confirmed habitat', 'high value potential habitat' and 'low value potential habitat' within the MLA.

A 'direct impact buffer' was overlaid on the habitat maps (regional and Project study area). This buffer comprises the direct disturbance footprint as displayed in Figure FA-2.

An 'indirect impact buffer' distance was determined, based on a review of Project EIS results and relevant literature. This review, which took into account indirect impacts associated with noise, vibration, light, dust and invasive species and produced a series of contours which were then applied in the impact assessment. It is discussed in detail in section FA.4.4.1.

To inform analyses relating to habitat fragmentation, the BPA mapping Criteria J (Corridors) was applied to the habitat maps and direct and indirect impacts were assessed accordingly.

FA.4.4.1 Indirect Impacts

Indirect impacts have been defined as identified alterations to the environment surrounding the Project in which MNES may exist, that may cause degradation to a point where MNES are negatively impacted. Based on this definition, the indirect impacts anticipated as a result of the Project can be categorised as noise, vibration, light, dust, invasive species, groundwater drawdown and subsidence.

As this is a spatial study, in order to assess the scale of indirect impacts on MNES it was necessary to calculate the spatial extent of each impact. This calculation resulted in a series of indirect impact contours which, when combined, created an indirect impact footprint which could be used in quantifying the indirect impact spatially. Where indirect impacts were determined to overlap directly impacted areas, the direct impact nullified the indirect impact based on the assumption that MNES could not exist once directly impacted. In such circumstances the area of overlap was not accounted for in the indirect impact analysis.

A description of the indirect impacts and their spatial extents follows.

FA.4.4.1.1 Noise

Noise has the potential to cause stress, hearing damage and behavioural changes (van der Ree *et al*., 2008). It may also increase the susceptibility of some animals to predation (reduced predator avoidance). Studies undertaken for roadside noise effects on birds, the most well studied species in this instance, impacts are most significant between 50 and 70 dB(A) at distances of < 100 m while mammals are generally less impacted (FWHA, 2004). Noise is not a recognised threat to priority vertebrate fauna taxa listed in the Burdekin Natural Resource Management (NRM) Region *Back on Track Actions for Biodiversity* report (the 'Back on Track report') (Department of Environment and Resource Management, 2010).

As such, a worst-case scenario 60 dB contour from all proposed works has been modelled and a buffer distance of 200 m from the edge of the contour will be added, to provide an indirect impact buffer zone.

FA.4.4.1.2 Dust

There are currently no air quality (dust) goals or standards defined for the protection of flora and fauna. The available information suggests that the standards and goals that are currently defined to protect human health and amenity are more stringent than required to protect against dust impacts on flora and fauna. A review of the available research work on dust impacts on vegetation was undertaken for the Curragh North Project (Doley 2003). This review concluded that:

- Mineral dusts, resulting from mining, quarrying, road operations, mineral processing, and wind erosion may be deposited on vegetation to the extent that they impede growth and threaten the survival of plants.
- Dusts that are chemically inert, or which do not markedly alter substrate pH, are generally effective [adversely affecting plant growth] if the dust load is greater than 5 g/m^2.
- Model calculations on a cotton crop suggest that dust loads of 5 g/m² or dust deposition rates of 500 mg/m²/day are unlikely to have a detectable effect on vegetative growth under the sunny conditions most conducive to cotton growth. A dust deposition rate of 1,000 mg/m²/day is predicted to result in measurable reductions in crop growth during overcast weather, but the effect may be more difficult to detect in sunny weather

Although there is no cotton crops in the project area a precautionary threshold of dust deposition rate of 500 mg/m²/day has been adopted as a threshold for any likely adverse impacts on surrounding vegetation. We have modelled the likely contour at which this deposition rate will exist thereby formulating the indirect impact contour.

FA.4.4.1.3 Vibration

Calculations indicate that blasts requiring up to 1,300 kg maximum instantaneous charge would not exceed the most stringent 115 dB(L) overpressure criterion at any of the identified sensitive receptor locations the closest of which is approximately 7 km. At this location overpressure levels of no more than 113 dB(L) are predicted.

Holthuijzen et al. (1990) experimentally examined the influence of blasting regimes at mines on nesting prairie falcons, testing tolerance of up to 140 dB, finding no observable effects to blasts in the range 560 – 1,000 m. Call (1979) suggested that new mining operations should not be allowed within 800 m of existing non-habituated prairie falcon pairs. (Ruddock & Whitfield, 2007) Because vibration impacts vary between species and will be intermittent a conservative buffer distance of 1,000 m from the edge of the pit has been applied.

FA.4.4.1.4 Light

Lighting associated with construction works at night will be implemented in a manner to reduce light pollution into the surrounding area (i.e. directional lighting, lighting with protective guards). It is considered unlikely that construction-related light will extend far beyond the immediate construction area, and as such, any adverse impacts (i.e. behavioural disruption, increased predator exposure) will be extremely localised. Light pollution is not recognised as a threat to priority vertebrate fauna taxa listed in the Burdekin NRM Region Back on Track report. The Commonwealth Government's *Review of mitigation measures used to deal with the issues of habitat fragmentation* report (van der Ree *et al.*, 2008) does not discuss light pollution beyond identifying it as a potential indirect impact associated with linear infrastructure. It is not considered likely that construction and/or operational lighting will be of consequence beyond approximately 50 m from the edge of the established disturbance footprint.

FA.4.4.1.5 Invasive Species

Construction activities may spread weeds via construction vehicles and plant, and the movement of soil (fill). Clearing of previously undisturbed vegetation may facilitate the spread of disturbance-tolerant animals and plants. The creation of an edge (the side of a directly impacted area) in previously undisturbed areas may facilitate the growth of disturbance-tolerant, highly competitive weed species, due to alteration of localised conditions at that edge (i.e. greater exposure to sunlight, wind – 'edge effects').

The Commonwealth Government's *Review of mitigation measures used to deal with the issues of habitat fragmentation* report (van der Ree *et al.*, 2008) summarises literature on habitat fragmentation impacts (and mitigation measures) associated with linear infrastructure. With respect to edge effects, of which weed incursion is a notable factor, van der Ree *et al.* (2008) reported that linear infrastructure projects may allow for weed proliferation where previously undisturbed areas are cleared.

Whilst strategies will be implemented to minimise the potential for invasive species impacts during the construction and operational phases of the Project, and in recognition of current disturbances, the risk associated with invasive species for threatened fauna and flora are sufficiently high that a conservative approach to describing indirect impacts has been adopted. Thus, a 100 m buffer from the edge of the established disturbance footprint has been applied.

FA.4.4.1.6 Groundwater

The impacts of groundwater drawdown on vegetation communities within the Project site are regarded as low. There are no identified groundwater dependent ecosystems located on the Project site, and the groundwater piezometeric levels associated with usable aquifers are at depths >20 m and thus not accessible to the existing vegetation. Current information (groundwater level monitoring on site) indicates little or no hydraulic connectivity (linkage) between the piezometeric groundwater levels (associated with the underlying confined aquifers) and the ephemeral surface water resources or perched water tables. Thus any decrease in groundwater levels, due to mine depressurisation will not impact on the vegetation communities.

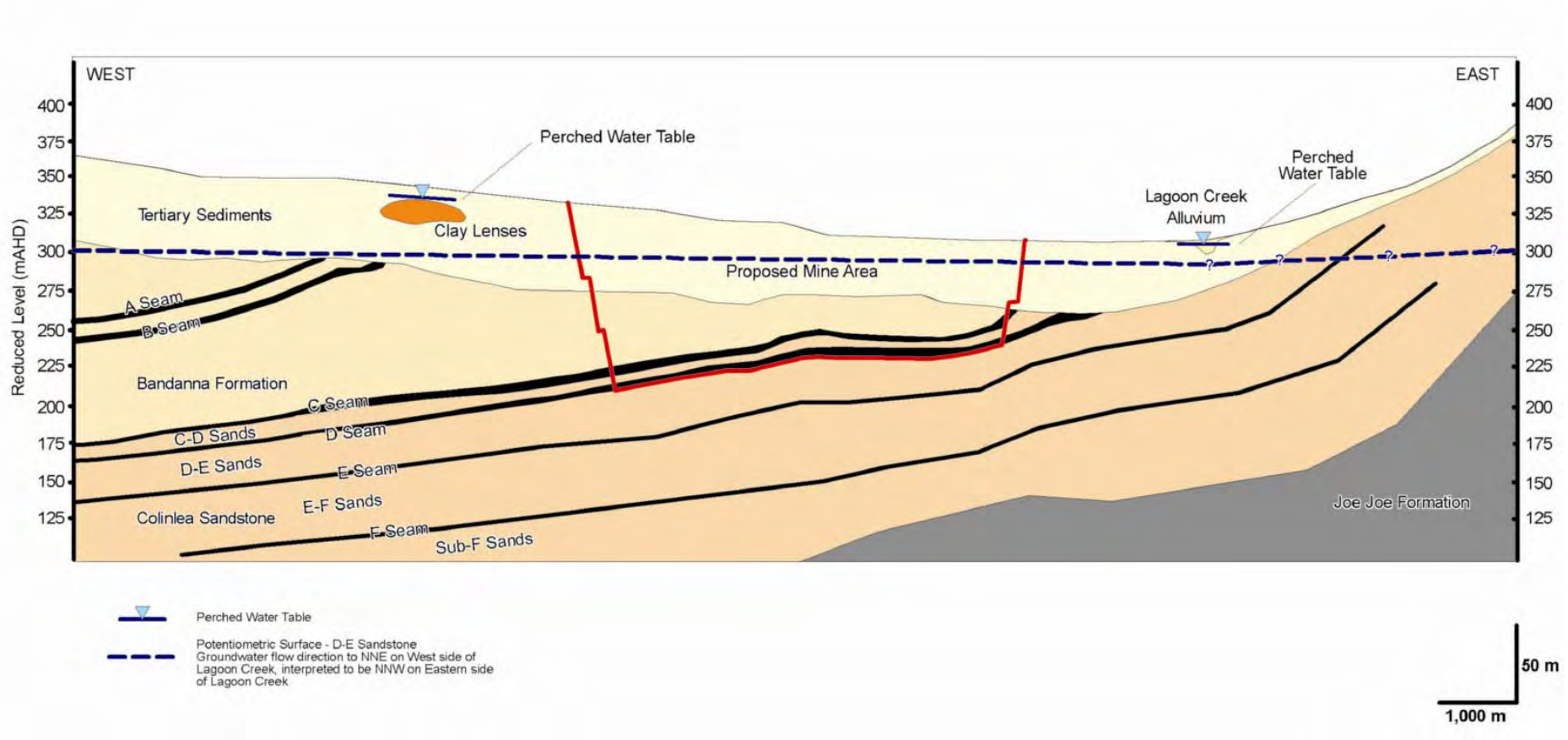
Incidents of isolated perched groundwater during and immediately after the wet season, within the weathered Tertiary laterite and saprolite and clay-rich Quaternary alluvium, where groundwater has been recorded at depths of 0.5 to 1.5 m below surface, are possible (Figure FA-6). These perched water tables may provide limited water (low sustainable volumes) for local vegetation communities.

Based on the low permeability of the Tertiary laterite and saprolite and the very low topographic gradients, drawdown within these Tertiary units, resulting from open pit mining, would be limited to some 10 to 100 m around the pits. Any perched water within this zone would be expected to report to the open pit. The vegetation in the area immediately adjacent to the mine pit will, however, be disturbed / removed due to the envisaged infrastructure (surface water levees, roads, water and power easements, etc.).

In order to validate this conceptualisation and obtain additional groundwater - surface water interaction information across the entire mine site, nested bores, comprising shallow (~ 10 m into the weathered Tertiary and Quaternary alluvium) and deep (~ 30 m into the underlying coal seam aquifers) are being constructed along Sandy Creek. These bores will allow for further assessment of possible hydraulic connectivity.

Overall we have selected a 200 m buffer from the edge of the mine pits in a conservative effort to minimise the potential of indirectly impacting Groundwater Dependent Ecosystems (GDE's).

Figure FA-6: Perched water tables and the potentiometric surface in relation to the proposed Mine Area



FA.4.4.2 Impact Quantification

Quantification of the amount of potential habitat for each threatened flora and fauna species was undertaken with respect to the area (and relative proportion) of potential habitat (confirmed, high value and low value) affected by direct impacts and indirect impacts.

FA.4.4.3 Model Validation

To test the outputs of the model, habitat mapping for the black-throated finch (southern) was undertaken for the Townsville region, using the same criteria as those applied to the Project study area and surrounding landscape. The potential habitat map that was produced for the Townsville region was compared with the 'map of important areas' for the black-throated finch (southern) as presented in the Significant Impact Guidelines for the Endangered Black-Throated Finch (southern) (*Poephila cincta cincta*) (Commonwealth Department of Environment, Water, Heritage and the Arts (DEWHA – now SEWPAC), 2009). The 'map of important areas' depicts sighting records with a 5 km buffer about each record. When compared, the potential habitat map produced via the habitat model closely resembled the 'map of important areas' in that important areas were generally identified as 'high value potential habitat' for the subspecies. 'Low value potential habitat' typically corresponded with areas adjacent to mapped 'important' areas'. The results of this visual comparison instilled confidence in the validity of the habitat modelling and mapping process.

FA.4.4.4 Model and Mapping Assumptions

Importantly, the potential habitat mapping outputs have limitations. That is, the model attempts to describe 'potential habitat' based on key habitat features at a regional scale, but does not attempt to describe or predict where a particular species might occur. This is an important differentiation, as there are a number of factors that contribute to where a species occurs in the landscape. This not only includes those habitat factors that are important and naturally occur in the landscape (vegetation communities, floristic composition, water availability, food and shelter resources, local micro habitat features), but may also include those disturbance factors that have a negative effect on distribution and abundance (habitat condition, introduced species abundance, past land use).

The modelling and mapping process does not take into account localised features, previous disturbance (other than remnant vegetation current extent), relationships with introduced species, local habitat condition or current land use. It takes key habitat features at a regional scale that can be spatially represented to describe potential habitat. For this reason, the mapping outputs of potential habitat do not reflect current distribution or predict occurrence of a species and indeed provides an overestimate of where species actually occur.

Likewise, while potential habitat has been mapped, it is not considered that all potential habitat is occupied. Therefore any quantification of potential direct and indirect impact is relevant only to potential habitat, and not occupied habitat.

The habitat modelling and mapping exercise was also underpinned by a number of assumptions. Habitat criteria for individual species were based on the **available information** for that species, with a conservative approach to capturing all potential habitat applied (based on an understanding of species' habitat requirements and distribution).

The geospatial data incorporated into the model may be susceptible to inaccuracies, particularly where ground-truthing of the data has not been undertaken, or has not been included in the assessment to date. Where a particular habitat feature (i.e. an RE) occurred as part of a mapped mixed polygon (a vegetation unit comprising a number of different REs), it was only considered to be potential habitat where the specified 'habitat' RE comprised at least 20% of the mapped vegetation unit. The 20% limit

is a conservative approach that allows for mixed polygons that include specified REs to be accommodated in the modelling process.

Habitat value was informed by applying Queensland DERM BPA mapping data to the model. Field observations relating to habitat value in the rail study area will be incorporated into the discussion of potential impacts to habitat for threatened species.

In general, the modelling and mapping exercise sought to identify where potential habitat occurred for each species over an extent of several thousand square kilometres. While the actual occurrence and value of potential habitat 'on the ground' may not be reflected by the mapping in some instances (i.e. where vegetation mapping inaccuracies occur or where habitat value is diminished due to localised degrading processes), the conservative approach applied and the model validation indicate that the process will allow for a more realistic assessment of impacts of the Project to threatened species and TECs upon further refinement.

Further refinement and review of the habitat mapping, including assessment of additional site specific information, will be undertaken as part of planned ongoing studies. The updates will be available to inform the assessment of direct and indirect impacts, and finalisation of the offsets strategy.

FA.4.5 Assessment of Impacts on Flora and Fauna

Desktop information, field survey results and habitat mapping were analysed to identify potential impacts to EPBC Act-listed threatened and migratory fauna of relevance to the Project study area. This assessment included:

- A review of impacting processes (including EPBC Act-listed key threatening processes, and Project (Mine) -specific direct and indirect impacts) potentially applicable to EPBC Act-listed threatened and migratory fauna;
- Quantification of direct and indirect impacts to potential habitat for EPBC Act-listed threatened and migratory fauna, including:
  - Comparative analysis of amount of potential habitat exposed to *direct impacts* with amount of potential habitat available in regional landscape (as defined in Section 7.2.1 - where regional landscape is the landscape surrounding the Project study area as depicted on a map sheet at a scale of 1:500,000).
  - Comparative analysis of amount of potential habitat exposed to *indirect impacts* with amount of potential habitat available in regional landscape (as defined in Section 7.2.2- where regional landscape is the landscape surrounding the Project study area as depicted on a map sheet at a scale of 1:500,000).
- Discussion of impacts on a species-by-species basis, including assessment of significance of impacts in accordance with the Commonwealth's *Significant Impact Guidelines 1.1 – Matters of National Environmental Significance* (DEWHA (now SEWPAC), 2009b);
- Identification of areas in the Project area where impacts to numerous MNES may occur (overlay of potential habitat for all threatened species (flora and fauna) and TECs; and
- Description of proposed mitigation measures (as presented in Alpha Coal Project (Mine) EIS, and where these measures should be targeted based on results of impact assessment.

FA.5 Flora and Fauna Assessment Results – Desktop, Field and Habitat Mapping

Detailed in Table FA.4 below is a summary of the desktop assessment, field survey and habitat mapping results for each of the 14 threatened species and three TECs of relevance to the Project study area. Further information on each of these MNES, including habitat mapping, is presented in Appendix FA.A of this report. An assessment of impacts to these MNES is provided in Section F.6.7 below.

Table FA-4 Summary of Results – Threatened Flora and Fauna

Species	Desktop assessment results	Field survey effort and results	Likelihood of Occurrence	Description of habitat mapping
Threatened Ecological Communities				
Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin	This TEC was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool.	Flora surveys at the site did not identify this TEC nor any of its constituent Regional Ecosystems.	Unlikely	As the TEC was considered unlikely to occur on the site it was not mapped
Brigalow (Acacia harpophylla dominant and co-dominant)	This TEC was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool.	Flora surveys at the site did not identify this TEC nor any of its constituent Regional Ecosystems.	Unlikely	As the TEC was considered unlikely to occur on the site it was not mapped
Weeping Myall Woodlands	This TEC was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool.	Flora surveys at the site did not identify this TEC nor any of its constituent Regional Ecosystems.	Unlikely	As the TEC was considered unlikely to occur on the site it was not mapped
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	This TEC was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool.	Flora surveys at the site did not identify this TEC nor any of its constituent Regional Ecosystems.	Unlikely	As the TEC was considered unlikely to occur on the site it was not mapped
The community of native species dependent on natural discharge of groundwater from the Great Artesian Basin	This TEC was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool.	Flora surveys at the site did not identify this TEC nor any of its constituent Regional Ecosystems.	Unlikely	As the TEC was considered unlikely to occur on the site it was not mapped

Species	Desktop assessment results	Field survey effort and results	Likelihood of Occurrence	Description of habitat mapping
Plants				
Acacia ramiflora	The species was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool. This species was not catalogued within the Queensland DERM Wildlife Online and Queensland Herbarium HERBRECS databases.	Flora assessments undertaken at in accordance with the methodologies detailed in Section FA.2 *Acacia ramiflora* was not detected from the Project study area during field surveys.	Unlikely to occur	As the Species was considered unlikely to occur it was not mapped
Cadellia pentastylis (Ooline)	The species was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool. This species was not catalogued within the Queensland DERM Wildlife Online and Queensland Herbarium HERBRECS databases.	Flora assessments undertaken at sites depicted in accordance with the methodologies detailed in Section FA.4.2 *Cadellia pentastylis* was not detected from the Project study area during field surveys.	Unlikely to occur	As the Species was considered unlikely to occur it was not mapped
Corymbia clandestina	This species was identified within the Queensland DERM Wildlife Online Search. The species was not predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool and was not catalogued within the Queensland DERM Wildlife Online and Queensland Herbarium HERBRECS databases.	Flora assessments undertaken at sites depicted in accordance with the methodologies detailed in Section FA.4.2 *Corymbia clandestina* was not detected from the Project study area during field surveys.	Unlikely to occur	As the Species was considered unlikely to occur it was not mapped

Species	Desktop assessment results	Field survey effort and results	Likelihood of Occurrence	Description of habitat mapping
Dichanthium queenslandicum (King Bluegrass)	The species was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool. This species was not catalogued within the Queensland DERM Wildlife Online and Queensland Herbarium HERBRECS databases.	Flora assessments undertaken at sites depicted in accordance with the methodologies detailed in Section FA.4.2 *Dichanthium queenslandicum* was not detected from the Project study area during field surveys.	Low likelihood of occurring	Relatively small amounts of potential high value and low value habitat for *Dichanthium queenslandicum* was mapped at the north east of the mine site. One portion of the habitat was mapped as crossing into the boundary of the Alpha MLA
Birds				
Geophaps scripta scripta (squatter pigeon southern)	The squatter pigeon was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool and the Queensland DERM Wildlife Online database returned a record of this species.	Fauna assessments were undertaken in accordance with the methodologies detailed in Section FA.4.3. The southern squatter pigeon was recorded during the survey within the Non-remnant Grassland vegetation community.	Confirmed occurrence	Much of the regional landscape surrounding the mine area and within the Project MLA contains potential high and low value habitat for the squatter pigeon.
Neochmia ruficauda ruficauda (star finch)	The star finch was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool. The Queensland DERM Wildlife Online database did not return a record of this species.	Fauna assessments were undertaken in accordance with the methodologies detailed in Section FA.4.3. Targeted field surveys failed to confirm the presence of any individuals in the study area.	Moderate likelihood of occurring.	Neither the regional landscape surrounding the Project MLA, nor the MLA itself contain a large amount of potential high or low value habitat for the Star Finch. The habitat that does exist is largely centred around waterways but is significantly fragmented.
Erythrotriorchis radiatus (red goshawk)	The red goshawk was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool and the Queensland DERM Wildlife Online database returned a record of this species.	Fauna assessments were undertaken in accordance with the methodologies detailed in Section FA.4.3. Targeted field surveys failed to confirm the presence of any individuals in the study area.	Low likelihood of occurring.	Much of the regional landscape surrounding the mine area and within the Project MLA contains potential high and low value habitat for the red goshawk.

Species	Desktop assessment results	Field survey effort and results	Likelihood of Occurrence	Description of habitat mapping
Rostratula australis (Australian painted snipe)	The Australian painted snipe was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool. The Queensland DERM Wildlife Online database did not return a record of this species.	Fauna assessments were undertaken in accordance with the methodologies detailed in Section FA.4.3. Targeted field surveys failed to confirm the presence of any individuals in the study area.	Low likelihood of occurring	Potential high and low value habitat for the Australian painted snipe is sparsely represented throughout the Project MLA and the surrounding region.
Poephila cincta cincta (black-throated finch)	The black-throated finch (southern) was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool. No historical records of this species were returned from a query of relevant databases.	Fauna assessments were undertaken in accordance with the methodologies detailed in Section FA.4.3. Targeted field surveys failed to confirm the presence of any individuals in the study area.	Low likelihood of occurring	Much of the regional landscape surrounding the mine area and within the Project MLA contains potential high and low value habitat for the black-throated finch.
Mammals				
Nyctophilus timoriensis (greater long-eared bat)	The greater long-eared bat was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool. No historical records of this species.	Fauna assessments were undertaken in accordance with the methodologies detailed in Section FA.4.3. The greater long-eared bat was not detected from the Project study area during field surveys.	Low likelihood of occurrence.	Much of the regional landscape surrounding the mine area and within the Project MLA contains potential high and low value habitat for the greater long-eared bat.
Dasyurus hallucatus (northern quoll)	The northern quoll was predicted to occur in the Project study area by the Commonwealth Protected Matters Search Tool. The Queensland DERM Wildlife Online database returned a record of this species.	Fauna assessments were undertaken in accordance with the methodologies detailed in Section FA.4.3. The northern quoll was not detected from the Project study area during field surveys.	Unlikely to occur.	As the Species was considered unlikely to occur it was not mapped

Species	Desktop assessment results	Field survey effort and results	Likelihood of Occurrence	Description of habitat mapping
Lasiorhinus krefftii (northern hairy-nosed wombat)	The northern hairy-nosed wombat was predicted to occur in the Project study area by the Commonwealth Protected Matters Search Tool. The Queensland DERM Wildlife Online database did not return a record of this species.	Fauna assessments were undertaken in accordance with the methodologies detailed in Section FA.4.3. The northern hairy-nosed wombat was not detected from the Project study area during field surveys.	Unlikely to occur.	As the Species was considered unlikely to occur it was not mapped
Sminthopsis douglasi (julia creek dunnart southern)	The Julia creek dunnart (southern) was predicted to occur in the Project study area by the Commonwealth Protected Matters Search Tool. The Queensland DERM Wildlife Online database did not return a record of this species.	Fauna assessments were undertaken in accordance with the methodologies detailed in Section FA.4.3. The Julia creek dunnart (southern) was not detected from the Project study area during field surveys.	Unlikely to occur.	As the Species was considered unlikely to occur it was not mapped
Reptiles				
Denisonia maculata (ornamental snake)	The ornamental snake was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool. The Queensland DERM Wildlife Online database did not return a record of this species.	Fauna assessments were undertaken in accordance with the methodologies detailed in Section FA.4.3. The ornamental snake was not detected from the Project study area during field surveys.	Moderate likelihood of occurrence.	A reasonable proportion of the regional landscape to the east of the mine area has potential high and low value habitat for the ornamental snake. The is a very small area of low and high value habitat in the north east corner of the Project MLA.
Egernia rugosa (yaka skink)	The yaka skink finch was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool. The Queensland DERM Wildlife Online database returned a record of this species.	Fauna assessments were undertaken in accordance with the methodologies detailed in Section FA.4.3. The yaka skink was not detected from the Project study area during field surveys.	Moderate likelihood of occurrence.	Much of the regional landscape surrounding the mine area and within the Project MLA contains potential high and low value habitat for the yaka skink.

Species	Desktop assessment results	Field survey effort and results	Likelihood of Occurrence	Description of habitat mapping
Furina dunmalli (dunmall's snake)	The dunmall's snake was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool. The Queensland DERM Wildlife Online database did not return a record of this species.	Fauna assessments were undertaken in accordance with the methodologies detailed in Section FA.4.3. The dunmall's snake was not detected from the Project study area during field surveys.	Moderate likelihood of occurrence.	A reasonable proportion of the regional landscape to the east of the mine area has potential high and low value habitat for the dunmall's snake, however no potential habitat has is contained within the Project MLA.
Paradelma orientalis (brigalow scaly-foot)	The brigalow scaly-foot was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool. The Queensland DERM Wildlife Online database did not return a record of this species.	Fauna assessments were undertaken in accordance with the methodologies detailed in Section FA.4.3. The brigalow scaly-foot was not detected from the Project study area during field surveys.	Moderate likelihood of occurrence.	The majority of the regional landscape surrounding the mine area and all of the Project MLA, is devoid of potential high and low value habitat for the brigalow scaly-foot. The only potential habitat is over 50 km south of the Project MLA.
Rheodytes leukops (fitzroy river turtle)	The fitzroy river turtle was predicted to occur in the Project study area by the Commonwealth Protected Matters Search Tool. The Queensland DERM Wildlife Online database did not return a record of this species.	Fauna assessments were undertaken in accordance with the methodologies detailed in Section FA.4.3. The Fitzroy river turtle was not detected from the Project study area during field surveys.	Unlikely to occur	As the Species was considered unlikely to occur it was not mapped

FA.5.1 Listed Threatened Ecological Communities

The results of the EPBC Act Protected Matters Search Tool database search identified five EPBC Act listed Threatened Ecological Communities (TECs) as potentially being present within the mine study area (Table FA-4). Further desktop studies and analyses reduced the likelihood of these TEC's being present down to unlikely for the following reasons:

- Brigalow (*Acacia harpophylla* dominant and co-dominant);
  - The Project MLA is primarily within the Desert Uplands Bio-region and does not contain any of this TEC's constituent Regional Ecosystems.
- Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin;
  - The Project MLA is primarily within the Desert Uplands Bio-region and does not contain any of this TEC's constituent Regional Ecosystems.
- Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions;
  - The Project MLA is primarily within the Desert Uplands Bio-region and does not contain any of this TEC's constituent Regional Ecosystems.
- The community of native species dependent on natural discharge of groundwater from the Great Artesian Basin
  - The Project MLA does not contain any of this TEC's constituent Regional Ecosystems.
- Weeping Myall Woodlands.
  - While the Project MLA does contain one of this TEC's constituent Regional Ecosystems, Weeping Myall (*Acacia pendula*) is not present on site and therefore this TEC it is not considered to be present.

FA.5.1.1 Listed Migratory Species

The results of the original Protected Matters Search Tool indicated that ten EPBC Act listed Migratory fauna species may potentially occur within the Project site. During the field survey periods, the presence of two of these ten species was confirmed, and an additional 22 migratory species were sighted. After further additional desktop searches 4 more migratory species were indicated as potentially occurring on site.

In total, there were 12 species indicated through the combined desktop searches that were not confirmed on site, four of which were considered to have a moderate or high potential of being present within the mine study area, and the final 8 were considered to have a low or unlikely potential of being present within the Project site.

As habitat mapping for EPBC Act-listed threatened species is considered likely to also capture habitat for migratory species (including woodland birds, wetland and (freshwater) aquatic reptiles) it was not deemed necessary to map the potential migratory species habitat. Furthermore, mitigation measures and habitat offsets for the assessed threatened species are also likely to apply to migratory species.

Table FA-5 Migratory species indicated via desktop searches as potentially present within the project (Mine) study area

Scientific Name	Common Name	Likelihood of Occurrence
Accipiter novaehollandiae	Grey Goshawk	Low
Anas supeciliosa	Pacific Black Duck	Confirmed
Anthus novaeseelandiae	Australian Pipit	Confirmed
Apus pacificus	Fork-tailed Swift	Moderate
Aquila audax	Wedge-tailed Eagle	Confirmed
Ardea alba	Great Egret	Confirmed
Ardea ibis	Cattle Egret	High
Ardea intermedia	Intermediate Egret	Confirmed
Chenonetta jubata	Wood Duck	Confirmed
Anas gracilis	Grey Teal	Confirmed
Coracina novaehollandiae	Black-faced Cuckooshrike	Confirmed
Elanus axillaris	Black-shouldered Kite	Confirmed
Elseyornis melanops	Black-fronted Dotterel	Confirmed
Eurystomus orientalis	Dollarbird	Confirmed
Falco berigora	Brown Falcon	Confirmed
Falco cenchroides	Nankeen Kestrel	Confirmed
Falco hypoleucos	Grey Falcon	Low
Falco longipennis	Australian Hobby	Confirmed
Gallinago hardwickii	Latham's Snipe, Japanese Snipe	Low
Grus rubicunda	Brolga	Confirmed
Haliastur sphenurus	Whistling Kite	Confirmed
Haliaeetus leucogaster	White-bellied Sea-Eagle	Low
Hirundapus caudacutus	White-throated Needletail	Low
Lophoictinia isura	Square-tailed Kite	Unlikely
Merops ornatus	Rainbow Bee Eater	Confirmed
Myiagra cyanoleuca	Satin Flycatcher	Low
Nettapus coromandelianus	Cotton Pygmygoose	Moderate
Nycticorax caledonicus	Nankeen Night Heron	Confirmed
Pelecanus conspicillatus	Australian Pelican	Confirmed
Rostrtula benghalensis s. lat.	Painted Snipe	Low
Tadorna radjah	Radjah Shelduck	Moderate
Threskiornis molucca	White Ibis	Confirmed
Todiramphus macleayii	Forest Kingfisher	Confirmed
Todiramphus sanctus	Sacred Kingfisher	Confirmed
Vanellus miles	Masked Lapwing	Confirmed
Vanellus tricolor	Banded Lapwing	Confirmed

FA.6 Assessment of Impacts – Listed Flora and Fauna

FA.6.1 Introduction

The potential impacts of the Project are identified below and are considered as a consequence of the Project's construction and operation activities.

The construction of mine infrastructure has the potential to affect fauna populations through habitat loss, population isolation, edge and barrier effects, and an increase in mortality from mine activities and increased traffic and road use. The development of mine infrastructure will involve landscape modification procedures through vegetation clearing, a recognised threatening process that can affect different taxa in differing ways.

Barrier effects on fauna occur when a species is unable or unwilling to move between suitable habitats. This is caused by increased habitat fragmentation due to roadways and other mine infrastructure. Species most vulnerable to barrier effects are habitat specific fauna and low mobility species (where even a small reduction in movements can reduce genetic continuity within a population, hence reducing the effective population size). Species least vulnerable to barrier effects tend to be those that are highly mobile, including birds and larger mammals, although even these species can vary in their response to barriers. Low mobility species utilising the Project site have the potential to become genetically isolated. This occurs when individuals from a population within one fragment are unable to interbreed with individuals from populations in adjoining fragments.

The following potential impacts on fauna may result from the proposed works at the Project site:

- Land clearing and mining activities may reduce the available breeding and foraging habitat for fauna native species;
- Increased risk of fauna mortality resulting from vehicle strike and the destruction of tree hollows;
- Disruption of species behaviour;
- Increased habitat fragmentation and loss of connectivity across the mine infrastructure and pit areas;
- Diversion of these creeks will reduce the extent of riparian habitats and contribute to habitat fragmentation;
- An increase in noise, vibration and dust associated with the construction and operational phases of the Project may lead to the displacement of native species from their current home ranges;
- Changes in flow patters accompanied with an increased risk of sedimentation in riparian woodlands downstream of the proposed mine site. Higher levels of erosion can lead to a loss of morphological diversity in streams adversely affecting habitat quality that may result in biodiversity loss in affected areas;
- An increase of introduced fauna species identified as utilising the Project Site may occur, including the cane toad, feral pig, European rabbit, house mouse and feral goat;
- Mine-related infrastructure, such as sediment dams, may be accessible to fauna and may be additional water sources;
- Vegetation clearing will result in a localised reduction in the amount of roost and nesting sites, microhabitats and potential foraging areas for many fauna species. This would add population

pressure (such as competition for roost sites, mates and food resources) to resident bats in these adjacent areas and may potentially lead to decreased population viability; and

- Certain species, including the southern squatter pigeon, will be positively impacted by rehabilitation, providing grassland habitat which is not dominated by buffel grass.

FA.6.1.1 Critical Habitat

Habitat listed on the register of Critical Habitat (SEWPaC 2009) are areas of land that are defined as crucial to the survival of particular threatened species, populations or ecological communities.

There are no areas of recommended or declared Critical Habitat that are relevant to the Project site or the surrounding locality.

FA.6.1.2 Key Threatening Processes Listed Under the EPBC Act

There are eight Key Threatening Processes (KTP) relevant to the flora of the Project site and twelve relevant to Fauna of the Project site, listed under the EPBC Act. These are listed detailed below in Table FA-6.

Table FA-6 List of Key Threatened Processes relevant to EPBC-Listed Fauna and Flora of the Project site, with descriptions

Key Threatened Process	KTP Description	Relevance	
		Flora	Fauna
Land Clearance	Land clearance is defined as "*the destruction of the above ground biomass of native vegetation and its substantial replacement by non-local species or by human artefacts*" (TSSC 2001a). While the Project will require land clearance, with the adoption of mitigation measures the Project is considered unlikely to result in a significant increase to this KTP.	✓	✓
Competition and Land Degradation by Unmanaged Goats	Unmanaged Goats (*Capra hircus*) have the potential to result in significant land degradation, as well as direct impacts to a number of native and threatened species (DEWHA 2008a). This introduced species is known to occur in the Desert Uplands Bioregion (CDU 2001b), and was observed within the study area during site field surveys. However, assuming mitigation measures are adopted that aim to manage feral species within the Project site, the Project is considered unlikely to result in an increase to this KTP.	✓	✓
Dieback Caused by the Root-rot Fungus (Phytophthora cinnamomi)	There was no evidence of dieback caused by the Root-rot Fungus (*Phytophthora cinnamomi*) within the study area at the time of field surveys. However, the Project has the potential to spread this pathogen into the Project site, via infected machinery or the transport of infected soil material. Mitigation measures including the washing of at risk machinery prior to working on site and limiting the importation of any soil material will minimise the potential for impact on this KTP.	✓	✗
Competition and land degradation by rabbits	European Rabbits (*Oryctolagus cuniculus*) are considered to be one of Australia's most serious vertebrate pests. Rabbits threaten the survival of a number of native flora and fauna species, and vegetation communities; while the serious erosion problems caused by the species grazing and burrowing habits can have vast implications for landforms, geomorphic processes and sensitive sites, as well as primary industries (OEH 2011). This species is known to occur in the Desert Uplands Bioregion (CDU 2001b), and was observed within the study area during site field surveys. However, assuming mitigation measures are adopted that aim to manage feral species within the Project site, the Project is considered unlikely to result in an increase to this KTP.	✓	✓

Key Threatened Process	KTP Description	Relevance	
		Flora	Fauna
Invasion of Northern Australia by Gamba Grass and other introduced grasses	The introduced Gamba grass *Andropogon gayanus* is currently distributed throughout far-northern Queensland and coastal regions of the Northern Territory. Although Gamba Grass is not currently considered a threat to the Desert Uplands Bioregion, the species' distribution is believed to expand greatly in response to global climate change. Whereby the predicted effects of increasing mean temperature and changing rainfall is expected to cause a southerly shift in the species' distribution, allowing it to grow further south along the Queensland coast (QLD DPI 2008). As such, this species may pose a significant threat to the Project site in the future. Furthermore, 39 significant weeds have been recorded in the Desert Uplands Bioregion, of which 8 are introduced grasses including – Buffel Grass (*Cenchrus ciliaris)*, Burr Grass (*Cenchrus echinatus),* Olive Hymenachne (*Hymenachne emplexicaulis)*, Chinese Fountain Grass (*Pennisetum setaceum),* Johnson Grass (*Sorghum halepense),* Rat's Tail Grass (*Sporobolus spp.)* and Para Grass (*Urochloa mutica)* (CDU 2001a). Assuming mitigation measures are adopted that aim to manage invasive weed species within the Project site, the Project is considered unlikely to result in an increase to this KTP.	✓	✓
Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants	Escaped garden plants are believed to threaten the viability of a number of threatened native species and ecological communities throughout Australia. The invasion of escaped garden plants can have a number of adverse impacts on native species, including - genetic effects, introduction of disease, competition for resources, prevention of recruitment, alteration of ecosystem processes and changes to the abundance of native flora and fauna (TSSC 2010). There are 7 invasive garden plants that are now recognised as Weeds of National Significance that are known occur within the Desert Uplands Bioregion (CDU 2001a, TSSC 2010). These include Athel pine (*Tamarix aphylla)*, Lantana (*Lantana camara),* Salvinia (*Salvinia molesta)*, Mesquite (*Prospis pallida)* and (*Prospis glandulosa x velutina),* Parkinsonia (*Parkinsonia aculeate)* and Rubber vine (*Cryptostegia grandiflora).* Assuming mitigation measures are adopted that aim to manage weed species within the Project site, the Project is considered unlikely to result in a significant increase to this KTP.	✓	✓
Loss of Terrestrial Climatic Habitat Caused by Anthropogenic Emissions of Greenhouse Gases	The Loss of Terrestrial Climatic Habitat caused by Anthropogenic Emissions of Greenhouse Gases is defined as the *reductions in the bioclimatic range within which a given species or ecological community exists due to emissions induced by human activities of greenhouse gases (TSSC 2001b)*. Climate change and associated impacts are considered unlikely to be significantly impacted by the Project. This KTP has been addressed in the Greenhouse Gas Assessment SEIS Volume 2, Appendix Q undertaken for this project.	✓	✓
Predation, Habitat Degradation, Competition and Disease Transmission by Feral Pigs	Feral pig (*Sus scrofa)* activity results in degradation of habitat, disease transmission, and increased competition for resources with native species as well as predation upon native species (TSSC 2001c). This introduced species is known to occur in the Desert Uplands Bioregion (CDU 2001b), and feral pig activity was observed in the study area during site field surveys. As such, mitigation measures are recommended to minimise the potential for the Project to result in an increase to this KTP.	✓	✓

Key Threatened Process	KTP Description	Relevance	
		Flora	Fauna
Predation by European Red Fox	The European Red Fox (*Vulpes vulpes)* is known to occur in the Desert Uplands Bioregion (CDU 2001b), however was not observed within the study area during site field surveys. Assuming mitigation measures are adopted that aim to manage feral species within the Project site, the Project is considered unlikely to result in an increase to this KTP.	×	✓
The biological effects, including lethal toxic ingestion, caused by Cane Toads (Bufo marinus).	Cane Toads (*Bufo marinus)* eat a wide variety of prey, breed opportunistically and have a far greater fecundity than native anurans. Cane Toads also have the potential to compete with native species for food and shelter. As all stages of the Cane Toad's lifecycle are poisonous, predators are susceptible to death by toxic ingestion (SEWPaC, 2010). This introduced species is known to occur in the Desert Uplands Bioregion (CDU 2001b), and was observed within the study area during site field surveys. Threatened species predicted or known* to occur within the Project area that are directly threatened by Cane Toads (TSSC 2005) include: • Rainbow Bee-eater* (*Merops ornatus*); • Ornamental Snake (Denisonia maculata); and • Northern Quoll (Dasyurus hallucatus). The Project has the potential to cause disturbance to the surrounding area, which may facilitate the movement of Cane Toads in the region and provide further habitat for the species. However, assuming mitigation measures are adopted that aim to manage feral species within the Project site, the Project is considered unlikely to result in an increase to this KTP.	×	✓
Psittacine Circoviral (Beak and Feather) Disease Affecting Endangered Psittacine Species	Beak and feather *(Psittacine Circoviral*) disease is a disease affecting parrots and their allies (psittacines). It is often fatal to birds that contract it, and most species do not respond to treatment (TSSC 2001d). The Project is considered unlikely to result in an increase to this KTP, as there are unlikely to be any additional pressures placed on threatened avian species within the locality, assuming mitigation measures are adopted.	×	✓
Infection of Amphibians with Chytrid Fungus Resulting in Chtreidiomycosis	Chytrid fungus is known to threaten a number of listed frog species, and several common species also appear to be susceptible to it. Mitigation measures are recommended to minimise the potential for introduction of this fungus into the Project site, and should be adopted in order to ensure that the Project does not result in an increase to this KTP.	×	✓
Predation by Feral Cats	Feral cats (*Felis catus)* are a significant threat to native fauna on the Australian mainland and many offshore islands (DEWHA 2008b). This introduced species is known to occur in the Desert Uplands Bioregion (CDU 2001b), and was observed within the study area during site field surveys. However, assuming mitigation measures are adopted that aim to manage feral species within the Project site, the Project is considered unlikely to result in an increase to this KTP.	×	✓

FA.6.2 Impacts and Mitigation

Outlined below is a description of those processes related to the Project that have the potential to adversely affect flora and fauna species/ecological communities protected under the EPBC Act. For each impacting process, the following information is provided:

- An overview of the process including its causes and potential impacts
- How the impacting process relates to those EPBC Act-listed threatened flora species, TECs and threatened and migratory fauna species of relevance to the Project study area
- How the process will be managed and mitigated to avoid/minimise/reduce adverse impacts to those EPBC Act-listed threatened flora species, TECs and threatened and migratory fauna species of relevance to the Project study area

FA.6.2.1 Direct Impacts - Flora and Fauna

Direct impacts are defined as those areas of the project area that are physically disturbed (cleared) by the project activities including mining pit and mine infrastructure. The mine component disturbance area (as included in the SEIS) is presented in Figure FA-2. The disturbance area is a generic area designed to encompass all of the potential direct impact areas on the mining lease. The area has not been refined to remove areas between project elements (for example between the mine pit and the flood levees) that will not actually be directly impacted. As a result, the figure below is a conservative representation of the anticipated direct impact of the mine component of the project.

FA.6.2.1.1 Vegetation Clearance

Description of the Impact

Maintaining stands of vegetation across the Project site is important in order to maintain high biodiversity levels, carbon sequestration, and aiding ecosystems to maintain an assimilative capacity. Vegetation stands also help to combat the potential impacts of anthropogenic activities, by providing natural solutions to environmental problems, such as soil and bank stabilisation and reducing the risk of salinity and overland flow. Vegetation also provides important habitat for a range of fauna species.

Edge effects that result from the proposed works can include the establishment of weeds, alteration to microclimatic conditions (such as greater light intensity, more wind penetration, lower humidity) and a reduction in plant health through loss of photosynthetic potential (e.g. as a result of plants being covered by dust generated from vehicle movement on unsealed tracks). In the absence of appropriate control measures, the Project could cause environmental impacts in terms of edge effects and particularly, the introduction and / or spread of weed species throughout the Project site.

Relevance to Listed Flora and Fauna

The unavoidable loss of potential habitat for EPBC Act-listed threatened flora species, TECs and threatened and (and by proxy, migratory) fauna species of relevance to the Project study area was quantified via the habitat modeling and mapping exercise described in Section F.4.4

Potential habitat maps are provided in Appendix FA-A of this report.

Presented below are the results of this quantitative analysis with respect to mapped habitat that will experience direct impacts (i.e. habitat within the ‘direct impact footprint’ as defined in Section FA.4.4):

- Table FA-7 presents a quantification of the amount of mapped ‘high value potential habitat’ that will be exposed to direct impacts associated with vegetation clearing

- Table FA-8 presents a quantification of the amount of mapped ‘low value potential habitat’ that will be exposed to direct impacts associated with vegetation clearing

Table FA-7 Quantification of Direct Impacts to 'High Value Potential Habitat'

	A	B	C	D	E	F
	Direct impact - number of hectares of HVPH* impacted	Number of hectares of HVPH* in landscape#	% HVPH* in landscape# directly impacted i.e. (a/b)*100	Direct impact footprint area	% Direct impact footprint area that is HVPH* (i.e. a/d)*100	% HVPH* in landscape# i.e. (b/total area of landscape)*100
Plants						
Dichanthium queenslandicum (King Bluegrass)	0.00 ha	756 ha	0.00	20,618 ha	0.00	0.03
Birds						
Geophaps scripta scripta	6007 ha	329,846 ha	1.82	20,618 ha	29.14	14.36
Neochmia ruficauda ruficauda	212 ha	30,175 ha	0.71	20,618 ha	1.03	1.31
Erythrotriorchis radiatus	290 ha	51,631 ha	0.56	20,618 ha	1.41	2.25
Rostratula australis	220 ha	36,164 ha	0.61	20,618 ha	1.07	1.57
Poephila cincta cincta	7467 ha	182,660 ha	4.09	20,618 ha	36.22	7.95
Mammals						
Nyctophilus timoriensis (South eastern form)	412 ha	6,109 ha	0.67	20,618 ha	2.00	2.66
Reptiles						
Denisonia maculata	0.00 ha	135,919 ha	0.00	20,618 ha	0.00	5.92
Egernia rugosa	1,690 ha	448,242 ha	0.38	20,618 ha	8.2	19.52
Furina dunmalli	0.00 ha	141,826 ha	0.00	20,618 ha	0.00	6.18
Paradelma orientalis	0.00 ha	3,185 ha	0.00	20,618 ha	0.00	0.14

*HVPH – 'high value potential habitat'

- 'landscape' is the landscape surrounding the Project study area (within the Brigalow Belt and Desert Uplands bioregions) as depicted on a map sheet at a scale of 1:500,000)

Table FA-8 Quantification of Direct Impacts to 'Low Value Potential Habitat'

	A	B	C	D	E	F
	Direct impact - number of hectares of LVPH* impacted	Number of hectares of LVPH* in landscape#	% LVPH* in landscape# directly impacted i.e. (a/b)*100	Direct impact footprint area	% Direct impact footprint area that is LVPH* (i.e. a/d)*100	% LVPH* in landscape# i.e. (b/total area of landscape)*100
Plants						
Dichanthium queenslandicum (King Bluegrass)	0.00 ha	504 ha	0.00	20,618 ha	0.00	0.02
Birds						
Geophaps scripta scripta	3,570 ha	575,590 ha	0.62	20,618 ha	17.32	25.07
Neochmia ruficauda ruficauda	4,900 ha	225,408 ha	2.17	20,618 ha	23.77	9.82
Erythrotriorchis radiatus	9,287 ha	851,049 ha	1.09	20,618 ha	45.05	37.06
Rostratula australis	123.22 ha	81,431 ha	0.15	20,618 ha	0.60	3.55
Poephila cincta cincta	4,310 ha	909,067 ha	0.47	20,618 ha	20.90	39.59
Mammals						
Nyctophilus timoriensis (South eastern form)	11,365 ha	1,049,627 ha	1.08	20,618 ha	55.12	45.71
Reptiles						
Denisonia maculata	0.00 ha	206,439 ha	0.00	20,618 ha	0.00	8.99
Egernia rugosa	1,690 ha	448,242 ha	0.38	20,618 ha	8.20	19.52
Furina dunmalli	0.00 ha	156,381 ha	0.00	20,618 ha	0.00	6.81
Paradelma orientalis	0.00 ha	2,002 ha	0.00	20,618 ha	0.00	0.09

*LVPH – 'low value potential habitat'

- 'landscape' is the landscape surrounding the Project study area (within the Brigalow Belt and Desert Uplands bioregions) as depicted on a map sheet at a scale of 1:500,000)

How Impact will be Mitigated / Managed

Although the vegetation within the Project site is well-represented in the wider region and does not represent any EPBC Act listed communities, in recognition of the intrinsic value of ecological habitat, every effort will be made to keep proposed disturbance areas to a minimum.

Clearing of vegetation along Lagoon Creek will be minimised to maintain habitat connectivity and provide a movement corridor for small terrestrial fauna species. Whilst this community will be physically fragmented, the actual degree of habitat fragmentation is highly dependent on the mobility of the organism in question (McIntyre and Hobbs 1999) and disconnected areas may continue to be utilised by some species if kept intact. Given the abundance of this community in the wider region it is unlikely the disturbance will have a considerable impact on its ecological value or habitat provision.

Native vegetation removal will be conducted only after:

- The areas to be cleared have been clearly delineated and identified to equipment operators and supervisors;
- Weed control measures such as vehicle wash downs have been implemented to prevent the spread of weed species along riparian corridors;
- Appropriate erosion and sediment-control structures are in place; and
- Clearance from environmental staff has been obtained.

To maintain the integrity of vegetated land that is not cleared, appropriate erosion and sediment controls are recommended to prevent sediment deposition in remaining habitat. Maintenance of retained areas of existing vegetation would also provide a source of seed for mine rehabilitation works.

An offsets strategy will be continue to be developed in consultation with SEWPaC and Queensland State Agencies in an effort to offset significant impacts on habitat agreed as important to the survival of the EPBC listed species identified within this study.

FA.6.2.1.2 Fauna Mortality

Description of the Impact

Any construction activity undertaken in an undisturbed environment has the potential to cause wildlife mortality if animals are present when vegetation is cleared, or where animals venture into active construction zones. Construction of the mine will require clearance of native vegetation therefore fauna residing in this vegetation may experience direct mortality. Animals that are particularly at risk include those that shelter in hollows, beneath rocks, logs and bark and ground animals that tend to hide rather than flee at approaching danger.

Increased vehicular movements associated with construction and operational activities have the potential to increase the incidence of wildlife strike and road kill. However, given vehicle movements are expected to be relatively slow the risk is expected to be minimised. Similarly, wildlife that is highly mobile is at risk of being trapped or injured in open pits or trenches within the project site.

Relevance to Listed Flora and Fauna

Any species of conservation significance within the direct impact footprint are at risk of mortal impacts. Table FA.8 and Table FA.9 outlines the amount of potential high and low value habitat within the direct impact footprint for each species.

How Impact will be mitigated/managed

Measures will be taken to minimise harm to affected fauna communities by inspecting the vegetation to be disturbed prior to clearing to ascertain whether any fauna are present. If fauna is present, it will be given the opportunity to move on naturally before clearing occurs.

The southern Squatter Pigeon, recorded during the surveys is directly threatened by *clearing and fragmentation of grassy woodland habitat for agriculture and development* (Department of Environment and Conservation, 2004). Relevant habitat clearance related mitigation measures for this species should therefore include:

- Care should be taken to ensure no mortality occurs due to vehicle strike. The behavioral characteristics of this pigeon tends to make it vulnerable to such accidents in that it is known to freeze in an attempt to go unnoticed instead of fleeing like the majority of other birds. This species has commonly been observed on tracks and roadways and in areas of vehicle activity. Persons operating vehicles in and adjacent to the Project site should be made aware of the presence of this threatened species and the potential for it to be encountered on vehicle tracks;
- Fauna spotters should conduct a thorough survey of the site prior to any vegetation clearing to determine the location of any squatter pigeon nests. Particular attention should be given to areas of short dry grass, grass tussocks and under bushes and fallen logs. If nests are located, translocation of the eggs/young should be conducted by qualified personnel to a suitable nearby habitat;
- Control of pest species, such as the European Rabbit and Feral Goat in areas known to be foraging habitat; and pests such as the Feral Cat in areas where the Southern Squatter Pigeon is known to flock; and
- Raise awareness of this species through a staff induction program, including photos, descriptions and preferred habitat.

A trained ecologist or other suitably qualified environmental field supervisor will precede or accompany clearing crews when clearing significant vegetation, in order to ensure disturbance to threatened flora and other significant resources is minimised.

*FA.6.2.2*Indirect Impacts – Flora and Fauna

The indirect impacts were calculated based on each impacts rationale as outlined below. In some cases, due to the conservative nature of the current direct disturbance area (described above), the indirect impact will be nullified. An example of this is the groundwater indirect impact which has been calculated as a function of the distance to the mining pit. In many areas of the site the direct impact footprint extends beyond the potential impact envelope (200 m from the pit) resulting in no indirect impact in relation to groundwater in those areas.

FA.6.2.2.1 Habitat Fragmentation and East - West Connectivity

Description of Impact

Barrier effects on fauna occur when a species is unable or unwilling to move between suitable habitats. This is caused by increased habitat fragmentation due to the construction of roadways and other mine infrastructure. The species that are most vulnerable to barrier effects include habitat-specific fauna and low mobility species (where even a small reduction in mobility can reduce genetic continuity within a population, hence reducing the effective population size). Species least vulnerable to barrier effects tend to be those that are highly mobile, including birds and larger mammals, although even these species can vary in their response to barriers. Low mobility species utilising the Project site

have the potential to become genetically isolated. This occurs when individuals from a population within one fragment are unable to interbreed with individuals from populations in adjoining fragments.

Relevance to Listed Flora and Fauna

The Queensland DERM BPA mapping Criterion J ('Corridors') was applied to the habitat mapping (as presented in Appendix FA.A of this report). This criterion ensures both existing vegetated corridors important for contiguity including re-growth and cleared areas that could serve this purpose if revegetated are assessed. These corridors include riparian habitats, transport corridors and "stepping stones" for motile species.

As a result of this mapping exercise Brigalow Belt and Desert Uplands corridors were identified within the region of the Project (See maps produced in Appendix FA.A), however no corridors were identified within either the indirect or direct disturbance or the MLA of the Project (Mine).

FA.6.2.2.2 Water Resources and Pollution

Description of Impact

For riparian woodlands downstream of the proposed mine site, changes in stream flow patterns can possibly result in increased levels of stream erosion (depending on surface water diversion design) and thus elevated concentrations of suspended sediment. Higher levels of erosion can lead to a loss of morphological diversity in streams, thereby adversely affecting habitat quality. Such a reduction in habitat quality may also result in a loss of biodiversity in impacted areas.

Riparian habitat is in good condition across much of the Project Site but grazing pressures have caused bank erosion and siltation in some of the more accessible areas. Most stream beds are comprised of highly permeable coarse sands; however some smaller watercourses where Brigalow or Coolabah dominate the tree layer grow on less permeable clays where deeper waterholes provide a source of water into the dry season.

Mine water demands for the Project comprise:

- CHPP make-up water;
- Haul road and hardstand watering (dust suppression);
- Workshop and vehicle wash (Mining Infrastructure Area [MIA]);
- Potable water; and
- Miscellaneous uses, such as construction water.

One of the waterways within the Project, Lagoon Creek, will need to be partly diverted at the commencement of the Project in order to facilitate mining operations and minimize sterilization of coal. The planned diversion of Lagoon Creek is 300 m wide, and extends for approximately 9 km and may result in some impacts on the environmental values of the aquatic flora and fauna:

- Clearing of riparian vegetation may result in erosion and sedimentation-related impacts, especially in the early years after the diversion, prior to re-establishment of foliage;
- Clearing of riparian vegetation may result in fragmentation of a valuable wildlife corridor, which, while not a major issue for mobile species (birds, bats), can be detrimental for the smaller terrestrial species; and
- Works occurring in the creek during and immediately following periods of flow may impede fish movements.

Relevance to Listed Flora and Fauna

Changes to water quality and hydrology as a result of the Project (Mine) may impact upon the quality of habitat for EPBC Act-listed species associated with the aquatic environment. EPBC-Act listed fauna that may utilise riparian habitats include the black-throated finch (southern), squatter pigeon (southern), red goshawk, Australian painted snipe, northern quoll and ornamental snake

How Impact will be mitigated/managed

The creek diversion will be designed to mimic the natural materials and geometry of Lagoon Creek as much as possible. The Australian Coal Association Research Program (ACARP) has conducted research into 'Design and Rehabilitation Criteria for Bowen Basin River Diversions' (July 2002) and the Department of Natural Resources and Mines has created the Central West Water Management and Use Regional Guideline: Watercourse Diversions – Central Queensland Mining Industry. These references will be considered in the design for maximising the environmental performance of the Lagoon Creek diversion.

To help mitigate and reduce potential environmental harm associated with the creek diversion, the following measures will be actioned:

- Clearing of riparian vegetation for the proposed creek diversion will be conducted in a staged manner, to allow fauna to migrate to adjacent habitat areas;
- Works to divert Lagoon Creek will be conducted when minimal (if any) water is present (preferably during the dry season) so as to reduce impacts to fish movements; and
- The creek diversion rehabilitation will be monitored to ensure the vegetation is stable and self sustaining

The following strategies will be implemented to help reduce potential environmental harm to the network of watercourses and aquatic environments on the Project site and throughout the broader catchment:

- Mine and process water will (where possible) be contained within a closed-loop system and recycled. No contaminated mine water or process water will be discharged from the Project site into the environment;
- Sediments traps will be designed and installed downstream of all land disturbances (such as water storage dams) in order to remove sediment from storm water that flows over such land disturbances; and
- A water quality, sediment quality and aquatic-fauna monitoring program will be initiated and continued throughout the Project life. This program will ensure the early detection and recording of Project impacts upon local surface water courses, thereby allowing mitigation strategies to be altered or developed.

The water quality monitoring program will include the following components:

- Establishment of surface water monitoring points in Lagoon Creek upstream of the Project site. Sampling will transpire immediately following first flow in the wet season and at a pre-determined calendar date during the dry season;
- Data from these sources will provide background water quality levels for comparison with downstream values;
- Sampling of Lagoon Creek, downstream of potential disturbances. The downstream results will be compared with those produced for upstream locations (which lie outside the impact area and the proposed creek diversion workings);

- Sampling of a variety of physico-chemical parameters that may be affected by mining activities such as heavy metals, dissolved oxygen, sedimentation, salinity etc.; and
- If the quality of water leaving the Project site deteriorates and is found to exceed background water-quality trigger values (i.e. ANZECC water quality values), then the Proponent will investigate the cause of such deterioration and report the results to DERM.

The aquatic fauna monitoring program will include:

- Annual sampling of aquatic fauna species (both vertebrate and invertebrate) following a significant rainfall event;
- Documentation of aquatic diversity and abundance;
- Inclusion of both downstream and upstream sampling locations, plus representative lacustrine and palustrine wetlands. Results from these locations will be compared;
- Collection and analysis of water quality at pre-determined monitoring locations including all identified aquatic environments; and
- Identification of sensitive species / habitat that could be used as indicators of stream health.

FA.6.2.2.3 Noise, Vibration and Light

Description of Impact

Construction and operation activities may cause increases in noise, vibration and light disturbance. This may result in localised disturbance to wildlife behaviours and dynamics (i.e. foraging, breeding and nesting) adjacent to the Project footprint. For example, exposure to unusual noise and light disturbance has been known to influence nesting behaviour and species richness in some sensitive species, especially birds (Francis *et al*., 2009). Increased lighting may also subject some native species to higher levels of predation.

Noise

Noise has the potential to cause stress, hearing damage and behavioural changes to some species (van der Ree *et al*., 2008). It may also increase the susceptibility of some animals to predation (reduced predator avoidance). The utilisation of suitable habitat near construction and operations areas may decrease as a result of increased noise.

Studies undertaken for roadside noise effects on birds, the most well studied species in this instance, impacts are most significant between 50 and 70 dB(A) at distances of < 100 m while mammals are generally less impacted (FWHA, 2004). As such, a worst-case scenario 60 dB contour from all proposed works has been modelled and a buffer distance of 200 m from the edge of the contour is being applied in assessing potential impacts.

Noise is not a recognised threat to priority vertebrate fauna taxa listed in the Burdekin Natural Resource Management (NRM) Region Back on Track Actions for Biodiversity report (the 'Back on Track report') (Department of Environment and Resource Management, 2010).

Vibration

Calculations indicate that blasts requiring up to 1,300 kg maximum instantaneous charge would not exceed the most stringent 115 dB(L) overpressure criterion at any of the identified sensitive receptor locations the closest of which is approximately 7 km. At this location overpressure levels of no more than 113 dB(L) are predicted.

Holthuijzen et al. (1990) experimentally examined the influence of blasting regimes at mines on nesting prairie falcons, testing tolerance of up to 140 dB, finding no observable effects to blasts in the range 560 – 1,000 m. Call (1979) suggested that new mining operations should not be allowed within 800 m of existing non-habituated prairie falcon pairs (Ruddock & Whitfield, 2007). Because vibration impacts vary between species and will be intermittent a conservative distance of 1,000 m from the edge of the pit is being applied in assessing potential impacts.

Vibration is not recognised as a threat to priority vertebrate fauna taxa listed in the Burdekin NRM Region Back on Track report. The Commonwealth Government's *Review of mitigation measures used to deal with the issues of habitat fragmentation* report (van der Ree *et al.*, 2008) does not discuss vibration beyond identifying it as a potential indirect impact associated with linear infrastructure.

Light

Lighting associated with construction works at night will be implemented in a manner to reduce light pollution into the surrounding area (i.e. directional lighting, lighting with protective guards). It is considered unlikely that construction-related light will extend far beyond the immediate construction area, and as such, any adverse impacts (i.e. behavioral disruption, increased predator exposure) will be extremely localised.

Light pollution is not recognised as a threat to priority vertebrate fauna taxa listed in the Burdekin NRM Region Back on Track report. The Commonwealth Government's *Review of mitigation measures used to deal with the issues of habitat fragmentation* report (van der Ree *et al.*, 2008) does not discuss light pollution beyond identifying it as a potential indirect impact associated with linear infrastructure. It is not considered likely that construction and/or operational lighting will be of consequence beyond approximately 50 m from the edge of the established disturbance footprint.

Relevance to Listed Flora and Fauna

Habitat degradation associated with noise, vibration and light may cause a reduction in the suitability of habitat for less-mobile species (i.e. ground-dwelling reptiles (ornamental snake, yakka skink, Dunmall's snake, brigalow scaly-foot), nesting birds (black-throated finch (southern), squatter pigeon (southern), red goshawk), and temporary avoidance of suitable habitat by more wide-ranging animals (i.e. northern Quoll, EPBC Act-listed threatened and migratory birds of relevance to mine study area). The extent of the impacts, as discussed above, is unlikely to extend beyond the following:

- Noise – 200 m from the edge of a modelled 60 dB noise contour.
- Vibration – 1,000 m from the edge of the open cut pit.
- Light – 50 m from the edge of the project disturbance area.

How Impacts will be mitigated/managed

In an effort to minimise the impacts of Noise, Vibration and Light on EPBC Listed species potentially occurring within the indirect impact zones, the following strategies will be adopted.

Noise and Vibration

The Proponent will:

- maintain all plant and equipment in good working order to ensure compliance with the noise criteria;
- site and design noise generating plant to comply with the applicable noise criteria at receptor locations outside of the mining lease boundary;

- develop a noise, vibration and overpressure monitoring program, making results of this monitoring available to the relevant authority upon request; and
- take immediate action to investigate and remedy any exceedance of the established noise, vibration or overpressure criteria; and

The following control strategies for blasting will be implemented:

- Carry out blasting only during daylight hours.
- Where there exists the possibility that instantaneous, short-duration, high-level noise events may occur during night-time hours (22:00 – 07:00), consideration will be given to the potential for the disturbance of sleep within residences and the accommodation village.
- Where monitoring or complaints indicate airblast overpressure or ground vibration levels of impact consistently above the environmental protection objectives, the following mitigations measures will be considered:
  - Reducing the maximum instantaneous charge (MIC) by using delays, reduced hole diameter and/or deck loading;
  - Changing the burden and spacing by altering the drilling pattern and/or delay layout, or altering the hole inclination;
  - Ensuring stemming depth and type is adequate; and
  - Restricting blasts to favourable weather conditions.

Light

Mitigation measures that may assist in minimising potential light spill include:

- Dust suppression programs;
- Shielding lights with hoods and louvers where practicable;
- Orientating workshop buildings within the mine disturbance area to minimise potential light spill; and
- Work programs will also be arranged, where possible, so that some activities to be carried out across surface areas of the mine that may be visible from surrounding view locations, occur within daylight hours of operation.

FA.6.2.2.4 Dust

Description of Impact

There are currently no air quality (dust) goals or standards defined for the protection of flora and fauna. The available information suggests that the standards and goals that are currently defined to protect human health and amenity are more stringent than required to protect against dust impacts on flora and fauna. A review of the available research work undertaken for the Curragh North Project on dust impacts on vegetation suggested a reduction in plant health through loss of photosynthetic potential as a result of plants being covered by dust was possible (Doley 2003). This review concluded that:

- Dusts that are chemically inert, or which do not markedly alter substrate pH, are generally effective [adversely affecting plant growth] if the dust load is greater than 5 g/m^2.
- Model calculations on a cotton crop suggest that dust loads of 5 g/m^2 or dust deposition rates of 500 $mg/m^2/day$ are unlikely to have a detectable effect on vegetative growth under the sunny

conditions most conducive to cotton growth. A dust deposition rate of 1,000 mg/m²/day is predicted to result in measurable reductions in crop growth during overcast weather, but the effect may be more difficult to detect in sunny weather

Although there is no cotton crops in the project area a precautionary threshold of dust deposition rate of 500 mg/m²/day has been adopted as a threshold for any likely adverse impacts on surrounding vegetation. We have modelled the likely contour at which this deposition rate will exist thereby formulating the indirect impact buffer zone (See mapping in Appendix FA.A of this report).

Relevance to Listed Flora and Fauna

As Mineral dusts, resulting from mining, quarrying, road operations, mineral processing, and wind erosion may be deposited on vegetation to the extent that they impede growth and threaten the survival of plants, project-related dust activities may have localised impacts on habitat that may be suitable for EPBC Act-listed flora and fauna.

How Impact will be mitigated/managed

Control of ambient levels of dust as a result of the operation of the Project may be achieved through reduction of source generation. This may be achieved using several management measures, including:

- Engineering control measures (partially included in the dispersion modelling);
- Dust suppression measures (partially included in the dispersion modelling);
- Rehabilitation of exposed surfaces (excluded from the dispersion modelling); and
- Operational procedures (excluded from the dispersion modelling).

Engineering Control Measures

The Proponent has designed engineering control measures into the project, where appropriate and technically possible. Controls incorporated in the dispersion modelling, that will be implemented on-site, include:

- In-Pit Crushing and Conveying (IPCC)

Additional control measures will be considered for application at the site that may further reduce dust emissions include:

- Enclosure of transfer points and sizing stations;
- Roof on overland conveyors;
- Belt washing and belt scrapers to minimise dust from the return conveyors;
- Reduced drop height from stackers to stockpiles; and
- Enclosure of raw coal surge bins.

Dust Suppression Measures

Dust suppression measures primarily include the application of water to control dust emissions. Measures that will be implemented include:

- Watering of haul roads (2 litres/m^2/hour of water applied);
- Additional dust suppression measures will be considered for application at the site that may further reduce dust emissions include:
- Watering of ROM stockpiles using water sprays as required,

  - For example, when dust is visibly observed as being generated from stockpiles due to stacking and reclaiming activities, or as a result of wind speed dependant emissions;
- Water sprays on stacker/reclaimer units;
- Water sprays at conveyor transfer points; and
- Optimal moisture content of product coal and reject material as they leave the CHPP which avoids the need for supplementary watering.

In the event that adverse conditions are encountered during operation of Alpha Coal Project, additional dust suppression measures may have to be implemented. The circumstances where this might be required include pre-strip and overburden dumping operations in the northern and southern pits and during construction of the CHPP and associated infrastructure.

FA.6.2.2.5 Introduced Species

Description of Impact

Edge effects resulting from the proposed works can include the establishment of weeds, alteration to microclimatic conditions (such as greater light intensity, more wind penetration, lower humidity) and a reduction in plant health through loss of photosynthetic potential (as a result of plants being covered by dust generated from vehicle movement on unsealed tracks). In the absence of appropriate control measures, the Project has the potential to cause impacts in relation to edge effects, and particularly in relation to the introduction and / or spread of weed species throughout the mine study area.

Three weed species declared as Class 2 weeds under the LP Act were recorded on the Project site during field surveys. The Class 2 classification means that the pests are established in Queensland and have, or could have adverse economic, environmental or social impacts. The management of these species requires regional coordination and are subject to programs led by the local government, community or landowners. Under the LP Act, landowners must take reasonable steps to keep land free of Class 2 pests.

An increase in introduced fauna species may also occur as the mine study area becomes utilised. There were seven introduced pest fauna species recorded during the field surveys, including the Cane Toad (*Rhinella marina*), House Mouse (*Mus musculus*), Feral Cat (*Felis catus*), Feral Pig (*Sus scrofa*), European Rabbit (*Oryctolagus cuniculus*), Feral Goat (*Capra hircus*) and Dingo/Wild Dog (*Canis familiaris dingo*), The latter five of the introduced pest fauna species identified on the Project site are declared as 'Class 2' pests under the Land Protection (Pest and Stock Route Management) Act 2002. Due to the potential for these species to impact on the environmental values of the Project Site, land managers are legally required to take reasonable steps to ensure that lands are kept free of Class 2 pests.

Relevance to Listed Flora and Fauna

Weeds and pests pose a significant threat to Australia's natural ecosystems. Extensive invasions can change ecological structure and upset the ecological balance in affected communities as they compete for space and resources with native species, including the EPBC-listed species identified within this assessment. In particular mines are prone to weed invasion, particularly where soils have been disturbed, along transport routes and surrounding infrastructure areas. The risks posed by weeds in mining areas include the introduction of new species, the spread of weeds to adjacent areas and increases in weed abundance in disturbed areas. Weeds can also diminish rehabilitation efforts by outcompeting species selected for revegetation and reduce overall land productivity.

How Impact will be mitigated/managed

Weeds

A number of weed management strategies are proposed to minimise the potential of future weed infestations. These will be adopted for all stages of mine activity including construction, operation and rehabilitation:

- The present location of weeds will be highlighted and a comprehensive weed spraying program implemented prior to the commencement of works. Declared weed species will be treated as per the relevant DEEDI fact sheet for each particular species;
- All organic materials, such as soil, will be certified as weed-free prior to acceptance on-site;
- Wash down facilities will be constructed at access points for vehicles arriving and departing from the Project site. These facilities will be bunded and located away from drainage lines to minimise the risk of weed spread;
- All vehicles entering the Project site and leaving properties known to contain declared weeds will be thoroughly washed down before entering clean areas; ensuring wheels, wheel arches and the undercarriage are free of mud and plant material;
- Radiators, grills and vehicle interiors will be cleaned for accumulated seed and plant material;
- Soil and fill material from weed affected areas will not be transported to clean sites. Minimising soil disturbance will limit the ability of weeds to become established;
- If weeds of management concern are identified, they will be eradicated from the site in accordance with local best management practice from the Jericho Shire Pest Management Plan and/or the DEEDI Pest Fact sheets Burdekin Dry Tropics Regional Pest Management Strategy (Maunsell Australia Pty Ltd, 2008) and / or the DEEDI Pest Fact Sheets (DEEDI, 2007);
- Observations of treated areas to assess the success of declared weed eradication will be undertaken;
- To promote the awareness of weed management issues, weed management will be included in the site induction program for the Project; and
- Prepare a site-specific Weed Management Plan (WMP). The WMP will describe how the weeds are to be managed in accordance with the LP Act and / or local government requirements for weeds not declared under state legislation.

The LP Act describes Class 2 pest species as those that are established in Queensland and have, or could have, an adverse economic, environmental, or social impact. The management of these pests species require coordination and they are subject to programs led by local government, community or landowners. Landowners must take reasonable steps to keep land free of Class 2 pests.

The following monitoring and reporting criteria are to be implemented for the Project study area:

- A Weed and Pest Management Plan is to be developed for implementation during construction;
- Monitoring in the form of annual observations by site personnel for weeds of management concern should be undertaken. These should be conducted following significant rain events in the wet season particularly in disturbed areas, roadsides, riparian zones and wash down facilities;
- All materials should be certified as weed free prior to acceptance on-site; and

- Monitoring in the form of annual observations by site personnel for weeds of management concern will be undertaken. These will also be conducted following significant rain events particularly in disturbed areas, roadsides, riparian zones and wash down facilities once safe access can be provided.

Pests

Seven introduced pest fauna species were recorded during the field surveys, including the Cane Toad (Rhinella marina), House Mouse (Mus musculus), Feral Cat (Felis catus), Feral Pig (Sus scrofa), European Rabbit (Oryctolagus cuniculus), Feral Goat (Capra hircus) and Dingo/Wild Dog (Canis familiaris dingo), the latter five of which are declared as 'Class 2' pests under the Land Protection (Pest and Stock Route Management) Act 2002.

Under the Land Protection (Pest and Stock Route Management) Act 2002, land managers must take reasonable steps to ensure that lands are kept free of Class 2 pests. Given this legal requirement, in addition to the potential for these species to impact the environmental values of the Project site, management strategies for each of the Class 2 pests are addressed below:

- Feral Cat: Control methods for feral cats include shooting, poisoning, trapping and fencing in combination with current land management practices and should be implemented on site as part of a Feral Pest Control Program.
- Feral Pig: Difficult to control, it is recommended that a combination of physical controls be employed, including shooting, poisoning, trapping and/or barrier construction. These controls should be implemented on site as part of a Feral Pest Control Program.
- European Rabbit: Shooting rabbits is one of the most common control methods. However, this has little noticeable effect on rabbit populations. Destroying warrens through ripping, ploughing, blasting, and fumigating is widely used. Poisoning is probably the most widely-used of the conventional techniques, as it requires the least effort.
- Feral Goat: Control methods include mustering, shooting, fencing and trapping, in conjunction with land management practices is most effective.
- Dingo/Wild Dog: Different control methods including shooting, poisoning, trapping and fencing in combination with current land management practices are most effective to control Dingoes and should be implemented on site as part of a Feral Pest Control Program.

The National Land & Water Resources Audit (NLWRA 2008) outlines two indicators for monitoring and reporting on invasive vertebrate pest species, as recommended by the National Coordinating Committee of the Australian Vertebrate Pests Committee (VPC), including:

1. Establishing the distribution and abundance of significant invasive vertebrate pests; and
2. Realising the impacts of significant invasive vertebrate pests.

As such, an Environmental Management Plan will be developed for the site, detailing the management strategies which will be implemented to address the potential impacts of significant vertebrate pests. Environmental monitoring is to be undertaken both during construction and operational phases of the project. The following monitoring and reporting criteria are to be implemented for the study area:

- A Pest Management Plan is to be developed for implementation during construction;
- Monitoring in the form of annual observations by site personnel for invasive vertebrate pests on site. In addition, the use of Infra-red digital camera's is recommended to target more cryptic pest

species. Camera's should be set out seasonally, and in a range of habitats within the Project Area - in order to monitor the distribution and abundance of pests in the area;

- Mitigation strategies will be implemented as necessary, in order to address the effectiveness of the management of vertebrate pest species on site; and
- To promote the awareness of pest monitoring and reporting issues at the Project Site, it is recommended that these issues be addressed in the Site Induction Program for the Project.

FA.6.2.2.6 Groundwater Drawdown

Description of Impact

There is potential that ecological communities that are dependent on groundwater supply may be impacted as a result of a reduction in Groundwater. However, as discussed below, this is unlikely to occur in this instance.

Relevance to Listed Flora and Fauna

The impacts of groundwater drawdown on vegetation communities within the Project site are regarded as low. There are no identified groundwater dependent ecosystems located on the Project site, and the groundwater piezometeric levels associated with usable aquifers are at depths >20 m and thus not accessible to the existing vegetation. Current information (groundwater level monitoring on site) indicates little or no hydraulic connectivity (linkage) between the piezometeric groundwater levels (associated with the underlying confined aquifers) and the ephemeral surface water resources or perched water tables. Thus any reduction in piezometeric pressure, resulting in decrease in groundwater levels, due to mine depressurisation will not impact on the vegetation communities.

Incidents of isolated perched groundwater, during and immediately after the wet season,within the weathered Tertiary laterite and saprolite and clay-rich Quaternary alluvium where groundwater has been recorded at depths of 0.5 to 1.5 m below surface. These perched water tables may provide limited water (low sustainable volumes) for local vegetation communities.

Based on the low permeability of the Tertiary laterite and saprolite and the very low gradients drawdown within the Tertiary units, resulting from open pit mining, would be limited, some 10 to 100 m around the pits. Any perched water within this zone would report to the open pit. The vegetation in the area immediately adjacent to the mine pit will, however, be disturbed / removed due to the envisaged infrastructure (surface water levees, roads, water and power easements, etc.).

How Impact will be mitigated/managed

In order to validate this conceptualisation and obtain additional groundwater - surface water interaction information across the entire mine site, nested bores, comprising shallow (~ 10 m into the weathered Tertiary and Quaternary alluvium) and deep (~ 30 m into the underlying coal seam aquifers) are being constructed along Sandy Creek. These bores will allow for further assessment of possible hydraulic connectivity.

Based on the bore baseline monitoring program, trigger and guideline values for assessing impacts of groundwater drawdown related to mining activities will be proposed for all identified aquifers, including the perched water table(s). If mine induced groundwater drawdown is indicated, mitigation through the Proponents "make-good" commitment will be made, which could include artificial recharge of affected areas with water from alternative water sources.

FA.6.2.2.7 Waste

The Project has the potential to create significant additional amounts of waste, such as building debris, petroleum or chemical waste, and miscellaneous farming waste, however detailed planning and management will be undertaken to ensure appropriate systems are in place to adequately deal with mine waste. Coal reject material is segregated into two categories, coarse reject and tailings.

The majority of overburden could be managed as non-acid forming material. However, there is potential for existing salinity to be washed from the overburden in response to rainfall events. Consequently, containment of run-off and water quality monitoring may be required depending on the sensitivity of ground and surface water to salinity. The results indicate that a water quality prediction for the disturbed mine waste is warranted.

The Project will produce rejects (course and fine) and tailings. The coarse reject material will be discharged directly onto a multi-slope reject drain screen for dewatering and then discharged on to a reject conveyor. The fine rejects are also directed to the reject conveyor. Both the coarse and fine rejects are delivered by conveyor to a reject bin where they are then disposed of by truck.

Indirect impacts on native fauna resulting from the Project may include those that result in habitat loss or degradation within the Project site, as well as loss or disturbance to migration paths throughout the landscape.

Suitable precautions will be taken to prevent water flow over or ponding on the waste dumps to minimise physical gully erosion of the dispersive materials, and to prevent leaching of the excessive salts, which act to prevent dispersive behavior. Good compaction will also help prevent ingress of water into the slopes. The use of flat slopes (<5% gradient if possible) or concave slopes (with steepest gradient at the top of the slope and reducing the gradient as slope length and quantity of runoff increase) will be applied to minimise gully formation.

FA.6.2.2.8 Subsidence

Subsidence impacts are not anticipated from this Project given that all mining operations will utilise the open-cut method.

FA.6.2.2.9 Quantification of Indirect Impacts

An ‘indirect impact footprint’ was established for each of the indirect impacts from the Project as discussed in section FA.4.4.1 of this report. The amount of potential habitat for EPBC Act-listed threatened flora species, and threatened and (and by proxy, migratory) fauna species of relevance to the mine study area that may experience indirect impacts from the Project was quantified via the habitat modeling and mapping exercise described in Section 4.4.

Presented below are the results of this quantitative analysis with respect to mapped habitat that may experience indirect impacts:

- Table FA-9 presents a quantification of the amount of mapped ‘high value potential habitat’ that may be exposed to indirect impacts.
- Table FA-10 presents a quantification of the amount of mapped ‘low value potential habitat’ that may be exposed to indirect impacts.

Table FA-9 Quantification of Indirect Impacts to 'High Value Potential Habitat'

	A	B	C	D	E	F
	Direct impact - number of hectares of HVPH* impacted	Number of hectares of HVPH* in landscape#	% HVPH* in landscape# directly impacted i.e. (a/b)*100	Direct impact footprint area	% Direct impact footprint area that is HVPH* (i.e. a/d)*100	% HVPH* in landscape# i.e. (b/total area of landscape)*100
Plants						
Dichanthium queenslandicum (King Bluegrass)	0.00 ha	756 ha	0.00	5,971 ha	0.00	0.03
Birds						
Geophaps scripta scripta	1,662 ha	329,846 ha	0.50	5,971 ha	27.85	14.36
Neochmia ruficauda ruficauda	101 ha	30,175 ha	0.34	5,971 ha	1.70	1.31
Erythrotriorchis radiatus	171 ha	51,631 ha	0.33	5,971 ha	2.87	2.25
Rostratula australis	46 ha	36,164 ha	0.13	5,971 ha	0.78	1.57
Poephila cincta cincta	1,645 ha	182,660 ha	0.90	5,971 ha	27.55	7.95
Mammals						
Nyctophilus timoriensis (South eastern form)	177 ha	61,109 ha	0.29	5,971 ha	2.97	2.66
Reptiles						
Denisonia maculata	0.00 ha	135,919 ha	0.00	5,971 ha	0.00	5.92
Egernia rugosa	2,897 ha	660,792 ha	0.44	5,971 ha	48.51	28.78
Furina dunmalli[1]	0.00 ha	141,826 ha	0.00	5,971 ha	0.00	6.18
Paradelma orientalis	0.00 ha	3,185.52 ha	0.00	5,971 ha	0.00	0.14

*HVPH – 'high value potential habitat'

- 'landscape' is the landscape surrounding the Project study area (within the Brigalow Belt and Desert Uplands bioregions) as depicted on a map sheet at a scale of 1:500,000)

Table FA-10 Quantification of Indirect Impacts to 'Low Value Potential Habitat'

	A	B	C	D	E	F
	Direct impact - number of hectares of LVPH* impacted	Number of hectares of LVPH* in landscape#	% LVPH* in landscape# directly impacted i.e. (a/b)*100	Direct impact footprint area	% Direct impact footprint area that is LVPH* (i.e. a/d)*100	% LVPH* in landscape# i.e. (b/total area of landscape)*100
Plants						
Dichanthium queenslandicum (King Bluegrass)	0.00 ha	504 ha	0.00	5,971 ha	0.00	0.02
Birds						
Geophaps scripta scripta	1,835 ha	575,590 ha	0.32	5,971 ha	30.73	25.07
Neochmia ruficauda ruficauda	1,402 ha	225,408 ha	0.62	5,971 ha	23.49	9.82
Erythrotriorchis radiatus	3,326 ha	851,049 ha	0.39	5,971 ha	55.70	37.06
Rostratula australis	180 ha	81,431 ha	0.22	5,971 ha	3.02	3.55
Poephila cincta cincta	2,095 ha	909,067 ha	0.23	5,971 ha	35.09	39.59
Mammals						
Nyctophilus timoriensis (South eastern form)	3,563 ha	1,049,627 ha	0.34	5,971 ha	59.67	45.71
Reptiles						
Denisonia maculata	0.37 ha	206,439 ha	0.00	5,971.89 ha	0.01	8.99
Egernia rugosa	844 ha	448,242 ha	0.19	5,971.89 ha	14.14	19.52
Furina dunmall	0.00 ha	156,381 ha	0.00	5,971.89 ha	0.00	6.81
Paradelma orientalis	0.00 ha	2,002 ha	0.00	5,971.89 ha	0.00	0.09

*LVPH – 'low value potential habitat'

- 'landscape' is the landscape surrounding the Project study area (within the Brigalow Belt and Desert Uplands bioregions) as depicted on a map sheet at a scale of 1:500,000)

FA.6.3 Overlay of Impacted Areas

Areas that may support habitat for numerous EPBC Act-listed species of relevance to the mine study area could be identified, which allowed for 'high value potential habitat' for all species distribution to be overlayed on a regional and a mine map (Figure FA-7 and Figure FA-8).

As shown in Figure FA-7 and FA-8, habitats associated with watercourses have the potential to support a number of EPBC Act-listed threatened flora species and threatened (and by proxy, migratory) fauna species. The potential for riparian areas to provide suitable habitat for EPBC Act-listed flora and fauna, as well as the value of these habitats as wildlife corridors (local and regional) for all wildlife, highlights the importance of riparian areas in this landscape. As such, the mitigation measures outlined above should be comprehensively employed at all water crossings and the vegetation (habitat) adjacent to waterways.

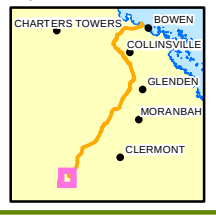
Offsetting may be required in agreed circumstances (refer to Volume 2 (Appendix X) of this SEIS for preliminary Offsets Strategy).

Presented below the figures are the results of the quantitative analysis with respect to mapped (overlayed) 'high value potential habitat' that may experience direct and indirect impacts from the Project. Table FA-11 presents a quantification of overlayed habitat that may be subjected to direct impacts. Table FA-12 presents a quantification of overlayed habitat that may be subjected to indirect impacts

440,000
450,000
7,440,000
7,430,000
7,420,000
Sandy Creek
Lagoon Creek
ALPHA MINE

LEGEND

- Town
- Existing Railway
- State Road
- Waterbody
- Watercourse
- Alpha MLA
- Mine Pit
- Direct Disturbance Footprint
- Proposed Alignment
- Vegetation Corridor (Brigalow Belt)
  - State
  - Regional
- Vegetation Corridor (Desert Uplands)
  - Very High
- Overlay of HVPH Impacted Area
  - *Number of Species*
  - 1 - 3
  - 4 - 6
  - 7 - 10
  - > 10
- Indirect Impact Buffer Contour
  - Vibration
  - Light
  - Invasive Species
  - Groundwater
  - Dust
  - Noise



Source: See Copyright Details below and for full disclosure please read Section 18.2 - References in the EIS

1:100,000 (at A3)

0 0.5 1 2 3 4 5

Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

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HANCOCK PROSPECTING PTY LTD

Alpha Coal Project
Supplementary Environmental Impact Statement

OVERLAY OF HVPH IMPACTED AREA - ALPHA MINE

Job Number	41-23742
Revision	A
Date	28 July 2011

Figure FA.7

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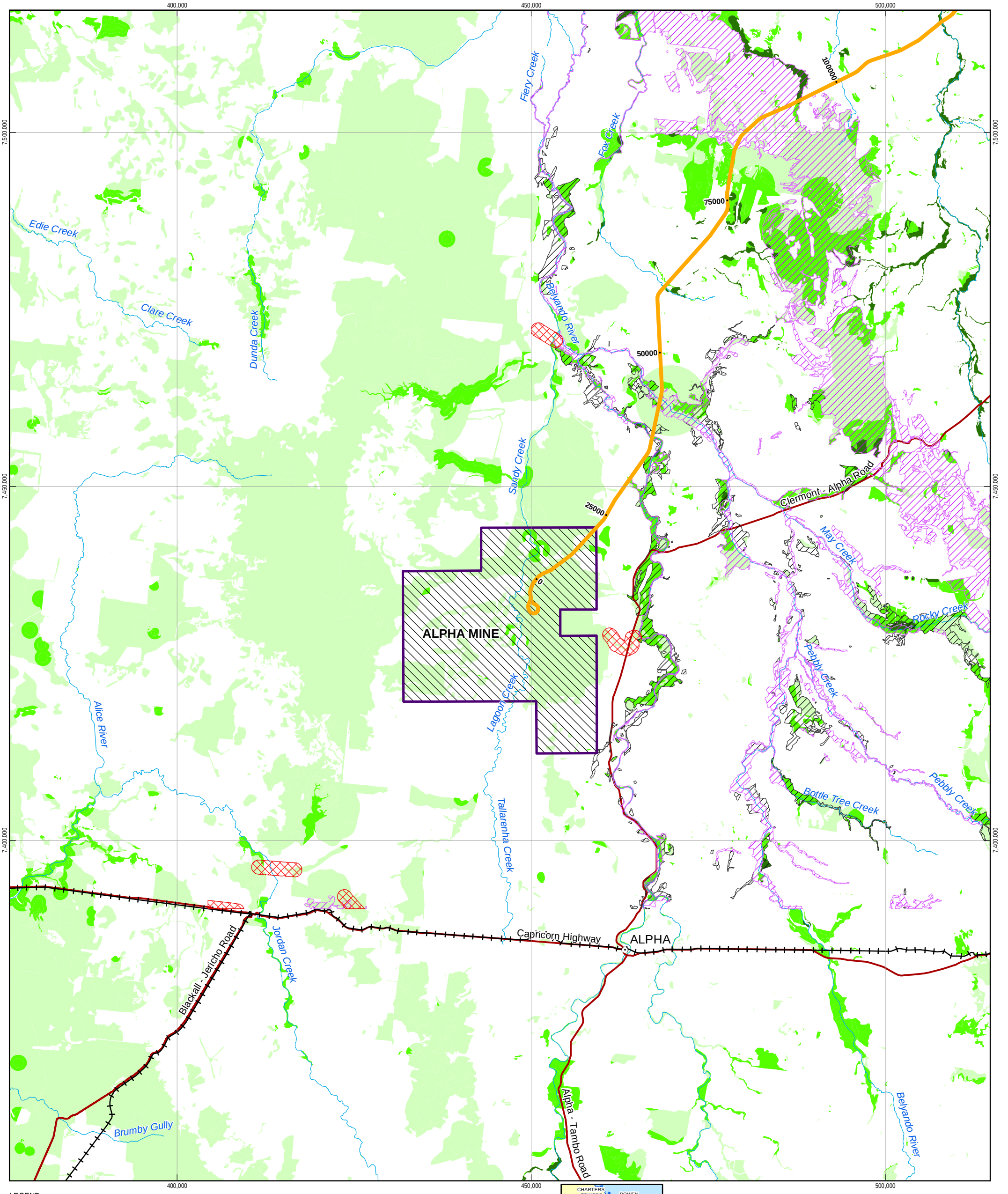
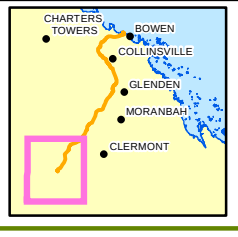


LEGEND

- Town
- Existing Railway
- State Road
- Waterbody
- Watercourse
- Alpha MLA
- Proposed Alignment
- Vegetation Corridor (Brigalow Belt)
  - State
  - Regional
- Vegetation Corridor (Desert Uplands)
  - Very High
- Overlay of HVPH Impacted Area
  Number of Species
  - 1 - 3
  - 4 - 6
  - 7 - 10
  - > 10



Source: See Copyright Details below and for full disclosure please read Section 18.2 - References in the EIS

1:500,000 (at A3)

0 2.5 5 10 15 20 25

Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

N

HANCOCK PROSPECTING PTY LTD

Alpha Coal Project
Supplementary Environmental Impact Statement

OVERLAY OF HVPH IMPACTED AREA - REGIONAL

Job Number	41-23742
Revision	A
Date	28 July 2011

Figure FA.8

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Table FA-11 Quantification of Direct Impacts to Overlayed Potential Habitat and Threatened Ecological Communities

	A	B	C	D	E	F
	Direct impact - number of hectares of potential habitat (overlayed)	Number of hectares of potential habitat (overlayed) – landscape#	% potential habitat (overlayed) in landscape# directly impacted i.e. (a/b)*100	Direct impact footprint area	% Direct impact footprint area that is potential habitat (overlayed) (i.e. a/d)*100	% potential habitat (overlayed) in landscape# i.e. (b/total area of landscape)*100
Potential habitat for 1-3 species	9,882 ha	561,925 ha	1.76	30,618 ha	47.93	24.47
Potential habitat for 4-6 species	317 ha	97,742 ha	0.33	20,618 ha	1.54	4.26
Potential habitat for 7-10 species	0.00 ha	10,565 ha	0.00	20,618 ha	0.00	0.46
Potential habitat for >10 species	0.00 ha	0.00 ha	0.00	20,618 ha	0.00	0.00

- 'landscape' is the landscape surrounding the Project study area (within the Brigalow Belt and Desert Uplands bioregions) as depicted on a map sheet at a scale of 1:500,000)

Table FA-12 Quantification of Indirect Impacts to Overlayed Potential Habitat and Threatened Ecological Communities

	A	B	C	D	E	F
	Indirect impact - number of hectares of potential habitat and TECs (overlayed)	Number of hectares of potential habitat and TECs (overlayed) – landscape#	% potential habitat and TECs (overlayed) in landscape# indirectly impacted i.e. (a/b)*100	Indirect impact footprint area	% indirect impact footprint area that is potential habitat and TECs (overlayed) (i.e. a/d)*100	% potential habitat and TECs (overlayed) in landscape# i.e. (b/total area of landscape)*100
Potential habitat for 1-3 species/TECs	2,725 ha	561,925 ha	0.48	5,971 ha	45.63	24.47
Potential habitat for 4-6 species/TECs	171 ha	97,742 ha	0.18	5,971 ha	2.88	4.26
Potential habitat for 7-10 species/TECs	0.00 ha	10,565 ha	0.00	5,971 ha	0.00	0.46
Potential habitat for >10 species/TECs	0.00 ha	0.0 ha	0.00	5,971 ha	0.00	0.00

- 'landscape' is the landscape surrounding the Project study area (within the Brigalow Belt and Desert Uplands bioregions) as depicted on a map sheet at a scale of 1:500,000)

FA.6.4 Monitoring and Reporting

The impact assessment has determined that a variety of monitoring and reporting requirements will be implemented to ensure impacts to fauna, flora and vegetation communities are minimised, or that improvements to procedures and processes can be implemented to further minimise impacts. These are detailed in the following sections.

A rehabilitation strategy will be developed for the Project site. This strategy will embody the concepts and recommendations presented above and include provision for monitoring of rehabilitation progress over the life of the operation.

The methodologies for the rehabilitation/re-vegetation works for the Project will use the most appropriate species for the landscape elements of the site. Species chosen for revegetation will be selected from the lists provided in this report showing the dominant flora of each community. Areas such as the overburden emplacement will be assessed for species to ensure long-term stability and rehabilitation success rather than quick fixes that may not be successful in the long term.

Measures should be taken to minimise harm to affected fauna communities by inspecting the vegetation to be disturbed prior to clearing to ascertain whether any fauna are present. If fauna is present, it should be given the opportunity to move on naturally before clearing occurs.

With regards to the vulnerable EPBC listed southern Squatter Pigeon (*Geophaps scripta scripta*), the following Regional and Local Priority threat abatement actions approved under s266B of the *Environment Protection and Biodiversity Conservation Act 1999* can be undertaken to support its recovery. An adaptation of relevant Threatened Species Scientific Committee (2008fp) recovery commitments relevant to the Project include:

- Monitoring of known population within the Project area to identify potential threats.
- Manage threats to areas of vegetation that support important populations.
- Develop and implement a stock management plan for key sites.
- Develop and implement a management plan, or nominate an existing plan to be implemented, for the control and eradication of feral herbivores in areas inhabited by the Southern Squatter Pigeon.
- Implement the appropriate recommendations outlined in the Threat Abatement Plan for Predation by Feral Cats (EA, 1999a) and the Threat Abatement Plan for Predation by the European Red Fox (EA, 1999b) in areas inhabited by the Southern Squatter Pigeon.
- Raise awareness amongst all staff involved with the mine site regarding the appearance of the Southern Squatter Pigeon as well as its location on site. Staff should be encouraged to record sightings of the bird.

FA.6.5 Decommissioning and Rehabilitation

A rehabilitation strategy will be developed for the Project site. This strategy will embody the concepts and recommendations presented above and include provision for monitoring of rehabilitation progress over the life of the operation.

Progressive rehabilitation of disturbed areas following the construction and operation phases will be performed, where possible. The initial focus of rehabilitation will be soil erosion and sediment control measures and will involve the implementation of physical controls as outlined in the Coal Mine Environmental Management Plan (EM Plan) (Volume 2, Appendix V).

The methodologies for the rehabilitation/re-vegetation works for the Project will use the most appropriate species for the landscape elements of the site. Such methodologies will include habitat matching of species to ensure rehabilitation success. Species chosen for revegetation will be selected from the lists provided in this report showing the dominant flora of each community and will be matched with final land use. Where possible, native vegetation within the Project site should be retained and managed, to form a source of seed stock to be used in mine rehabilitation works. Areas such as the overburden emplacement will be assessed for species to ensure long-term stability and rehabilitation success rather than quick fixes that may not be successful in the long term. The seeding of as many species as possible will be undertaken at each rehabilitated site, in order to promote more rapid recovery of the local vegetation and lasting groundcover.

It is recommended that recreated landforms are contoured to resemble the original local topography, and be re-contoured as a flat to undulating plain. Following stabilisation of the site, the focus of revegetation will aim to enhance the suitability of the site for wildlife (within operational safety bounds); however, some areas will be rehabilitated to pastures per the existing land use. Revegetation of the areas will include:

- Planting of a range of locally-occurring native shrubs, trees and groundcover plants;
- Inclusion of logs, dead trees and stumps in the landscaping / rehabilitation works;
- Incorporation of existing natural vegetation where possible;
- Linking of vegetation remnants;
- Focusing on riparian vegetation to protect waterways (including the Lagoon Creek diversion);
- Maintenance of rehabilitation through a rehabilitation monitoring plan; and
- Management of weeds and pest animals through a pest management plan.

Species chosen for rehabilitation will be locally indigenous and match soil type and land forms. The ground layer will be well established, to provide habitat and forage for fauna. The established ground layer will also aid in restoring ecosystem processes. The shape of rehabilitated areas will have a larger width, to reduce edge effects. Positioning of the rehabilitated area will aim to increase opportunity for re-colonisation of plant species, build on the existing natural vegetation and provide a sanctuary away from known sources of mine disturbance.

Monitoring of rehabilitated areas will be ongoing until the completion criteria have been met for the entire area of disturbance. Monitoring of rehabilitated and vegetation reference sites will provide statistically valid results, to show completion criteria have been met. This monitoring will also highlight areas that need further attention (eroded areas, areas requiring further seeding efforts, etc.). Monitoring will occur on an annual basis. Vegetation reference sites are used to create a comparable benchmark for rehabilitated sites to determine rehabilitative success. Vegetation reference sites will be chosen based on being

representative of the respective land disturbances such as topography, soil characteristics and vegetation type and structure Reference sites and rehabilitated sites will be assessed for quantitative data, including:

- Plant and litter cover;
- Plant density and species composition;
- Presence and abundance of weeds; and
- Soil erosion.

FA.6.6 Cumulative Impacts

The incremental effect of multiple impact sources (past, present and future) is referred to as 'cumulative impacts'. These impacts may become exacerbated over time. A consideration of cumulative environmental impacts combines Project impacts with additional, regional impacts from external sources.

Residual impacts are impacts that remain after a project's environmental management strategies, mitigation measures, and rehabilitation plans have been carried out. Residual impacts for the Project include removal of vegetation and associated habitat. Where there is residual loss or degradation of vegetation, habitat or land use upon completion of mine decommissioning (or as residual impact is identified prior to decommissioning), compensation in the form of further habitat rehabilitation, compensatory habitat, land rehabilitation, contribution to research or offsets can be employed.

The Alpha Coal Project is expected to have varying potential cumulative impacts on the environment. Potential impacts resulting from the mine are expected to be predominantly localised around the mine site and will be continue for the life of the project. Where possible, adverse impacts are avoided or mitigated via implementation of sound environmental protection and management criteria.

Closer to the Project site cumulative effects associated with the Project may include impacts to air quality (dust), groundwater, surface water and noise etc. Additional cumulative effects may occur due to the compounding and synergistic interactions arising from other developments, occurring in the same area or over similar time frames to the project being assessed. Environmental values may be impacted as a result of a geographic overlap of project areas, scheduling overlap or using the same infrastructure, services and resources. Many of the cumulative effects associated with the Project are derived on a broader scale from transport, economic and social interactions between the Alpha Coal Project and other existing or proposed projects within the project vicinity.

The proposed projects located adjacent to the Alpha Coal Project (Mine) that have the potential to have a significant cumulative impact particularly on social and environmental values in the local area include:

- Kevin's Corner Project (Kevin's Corner), a proposed 30 Mtpa open cut and underground coal mine located on mining lease application (MLA) 70425, immediately north and adjoining the Alpha MLA;
- Waratah Galilee Coal Mine (Waratah), which is a proposed 25 Mtpa open cut coal mine adjoining Alpha MLA to the south;

- Galilee Basin Power Station, a proposed coal-fired power station producing 900 MW (net) immediately to the south of the Alpha MLA;
- South Galilee Coal Project (SGCP), which is a proposed 15-20 Mtpa open cut and underground mining operation located to the south west of the Alpha township;
- Powerlink power transmission line, a proposed transmission lines from Lilyvale substation to a new Galilee Hub substation (during construction phase) to supply power to the Project; and
- SunWater raw water line, a proposed water pipeline from Moranbah to a raw water dam within Alpha Coal Project MLA.

It is possible that the highly localised direct impacts and indirect impacts from the Project (Mine) may contribute to a more regional loss of/degradation to habitat when impacts area assessed cumulatively.

FA.6.7 Significance of Impacts

This assessment has expanded upon the previously presented analysis of potential impacts of the Project to EPBC Act-listed flora and fauna. Habitat mapping has allowed for the identification of the spatial distribution of potential habitat for the one threatened flora species, ten threatened (and by proxy, migratory) fauna species that may occur, with unknown spatial and temporal variability, across the Project study area. The amount of potential habitat that may experience direct and indirect impacts from the Project has been quantified and an overlay of potential habitat for each of the species allowed for identification of areas which may be particularly noteworthy for EPBC Act-listed flora and fauna, thereby requiring further investigation potentially resulting in management and mitigation.

A discussion of the impacting processes associated with the Project, and how these processes may relate to and impact upon the relevant MNES (flora and fauna) was presented, as well as impact-specific mitigation and management strategies that will prevent, reduce or minimise these impacts.

Presented below is a summary of the significance of impacts to EPBC Act-listed flora, ecological communities and fauna, in the context of the Commonwealth Significant Impact Guidelines 1.1 - Matters of National Environmental Significance (DEWHA, 2009b). This assessment expands upon the assessment of significance previously presented.

FA.6.7.1 Threatened Species

FA.6.7.1.1 Endangered Species

The two EPBC-Act listed endangered species considered at risk of potential impacts from the Project were the black-throated finch (southern) and the star finch. Neither species was detected during field studies. Furthermore, during desktop assessments there was no indication that the Project area supported a 'population' of either species, as defined under the EPBC Act. This definition states that a *'population of a species' is defined…as an occurrence of the species in a particular area. In relation to critically endangered, endangered or vulnerable threatened species, occurrences include but are not limited to:*

- *a geographically distinct regional population, or collection of local populations, or*

- *a population, or collection of local populations, that occurs within a particular bioregion (DEWHA, 2009b).*

The habitat mapping assessment conducted as part of this study indicated that potential habitat for both species does occur within the Project area and in the surrounding landscape. However, the amount of potential habitat likely to be impacted directly or indirectly by the Project was minimal in proportion to that indicated in the surrounding region. HVPH for the star finch directly or indirectly disturbed was < 1% of that found in the surrounding region. In the case of the black-throated finch, the study indicated < 5% of the HVPH in the region would be directly disturbed. In both cases this is likely to be less than the margin of error associated with such an analysis.

Although unavoidable loss of potential habitat will be discussed with Federal and State agencies during the development of the Alpha Coal Project Offset Strategy (refer to Volume 2, Appendix X of this SEIS) all indications as a result of this analysis suggest additional and consequential impacts on either of these species will be minimal. This conclusion is strengthened when coupled with the implementation of sound mitigation measures, management strategies and monitoring programmes as detailed in the Coal Mine EM Plan (Volume 2, Appendix V of this SEIS).

FA.6.7.1.2 Vulnerable Species

The assessment of the significance of the impacts of an action on EPBC Act-listed vulnerable species focuses on impacts to 'important populations' (population defined in Section FA.6.7.1.1 above). 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 (DEWHA, 2009b).*

As a result of field and desktop studies, a total of 10 EPBC-Act listed vulnerable species were considered to be at risk of potential impacts from the Project. Of the 10 species only the squatter pigeon (southern) was detected during field studies.

As a result of the impact analysis through mapping potential habitat, 4 species had no potential direct or indirect impact as a result of the Project (*Dicanthium queenslandicum, Denisonia maculate, Furina dunmalli and Paradelma orientalis*) as none of their potential habitat was indicated within the direct or indirect footprints. The greatest percentage of the HVPH of a vulnerable species in the Project region that may be impacted by the Project, was the squatter pigeon with 1.82% of the regional habitat being potentially impacted. Furthermore, when combining the percentage of HVPH with LVPH, the greatest impact was still minimal and also on squatter pigeon habitat with 2.44% being potentially impacted.

Although unavoidable loss of potential habitat will be discussed with Federal and State agencies during the development of the Alpha Coal Project Offset Strategy (refer to Volume 2, Appendix X of this SEIS) all indications as a result of this analysis suggest additional and consequential impacts on either of these species will be minimal. This conclusion is strengthened when coupled with the implementation of sound mitigation measures,

management strategies and monitoring programmes as detailed in the Coal Mine EM Plan (Volume 2, Appendix V of this SEIS).

FA.6.7.1.3 Migratory Species

The Commonwealth *Significant Impact Guidelines 1.1 - Matters of National Environmental Significance* (DEWHA (now SEWPAC), 2009b) defines 'important habitat' for migratory species as:

- *habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically 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*

The 36 migratory species which were positively identified as a result of combined desktop and field surveys efforts are widespread geographically throughout eastern Queensland and the local populations on the Project site are unlikely to constitute an 'ecologically significant proportion' of the total populations. Furthermore, the Project site is not at the limit of these species range, nor are these species considered to be declining within the region. As habitat present on the site is replicated throughout the greater region it is unlikely that habitat present is critical for the survival of any of these species. Therefore, it is unlikely that the Project will have a significant impact on the regional populations of these species.

FA.6.8 Summary of Impacts

The analysis conducted in this report indicates that while there is a risk of impacts on potential habitat for 7 of the 11 EPBC-listed species considered to have a low, moderate or high likelihood of occurring on site, the impacts are likely to be low. In combining the results of the analysis with the raft of mitigation measures, management strategies and monitoring programs detailed in the Coal Mine EM Plan (Volume 2, Appendix V of this SEIS), the impacts on any EPBC-listed species are likely to be insignificant.

In conclusion, the results of this study indicate that the Project is unlikely to:

- *lead to a long-term decrease in the size of a population,*
- *reduce the area of occupancy of the species,*
- *fragment an existing population into two or more populations,*
- *adversely affect habitat critical to the survival of a species,*
- *disrupt the breeding cycle of a population,*
- *modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline,*
- *result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species habitat,*
- *introduce disease that may cause the species to decline, or*
- *interfere with the recovery of the species* (DEWHA, 2009b).

FA.7 Aquatic Flora and Fauna and Stygofauna

FA.7.1 Methodology

To describe the existing aquatic flora and fauna values of the study area a combined desktop and seasonal field survey was conducted. The desktop assessment comprised a review of relevant literature and database searches. Surveys were conducted to obtain ecological information relevant to the Project and to ground-truth results from desktop assessments.

The aquatic flora and fauna sampling methodology for the Project site was based on 'standard survey' techniques that are used to sample aquatic and aquatic vertebrate fauna. Sampling was conducted using the following survey methods were used:

- Aquatic and riparian vegetation identification;
- Macro-invertebrate sampling;
- Aquatic vertebrate fauna sampling, involving drag netting and baited traps;
- Spotlighting; and
- Habitat assessments.

This section is based upon the findings of the following document:

- AustralAsian Resource Consultants (AARC) (2010a). Alpha Coal Project, Aquatic Ecology Assessment. Prepared for Hancock Prospecting Pty Ltd. September 2010.

*FA.7.1.1*Desktop Survey

The following databases were searched for historical records of flora and fauna within the vicinity of the mine study area that have habitat requirements intrinsically linked to aquatic habitats:

- EPBC Act Online Database:
  - This database provides general guidance on MNES and other matters protected by the EPBC Act for a nominated area.
  - Search area encompassed a 100km buffer surrounding a point at coordinates -23.24,146.46
  - Data retrieved 8 June 2010.
- Wildlife Online Database (Department of Environment and Resource Management (DERM):
  - This database uses records collected from previous surveys, including the Queensland Museum surveys as well as records from the public.
  - While screening of data occurs, some misidentifications are possible.
  - Initial search area encompassed the Central Highlands Regional Council jurisdiction. This data was retrieved 11 Feb 2009.
  - Upon review for the production of this report, the search was repeated within a revised search area 100 km x 100 km, surrounding the Mine Study Area. The coordinates of the revised search area are Point A -22.75046, 145.989507; Point B -22.753652, 146.963474; Point C -23.656973, 146.963228; Point D -23.653639, 145.982694.

FA.7.1.2 Field Survey

Aquatic assessments were undertaken across the mine study area and surrounding area in March 2009 and March 2010. Further surveys were undertaken in June 2011. Refer below for details regarding the distribution and methods employed at each aquatic sampling location. Figure FA-9 shows the location of the survey field sites.

Initial site scoping was conducted to aid the field survey planning using two methods. Firstly, aerial photography and topographic maps of the mine study area were reviewed to gain an overall perspective of the location of watercourses, and the direction of water flow.

Secondly, accessible areas of the mine study area were broadly surveyed from a vehicle. This allowed for the targeting of upstream, midstream, and downstream locations, as well as habitats potentially occupied by species of conservation significance. Once locations were determined the following six key survey methods were employed, which are outlined below.

FA.7.1.2.1 Aquatic and Riparian Vegetation Identification

At each of the 42 sites surveyed, a brief description of the riparian vegetation was recorded. This is captured more fully in the Terrestrial Flora and Fauna Report produced by AARC. Where instream flora was observed, it was also identified, and dominance recorded.

FA.7.1.2.2 Macro-invertebrate Sampling

The shallows of the waterbodies at 19 sites were kick-sampled (disturbing the stream bed and passing a D-frame net with a 100 micrometre mesh-size through the resulting plume, along 5-10 m sections of the waterbody). Various microhabitats within the stream were targeted. All macro-invertebrates sampled over a 20 minute period were placed in a preservative solution and identified to family or sub-family level. Samples collected during the March 2009 survey were identified at the Australian Centre for Tropical Freshwater Research, and samples collected in March 2010 were identified at FRC Environmental.

FA.7.1.2.3 Aquatic Vertebrate Fauna Sampling

The aquatic vertebrate composition of each survey site was tested at a total of 16 sites using two methods: drag netting, and baited traps, as explained below.

Drag Netting

The waterbody at each survey site in which vertebrate fauna sampling was undertaken was swept using a 25 mm mesh-size drag net strung between two people as they walked slowly up sections of the waterbody. This method allows large sections of the watercourse to be sampled; however, snags and benthic debris can allow fish to avoid the net. Watercourses too narrow / shallow to allow the net to extend were excluded from drag netting. A total of 12 sites were drag netted over the course of the field survey.

Baited Traps

Opera-house and box traps were used at each site where trapping was to be undertaken to target carnivorous species. Traps were baited with either dry dog biscuits or bones to lure fish and other vertebrates into the traps. At each site where trapping was undertaken, four traps were left out for three nights each, and emptied at first light. All animals captured were identified, their abundances recorded, and then released back into the water. As 14 sites were trapped, a total of 168 trap nights were conducted on the mine study area.

FA.7.1.2.4 Spotlighting

Spotlighting was carried out at night along various sections of the waterbodies in an attempt to observe nocturnal wildlife that are less likely to be detected by other survey methods, such as frogs and reptiles.

FA.7.1.2.5 Habitat Assessment

A habitat assessment was performed at 18 selected sites using a modified version of the AUSRIVAS protocols developed by the Department of Natural Resources and Mines in 2002. AUSRIVAS is a nationally standardised method for giving an assessment of the biological health of inland rivers within Australia. Each surveyed site was given a score out of 135, with higher numbers indicating favourable habitats normally associated with healthy waterways.

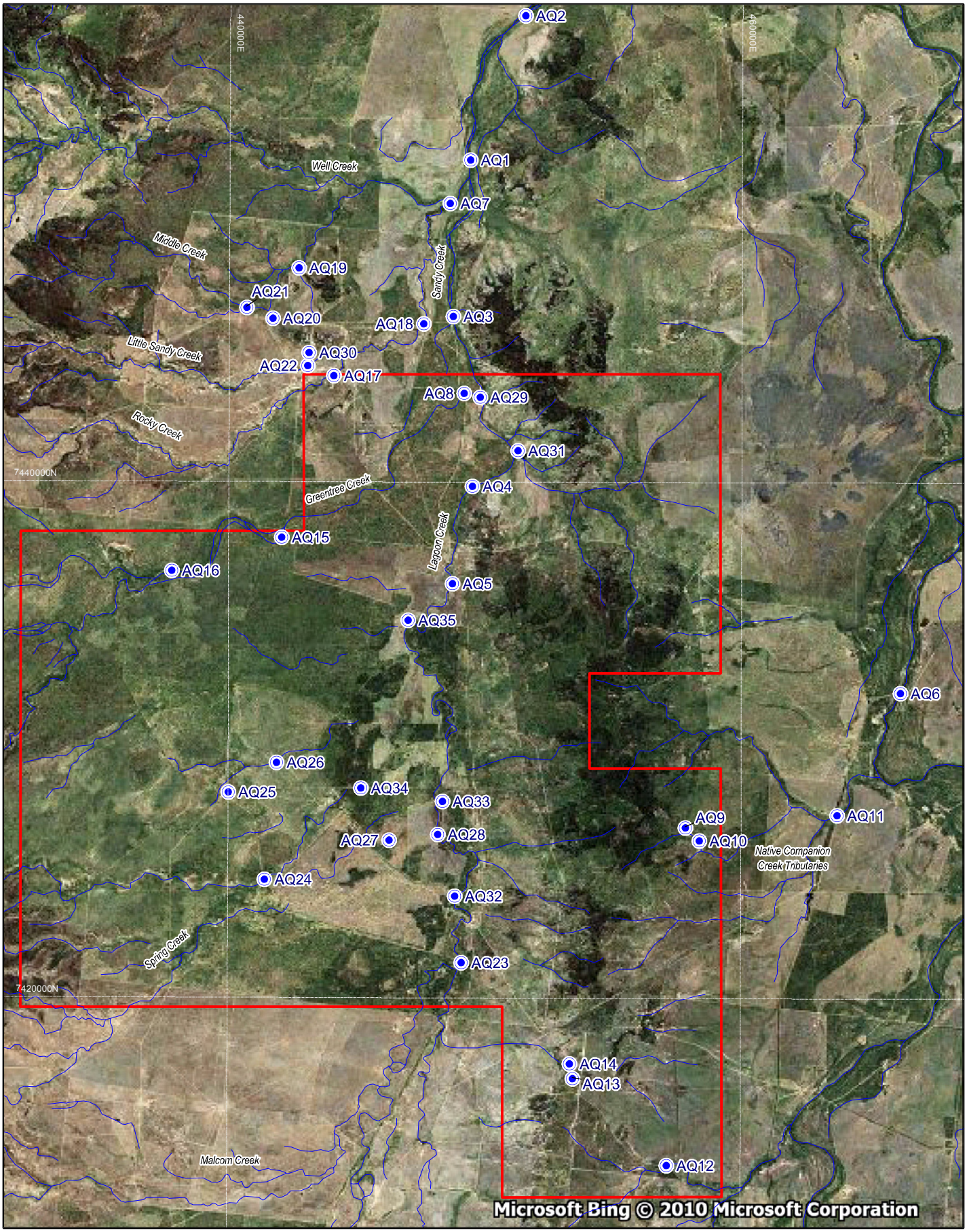
FA.7.1.2.6 Stygofauna sampling

Stygofauna surveys were undertaken to assess local communities. As there are no Queensland-specific stygofauna sampling guidelines DERM require proponents to follow the sampling protocols of the WA EPA. The WA EPA Guidance Statement 54 recommends that for environmental impact assessment, 40 stygofauna samples be collected for each impact area, and an additional 40 samples be collected from reference bores surrounding the impact area (EPA 2003, 2007).

However, Guidance Statement 54a (EPA 2007) does make allowances for pilot studies that are less intensive as follows:

- In some cases, proponents may believe there is little likelihood of subterranean fauna occurring in a project area but desktop review does not provide convincing evidence to support this position. A pilot study may be an effective method of determining whether subterranean fauna occur. Much less sampling is required to characterize the type of community present than to document all species. If the area supports significant subterranean fauna, the results of the pilot study can be used to focus the more comprehensive survey that will be required to document all species and assess their conservation.
- The design of pilot studies is likely to vary according to situation. The aim will usually be to determine whether a project area has significant subterranean faunal values, which can be achieved with low sampling effort (Culver et al., 2004; Eberhard et al., 2009). It is expected that 6-10 stygofaunal samples or 10-15 troglofaunal samples will be collected in pilot studies. If the pilot study reveals the occurrence of significant subterranean fauna, more intensive investigation is likely to be required.

There are no known stygofauna from the proposed project area around Alpha, and groundwater has a typically high electrical conductivity, therefore the likelihood of encountering stygofauna on the Project Site is considered to be low. This Project has therefore, adopted the ‘Pilot Study’ approach outlined in the preceding paragraphs.



Mining Lease Boundary Application (MLA70426) Boundary

Aquatic Sample Location (2009)

Aquatic Sample Location (2010)

Source: See Copyright Details below and for full disclosure Please Refer to the SEIS ***Volume 2, Appendix B***

0 2 4Km

Scale 1:200 000 (A4)

Datum: GDA94, MGA Zone55

N W E S

HANCOCK PROSPECTING PTY LTD

Alpha Coal Project
Supplementary Environmental Impact Statement

ALPHA COAL PROJECT (MINE)
DISTRIBUTION OF AQUATIC SAMPLING LOCATIONS MINE STUDY AREA

Job Number	4262 6680
Revision	A
Date	25-03-2011

Figure: FA.9

File No: 42626680-g-2032.wor

FA.7.1.3 Results of Aquatic Flora, Fauna and Stygofauna Assessment

A total of 42 sites were assessed for various elements during the aquatic survey and 15 bores were assessed for the presence of Stygofauna. Detail of the results of each analysis type can be found in Volume 5, Appendix E2 and E3 of the Alpha Coal Project EIS.

FA.7.1.4 Aquatic Flora, Fauna and Stygofauna of Conservation Significance

The results of the Protected Matters Search Tool and the revised Wildlife Online Database searches indicated no EPBC listed species that relied on aquatic habitat for their survival such as amphibians, aquatic macroinvertebrates and fish. While some species identified in the searches are known to unexclusively utilise riparian zones, an assessment of any and all direct and indirect impacts on their potential habitat has been conducted within the terrestrial flora and fauna results sections of this report (Section FA.5).

No EPBC-listed threatened flora or fauna species were identified during field surveys of the mine study area. As there were no EPBC listed species identified during the Aquatic Flora and Fauna or the Sygofauna assessment that relied on the aquatic habitat for survival, no impact assessment was required.

FA.8 Great Artesian Basin

The proposed Hancock coal mining projects, Alpha Coal Project and Kevin's Corner Coal Project, located within the Galilee Basin target coal seams of the Colinlea Sandstone. This Permian age unit and the overlying Permian Bandanna Formation occur below the younger Triassic age Great Artesian Basin (GAB).

The confined aquifers of the GAB are bounded below by the Rewan Group (Habermehl, 2000), indicating that the proposed Hancock mining activities will occur in older formations below the GAB and separated from the oldest GAB aquifer, the Clematis Sandstone, by the Rewan Group.

A geological cross-section (Figure FA-10), west-east, (covering a distance of 310 km) through the proposed mining area was compiled based on available exploration log data for the area. The cross-section indicates the continuous thick (~ 175 m) Rewan Group separating the Bandana Formation (containing the A-B coal seams) and the Clematis Sandstone GAB aquifer. The target coal seams for the Hancock mining operations are the C and D coal seams within the Colinlea Sandstone, which are further separated from the GAB by the groundwater poor (in terms of both quantity and quality) Bandana Formation.

Figure FA-11 provides a geological plan view of the area indicating the geological unit outcrops and the Hancock MDL boundaries. The regional geological model shows that the Rewan Group subcrop and outcrop within MDL285 and MDL333 and the Clematis Sandstone subcrops within 8 km of the MDL boundaries. The GAB aquifers do not outcrop at all within the MDLs.

Dewatering of the hanging wall sediments and depressurising of the sediments (D-E sands) below the target coal seams can potentially induce vertical groundwater flow from the overlying (and underlying) units. The induced flow can result in decreases in groundwater levels within the surrounding units; which in turn could result in decreased bore yields. The potential for induced flow from the overlying Rewan Group was considered to determine whether mine dewatering could impact on the closest GAB aquifer, the Clematis Sandstone.

Figure FA-10: East-West cross-section across geological model (source, Salva, 2009)

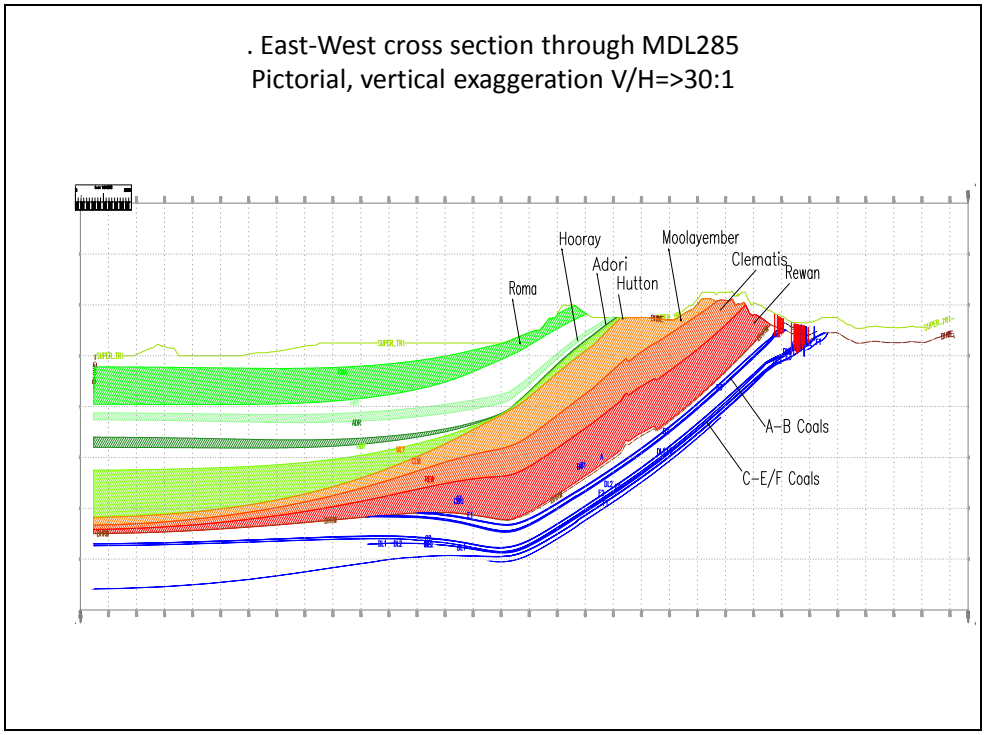
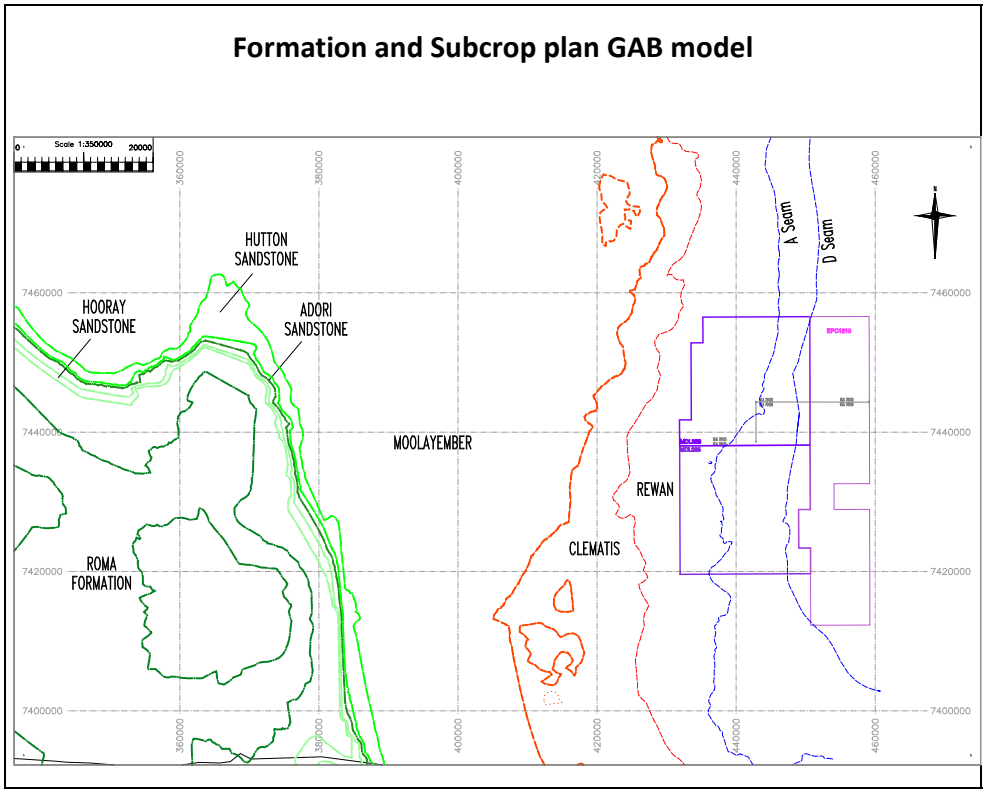


Figure FA-11: Formation and subcrop plan from GAB model (Source: Salva, 2009)



FA.8.2 Desktop Study

The Rewan Group comprises mudstone, siltstone, and lithic sandstone of fluvial, lacustrine, and Aeolian origin, and is generally considered to have low porosity and permeability (Butcher, 1984). The upper section mostly comprises shale and is considered to represent a seal to the basal Rewan Group sandstones (Henning et al., 2006) and is considered a barrier to groundwater migration from the deeper coal seams making it an important hydrocarbon exploration feature (Conybeare, 1970). The maximum encountered thickness of 1,363 m in the Bowen Basin (DME, 1997) may increase up to a suspected maximum thickness of 3,500 m. This unit is widely recognised as the basal unit of the GAB.

All of the water-bearing units below the Rewan Group exist as confined water-bearing units that contain reservoirs of groundwater, which display different hydraulic characteristics and different hydrochemistry indicating a distinctly different hydrogeological system to the GAB (GABCC, 1998). The deeper water bearing units associated with the Permian coal measures are isolated from the GAB aquifers by the Rewan Group confining unit and are considered to be isolated water-bearing units (WorleyParsons, 2010).

Permeability of the Rewan Group aquitard is in the order of 0.1 millidarcy[1] to 1.0 millidarcy (9.3×10^{-5} to 9.3×10^{-4} m^2/day) (Cadman and Pain, 1998). However, porosity and permeability within this unit is thought to be highly variable. This is in line with Butcher (1984) who considers the Rewan Group as a barrier to vertical migration of groundwater from below to the GAB.

A study by Henning et al. (2006) evaluated inter-aquifer flow between the Clematis Sandstone, Rewan Group, Moolayember Formation and the Precipice Sandstone. The study concluded that the Moolayember Formation and the upper Rewan Group act as effective barriers to vertical groundwater movement between units.

It is generally accepted that the Rewan Group is a regional aquitard that prevents significant inter-aquifer transmission of water within and between basins. There are, however, indications that some preferential flow paths may exist across the aquifer allowing some inter-aquifer flow. There is no evidence, based on the exploration data compiled by Salva (2009) during the generation of the regional geological model (Figure 1 and Figure 2), of any large scale geological structures (faults, etc.), within the proposed mine areas that could promote inter-aquifer or inter-basin hydraulic connection.

FA.8.3 Potential for Induced Flow

The potential impacts of depressurizing the copal measure were evaluated based on available data, which allowed for the conceptualisation of the hydrogeology within the study area. This conceptualisation was used to construct a numerical groundwater model. The modelling, using the finite element modelling package FEFLOW, is currently being undertaken to assess the potential impacts of mine dewatering on groundwater resources and levels. Initial model predictions indicate that, due to the low permeable nature of the Rewan Group to the west and the Joe Joe Formation to the east, dewatering will elongate north-south within the more permeable Colinlea Sandstone.

[1] The SI unit for permeability is m^2. A traditional unit for permeability is the darcy (D), or more commonly the *millidarcy* (mD) (1 darcy $\approx 10^{-12} m^2$).

Piezometeric pressures will decrease, resulting in declining groundwater levels, to the west of the proposed coal projects. Drawdown would result in a hydraulic gradient from the overlying Rewan Group to the underlying coal measures. In order to evaluate the potential for induced flow the permeability (vertical) of the Rewan Group was considered and included in the numerical groundwater model.

FA.8.3.1 Site specific permeability data

In order to obtain representative permeability data, both horizontal and vertical, for the Rewan Group, an assessment of the Queensland Petroleum Exploration Data (QPED) database was conducted. Eighteen bores were recorded containing permeability data, obtained from drill stem tests during exploration drilling, within the study area.

The available QPED records are summarised in Table FA-13. The permeability (hydraulic conductivity) was determined for different depths within the bores. Several tests did not result in a response during the drill stem tests, indicating very low permeability (lower than the lowest permeability measured in Table 1, 0.0009 m/day).

Table FA-13 Drill stem test data

Bore No	Test depth (m)	Porosity (%)	Permeability Horizontal (m/day)	Permeability Vertical (m/day)
476	575.46	23.3	0.014	0.0014
476	578.82	12.2	0[2]	0
476	588.87	17.1	0	0
476	593.14	12	0	0
476	597.41	30	0.79	0.47
476	601.98	25.9	0.86	0.011
476	619.35	28.2	0.13	0.012
476	623.62	26.4	4.44	0.14
476	629.11	23.5	0.016	0.015
476	636.42	23.4	0.055	0.036
476	645.26	28.3	0.43	1.18
476	651.05	27.3	2.07	0.05
476	657.15	27.6	0.83	0.34
478	40.2	23.3	0.28	0.015
772	541.9	23	0	0
772	641.6	13.5	0	0
772	734.3	16	0	0
1045	906.37	18.2	0.07	0.006
1045	919	17.2	0.44	0.07
1045	929.3	20.3	0.28	0.028
1443	1149.43	20	0.02	0.005
1443	1158.28	25	0.099	0.07

[2] No response during drill stem test, very low permeability

Bore No	Test depth (m)	Porosity (%)	Permeability Horizontal (m/day)	Permeability Vertical (m/day)
1443	1169.02	25	0.099	0.07
1443	1179.57	25	0.13	0.055
1443	1193.63	22	0.029	0.005
1443	1203.21	21	0.029	0.0048
1443	1212.34	18	0.027	0.004
1443	1221.69	18	0.0048	0.003
1443	1234.57	23	0.0039	0.001
1443	1241.97	24	0.055	0.002
1443	1251.97	21	0.06	0.004
1443	1266.85	19	0.17	0.002
2232	22.4	27	0.001	0
2232	22.8	26	0.0009	0
2232	64	26	0.014	0

FA.8.4 Summary of Impacts on the Great Artisian Basin

These results indicate heterogeneity within the Rewan Group, which contains layers of very low permeability. These zones provide the confining pressures required for artesian and sub-artesian conditions recorded in the GAB and reduce the potential for vertical induced flow. The results match the conceptualisation of the Rewan Group acting as a regional aquitard, which prevents inter-aquifer and inter-basin flow.

The impacts of mine dewatering on the Rewan Group and ultimately to the Clematis Sandstone are therefore recognised as negligible. Ongoing groundwater modelling will be conducted to provide verification of this impact evaluation.

FA.9 Great Barrier Reef Marine Park

FA.9.1 EPBC Values

The Great Barrier Reef Marine Park (GBRMP) is a MNES under the EPBC Act. The area is listed as both a World Heritage Area and National Heritage Place. This assessment will consider the potential for impacts of the Project to the world heritage values of the Great Barrier Reef.

The Great Barrier Reef World Heritage Area (GBRWHA) was registered on the World Heritage List in 1981 in recognition of its identification with four formal criteria. These included that the area is a/an:

- *Outstanding example representing a major stage of the Earth's evolutionary history.* The Great Barrier Reef is the largest single collection of coral reefs in the world. The area includes over 2,900 reefs, 300 coral cays and 600 continental islands with reef morphologies and geological processes reflecting historical conditions and processes.
- *Outstanding example representing significant ongoing geological processes, biological evolution and man's interaction with his natural environment.* The Great Barrier Reef is the most biologically diverse ecosystem known to man with its immense diversity thought to reflect the maturity of a system that has evolved over millions of years. The values are demonstrated by the diversity of flora and fauna (both terrestrial and aquatic), heterogeneity and interconnectivity of the reef assemblage, ongoing erosion and accretion processes, and interconnections via the East Australia current.
- *Contain unique, rare and superlative natural phenomena, formations and features and areas of exceptional natural beauty.* The area provides some of the most spectacular scenery and is of exceptional natural beauty via an unparalleled aerial vista extent, diversity of landscapes and seascapes, abundance and diversity of flora and fauna including breeding colonies and migrating species.
- *Provide habitats where populations of rare and endangered species of plants and animals still survive.* The Great Barrier Reef contains important and significant natural habitats for species of conservation significance and there are large, ecologically complex areas (DEWHA, 2008).

FA.9.2 Potential Impacts

Five key waterways have been identified within or immediately adjacent to the Project area and as part of the Burdekin Basin. All other channels located within the Project area are tributaries of these key waterways. Currently, the Burdekin catchment is the largest single source of sediment to the Great Barrier Reef lagoon. Annual sediment discharge from the catchment is estimated to range between 0.2 and 20 million tonnes, with the average being 3.8 million tonnes. Major sediment discharges are associated with extreme rainfall events during cyclones and only occur every five to ten years. Sediment plumes from such events may be dispersed as far north as Cairns (CSIRO, 2002).

Potential impacts from the Project on the GBRMP include increased sediment input into and degraded water quality of the freshwater being discharged into the GBRMP. Disturbance to the soil surface as a result of mining activities will increase the potential for erosion, resulting in the transportation of sediment to receiving waters. Additionally, degradation of water quality

in the Burdekin Basin due to Acid Mine Drainage and/or accidental discharge has the potential to occur.

As a result of changes to the hydrology surrounding the Project, including stream flows and flood patterns, the quantity and quality of freshwater influx in downstream areas within the GBRMP catchment, may be altered.

FA.9.3 Impact Minimisation, Mitigation and Management

Spatial Scale of Aquatic Connectivity

The GBRMP is approximately 500 km to the east of the project site. Across this distance, any sediment load discharged from the mine site will travel through five water-ways. The flow will begin at Lagoon Creek flowing around 15 km into Sandy Creek, which then flows for around 30 km before linking with the Belyando River. This river then flows for around 190 km before joining the Suttor River River which flows for around 90 km before flowing into the Burdekin River. The Burdekin River then flows for over 100 km before discharging into the marine environment south of Ayr which is around 88 km south of Townsville. In total, the water flow from the Project to the GBRMP is greater than 400 km.

Due to the aquatic connectivity between the mine site and the GBRMP, risk of the above potential impacts negatively influencing the ecological processes of the aquatic system does exist. If the natural habitats that the protected area provides are impacted, the listing criteria for the GBRWHA may also be impacted.

Burdekin Falls Dam

All potentially impacted water is connected to the GBRMP via the Burdekin river thus passes through the Burdekin Falls Dam. It is predicted that 90% of the sediment delivered to the Burdekin Falls Dam is trapped by the dam (CSIRO, 2002). Additionally, the Burdekin dam controls the hydrology of the river. As such, any impact symptom that remains in the system after the long journey from the Project to the dam, is likely to be nullified prior to discharging into the marine environment, thus prior to impacting the GBRMP.

There are a series of mitigation measures and management strategies designed as a result of the above factors potentially causing environmental impact at a localised level. By default these measures and strategies will also minimise any impacts on the GBRMP. These measures are incorporated in an all-incompassing Water Management System which is summarised below. Greater detail in relation to this can be found in the Alpha Coal Project (Mine) EM Plan (Volume 2, Appendix V, Section V.3.4.7.1 of the SEIS).

Water Management System

In line with leading industry practice, the objectives of the water management system design for the Project are to:

- Provide for the separation and diversion of clean water away from the mine site.
- Minimise the volume of pit water (surface runoff draining to pit and groundwater seepage) generated by the Project.
- Avoid the need for discharge of contaminated water under normal operating conditions through preferential onsite reuse of contaminated water stores.

- Provide sufficient onsite storage to give an acceptable level of risk of accidental off-site discharge of contaminated water during significant rainfall events (no unplanned discharge under modeled historical conditions).
- Provide sufficient onsite storage to settle coarse suspended solids from dirty water (from overburden dumps and other disturbed areas) during significant rainfall events, through the application of the relevant guideline sediment dam storage capacity.
- Provide the flexibility to preferentially reuse sediment dam water onsite or release it to the creek, depending on the site water balance, stored water quality, and natural flows in the creek.

In addition to the above impacts will be minimised by two key factors that are exterior to the function, management or control of the project. The first of these factors is the spatial scale over which the aquatic connectivity between the Project and the GBRMP exist. The second is the presence of the Burdekin Falls Dam at the latter end of the aquatic connectivity corridor.

FA.9.4 Assessment of Impacts on the GBRMP

Potential impacts on the GBRMP have been assessed in conjunction with the mitigation measures and management strategies discussed above, in an effort to determine if they are likely to have a significant impact on the GBRMP.

The Commonwealth Department of SEWPAC *Significant Impact Guidelines 1.1 - Matters of National Environmental Significance* (DEWHA (now SEWPAC), 2009b), state that *an action is likely to have a significant impact on the World Heritage values if there is a real chance or possibility that it will cause:*

- One or more of the World Heritage Values to be lost,
- One or more of the World heritage values to be degraded or damaged, or
- One or more of the World Heritage values to be notably altered, modified, obscured or diminished (DEWHA (now SEWPAC), 2009b)

Notwithstanding the consequences of negative impacts on the GBRMP, the quantifiable outcome of any potential impact from the Alpha Coal Project (Mine) is unlikely to be of any significance, if a measurable impact exists at all. The spatial scale over which the aquatic connectivity exists between the Project and the GBRMP, coupled with the mitigation and management at the project site, as well as the presence of the Burdekin Falls Dam, protect the GBRMP ensure any negative impact from the Project is highly improbable.

FA.10 Conclusion

This assessment has identified a number of EPBC-listed species which potentially use habitat on the Project site and as a result of the Project they may be at risk from direct and indirect impacts. However, the scale of the potential impacts on available potential habitat when compared to that available in the surrounding region, offer strong indications that any EPBC-listed species occurring on or around the Project site are unlikely to be negatively impacted. The implementation of sound mitigation measures, management strategies and monitoring programmes as detailed in the Coal Mine EM Plan (Volume 2, Appendix V of this SEIS) with further minimise these potential impacts.

However, the results of this assessment should be taken into consideration alongside the assumptions and limitations discussed in Section F.4.4.4 of this report. Actual impacts that will require offsetting as a result of the Project will differ from those presented in this report and it is expected that real impacts will be either in the order of reasonable best case scenario presented in this report or even less so. Further refinement and review of the habitat mapping, including assessment of additional site specific information, will be undertaken as part of planned ongoing studies. The updates will be available to inform the assessment of direct and indirect impacts, and finalisation of the offsets strategy.

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FA.A.1 Appendix A - Threatened Species Profiles

FA.A.1.1 Introduction

Outlined below is a summary of information relating to the assessment of impacts to threatened species and ecological communities protected under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) that are of relevance to the mine study area. For each threatened species and threatened ecological community (TEC) identified during field studies and/or predicted to occur in the mine study area by the Commonwealth's Protected Matters Search Tool and/or previously recorded from the desktop search extent, the following information is presented:

- General overview of species distribution and habitat requirements
- Summary of threatening processes known or considered to be of relevance to the species
- Commonwealth survey guidelines applicable to the species and the survey effort undertaken during field studies for the Alpha Coal Project (Mine) (the 'Project') EIS and SEIS
- Species specific desktop assessment results
- Species specific field survey results
- Habitat mapping criteria selected to model and map potential habitat for the threatened species of relevance to the mine study area (with descriptive text explaining the rationale for habitat criteria selection provided where necessary)
- A 'regional' map depicting potential habitat for each species in the mine study area and surrounding landscape
- A figure depicting potential habitat for each species in the mine study area

FA.A.1.2 Black-Throated Finch (southern)

FA.A.1.2.1 EPBC Status

Endangered

FA.A.1.2.2 Distribution and Habitat Information

The black-throated finch (southern) (*Poephila cincta cincta*) was previously found throughout eastern and central Queensland north of the New South Wales border, however it is now only known from the Townsville region and scattered sites in central Queensland (Commonwealth Department of Sustainability, Environment, Water, Population and Communities (SEWPAC), 2011a). This largely sedentary, gregarious bird inhabits grassy open woodland and open forest habitats characterised by trees belonging to the genera *Eucalyptus*, *Corymbia*, *Acacia* and *Melaleuca* (SEWPAC, 2011a). Generally it occurs in habitats near watercourses or water bodies - almost all recent records of the subspecies south of the tropics have been in riparian areas (SEWPAC, 2011a). Three critical habitat resources are required to support the black-throated finch (southern):

- Water sources (both natural and artificial)
- Grass seeds (a mosaic of species that provide forage throughout the year (particularly during the wet season)
- Trees that provide suitable nesting habitat (Commonwealth Department of Environment, Water, Heritage and the Arts (DEWHA (now SEWPAC), 2009a); SEWPAC, 2011a)

Existing populations of the black-throated finch (southern) are thought to be highly fragmented (SEWPAC, 2011a).

FA.A.1.2.3 Threatening Processes

The background paper to the Commonwealth Government's *Significant Impact Guidelines for the Endangered Black-Throated Finch (southern) (Poephila cincta cincta)* (DEWHA, 2009a) identifies the following as key threats to the black-throated finch (southern):

- Habitat loss / fragmentation (through land clearing for development) and habitat degradation (trampling by domestic stock and feral animals; weed infestations)
- Inappropriate fire regimes
- Stock grazing (altered ground cover, degradation of water sources)
- Resource bottlenecks
- Drought (DEWHA, 2009)

Other threats include:

- Illegal trapping for the bird trade
- Hybridisation with the northern subspecies of the black-throated finch (*Poephila cincta atropygialis)*
- Predation by feral animals (DEWHA, 2009a)

Key threatening processes listed under the EPBC Act that may be of relevance to this species include:

- Competition and land degradation by rabbits
- Invasion of northern Australia by gamba grass and other introduced grasses
- Land clearance

- Loss of terrestrial climatic habitat caused by anthropogenic emissions of greenhouse gases
- Predation by European red fox
- Predation by feral cats
- Predation, habitat degradation, competition and disease transmission by feral pigs

FA.A.1.2.4 Survey Guidelines and Field Survey Effort

The Commonwealth Government's *Survey Guidelines for Australia's Threatened Birds* (DEWHA, 2009b) details recommended survey methodologies for detecting the black-throated finch (southern). As a guide, it is recommended that 10 hours per day are spent searching for the subspecies (in suitable habitat) over a five day period, for areas less than 50 ha (DEWHA, 2009b). In addition, surveys targeting waterholes and woodswallow nests are recommended to be carried out over two days for a minimum of six hours per day (DEWHA, 2009).

The Background Paper to the Commonwealth Government's *Significant Impact Guidelines for the Endangered Black-Throated Finch (southern) (Poephila cincta cincta)* (DEWHA, 2009a) expands upon the recommended survey guidelines presented in the *Survey Guidelines for Australia's Threatened Birds*. In summary, these guidelines indicate that presence/absence studies should comprise:

- Dry season: water source watching (recommended six hours per day for two days, for each water source in the study area)
- Wet season: water source watching (as described in point above) and targeted woodland searches within 600 m radius of water sources (one hour per hectare for a maximum of ten hours) (DEWHA, 2009a)

At the comprehensive and rapid fauna survey sites depicted in Figure FA-5 of the EPBC Report (Mine), standardised bird surveys (2ha for 20 minutes) for all bird species were undertaken. The bird survey methodology is described in Section FA.4.3.2.6 of the EPBC Report (Mine). In addition, opportunistic diurnal searches were also conducted on foot in areas considered likely to have high avian diversity (e.g. vegetated creek lines, dams), or to contain cryptic or threatened bird species.

FA.A.1.2.5 Desktop Assessment Results

The black-throated finch (southern) was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool.

No historical records of this species were returned from a query of relevant databases in the desktop search extent (as defined in Section FA.4.3.1 of the EPBC Report (Mine)).

FA.A.1.2.6 Field Results

The black-throated finch (southern) was not recorded in the mine study area during seasonal field studies for the Alpha Coal Project (Mine) EIS and SEIS.

FA.A.1.2.7 Habitat Mapping Criteria

Habitat modelling and mapping was undertaken using the methodology described in Section FA.4.4 of the EPBC Report (Mine).

The habitat criteria used to model and map potential habitat for the black-throated finch (southern) are presented in Table FA.A-1 below.

Table FA.A-1 Habitat Mapping Criteria – Black-Throated Finch (southern)

Mapping category	Known point records	Regional Ecosystems*	Queensland BPA Criteria F - Ecosystem Diversity	Queensland BPA Criteria G - Context and Connection	Altitude*	Proximity to water#
'Confirmed habitat'	5 km radius around post-1995 records - sourced from the *Significant Impact Guidelines for the Endangered Black-Throated Finch (southern) (Poephila cincta cincta)* (DEWHA, 2009a) http://www.environment.gov.au/epbc/publications/pubs/black-throated-finch-background.pdf	NA				
'High value potential habitat'	NA	10.3.1, 10.3.2, 10.3.3, 10.3.4, 10.3.5, 10.3.6, 10.3.9, 10.3.10, 10.3.11, 10.3.12, 10.3.13, 10.3.14, 10.3.15, 10.3.16, 10.3.17, 10.3.19, 10.3.20, 10.3.21, 10.3.22, 10.3.23, 10.3.25, 10.3.27, 10.3.28, 10.3.30, 10.3.31, 10.4.1, 10.4.2, 10.4.3, 10.4.4, 10.4.5, 10.4.6, 10.4.9, 10.5.1, 10.5.2, 10.5.4, 10.5.5, 10.5.7, 10.5.8, 10.5.9, 10.5.10, 10.5.11, 10.5.12, 10.7.1, 10.7.2, 10.7.3, 10.7.4, 10.7.5, 10.7.6, 10.7.7, 10.7.8, 10.7.9, 10.7.10, 10.7.11, 10.7.12, 10.9.1, 10.9.2, 10.9.3, 10.9.5, 10.9.6, 10.9.8, 10.10.1, 10.10.2, 10.10.3, 10.10.4, 10.10.5, 10.10.7, 11.2.1, 11.2.5, 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.6, 11.3.8, 11.3.9, 11.3.10, 11.3.12, 11.3.13, 11.3.14, 11.3.15, 11.3.16, 11.3.17, 11.3.18, 11.3.19, 11.3.20, 11.3.23, 11.3.25, 11.3.27, 11.3.28, 11.3.29, 11.3.30, 11.3.32, 11.3.33, 11.3.35,	Very High or High	Very High or High	50 – 350 m	RE polygon ≤ 3 km from water

Mapping category	Known point records	Regional Ecosystems*	Queensland BPA Criteria F - Ecosystem Diversity	Queensland BPA Criteria G - Context and Connection	Altitude*	Proximity to water#
		11.3.36, 11.3.37, 11.3.39, 11.4.2, 11.4.3, 11.4.5, 11.4.8, 11.4.10, 11.4.12, 11.4.13, 11.5.1, 11.5.2, 11.5.3, 11.5.4, 11.5.5, 11.5.8, 11.5.9, 11.5.12, 11.5.13, 11.5.14, 11.5.17, 11.5.20, 11.5.21, 11.7.1, 11.7.2, 11.7.3, 11.7.4, 11.7.6, 11.8.2, 11.8.4, 11.8.5, 11.8.8, 11.8.9, 11.8.11, 11.8.12, 11.8.14, 11.8.15, 11.9.2, 11.9.3, 11.9.7, 11.9.9, 11.9.14, 11.10.1, 11.10.4, 11.10.6, 11.10.7, 11.10.11, 11.10.12, 11.10.13, 11.11.1, 11.11.2, 11.11.3, 11.11.4, 11.11.6, 11.11.7, 11.11.8, 11.11.9, 11.11.10, 11.11.11, 11.11.12, 11.11.15, 11.11.16, 11.11.17, 11.11.19, 11.11.20, 11.12.1, 11.12.2, 11.12.3, 11.12.5, 11.12.6, 11.12.7, 11.12.8, 11.12.9, 11.12.10, 11.12.11, 11.12.12, 11.12.13, 11.12.14, 11.12.17, 11.12.20				
'Low value potential habitat'	NA	10.3.1, 10.3.2, 10.3.3, 10.3.4, 10.3.5, 10.3.6, 10.3.9, 10.3.10, 10.3.11, 10.3.12, 10.3.13, 10.3.14, 10.3.15, 10.3.16, 10.3.17, 10.3.19, 10.3.20, 10.3.21, 10.3.22, 10.3.23, 10.3.25, 10.3.27, 10.3.28, 10.3.30, 10.3.31, 10.4.1, 10.4.2, 10.4.3, 10.4.4, 10.4.5, 10.4.6, 10.4.9, 10.5.1, 10.5.2, 10.5.4, 10.5.5, 10.5.7, 10.5.8, 10.5.9, 10.5.10, 10.5.11, 10.5.12, 10.7.1, 10.7.2, 10.7.3, 10.7.4, 10.7.5, 10.7.6, 10.7.7, 10.7.8, 10.7.9, 10.7.10, 10.7.11, 10.7.12, 10.9.1, 10.9.2, 10.9.3, 10.9.5, 10.9.6, 10.9.8, 10.10.1, 10.10.2, 10.10.3, 10.10.4, 10.10.5, 10.10.7, 11.2.1, 11.2.5, 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.6, 11.3.8, 11.3.9, 11.3.10, 11.3.12, 11.3.13, 11.3.14, 11.3.15, 11.3.16, 11.3.17,	Medium or Low	Medium or Low	< 50 m or >350 m	RE polygon > 3 km from water

Mapping category	Known point records	Regional Ecosystems*	Queensland BPA Criteria F - Ecosystem Diversity	Queensland BPA Criteria G - Context and Connection	Altitude*	Proximity to water#
		11.3.18, 11.3.19, 11.3.20, 11.3.23, 11.3.25, 11.3.27, 11.3.28, 11.3.29, 11.3.30, 11.3.32, 11.3.33, 11.3.35, 11.3.36, 11.3.37, 11.3.39, 11.4.2, 11.4.3, 11.4.5, 11.4.8, 11.4.10, 11.4.12, 11.4.13, 11.5.1, 11.5.2, 11.5.3, 11.5.4, 11.5.5, 11.5.8, 11.5.9, 11.5.12, 11.5.13, 11.5.14, 11.5.17, 11.5.20, 11.5.21, 11.7.1, 11.7.2, 11.7.3, 11.7.4, 11.7.6, 11.8.2, 11.8.4, 11.8.5, 11.8.8, 11.8.9, 11.8.11, 11.8.12, 11.8.14, 11.8.15, 11.9.2, 11.9.3, 11.9.7, 11.9.9, 11.9.14, 11.10.1, 11.10.4, 11.10.6, 11.10.7, 11.10.11, 11.10.12, 11.10.13, 11.11.1, 11.11.2, 11.11.3, 11.11.4, 11.11.6, 11.11.7, 11.11.8, 11.11.9, 11.11.10, 11.11.11, 11.11.12, 11.11.15, 11.11.16, 11.11.17, 11.11.19, 11.11.20, 11.12.1, 11.12.2, 11.12.3, 11.12.5, 11.12.6, 11.12.7, 11.12.8, 11.12.9, 11.12.10, 11.12.11, 11.12.12, 11.12.13, 11.12.14, 11.12.17, 11.12.20				
'Generally not suitable'	NA	All other REs and non-remnant vegetation				

*sourced from Queensland Department of Environment and Resource Management (DERM) Essential Habitat Factors for black-throated finch (southern)

includes rivers/streams, wetlands and bores for which geospatial data was available

Habitat within approximately 5 km of the centre of mapped 'important areas' for the black-throated finch (southern), as presented in the Background Paper to the Commonwealth Government's *Significant Impact Guidelines for the Endangered Black-Throated Finch (southern) (Poephila cincta cincta)* (DEWHA, 2009a), was mapped as 'confirmed habitat'.

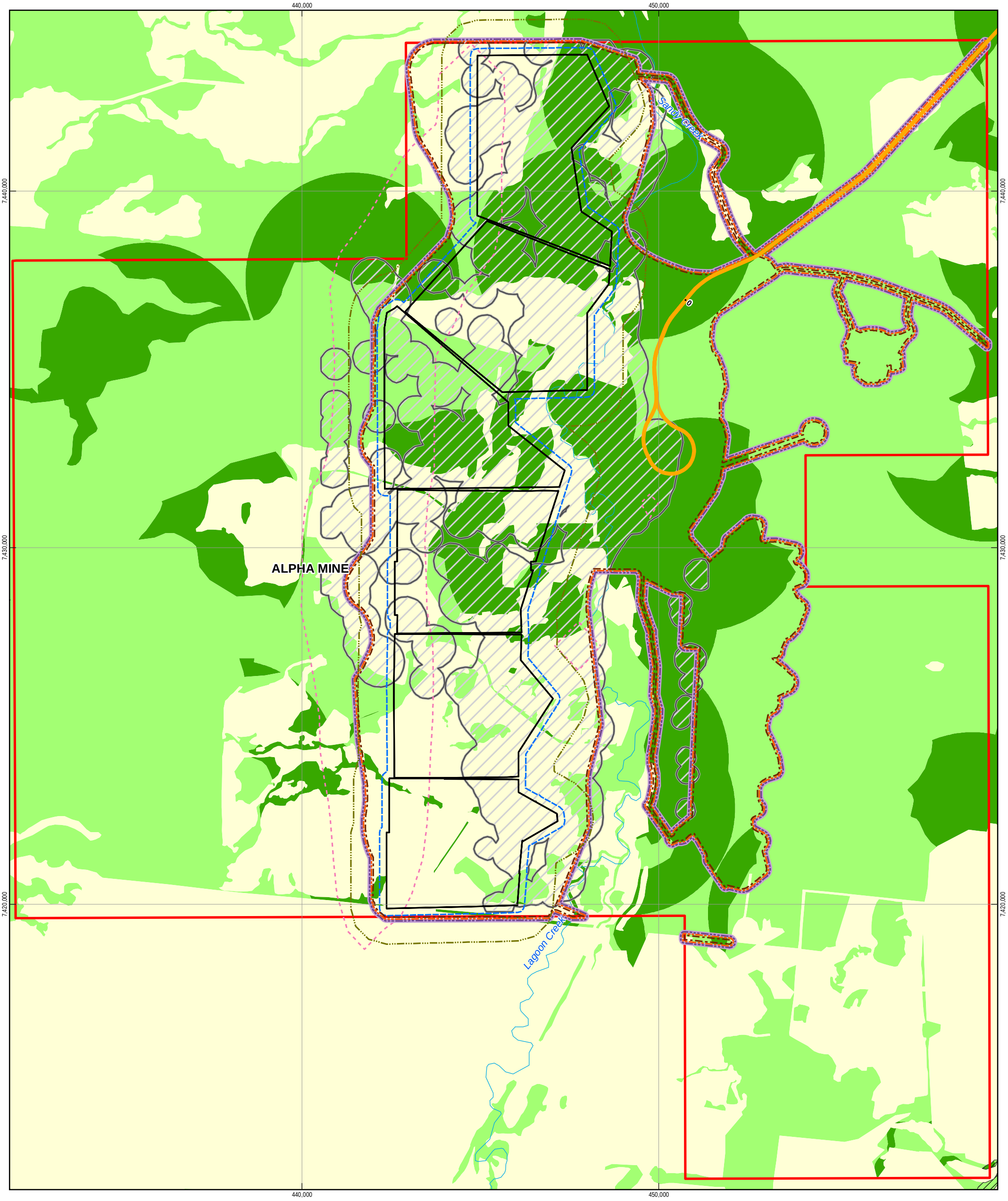
In order to qualify as 'high value potential habitat' for the black-throated finch (southern), based on the rules of the model, a mapped remnant vegetation unit (RE polygon) needed to:

- Contain a Regional Ecosystem (RE) listed in Table FA.A-1 above (if a mixed polygon, the RE must comprise at least 20% of that polygon) **AND**
- Have a very high or high Ecosystem Diversity rating (Queensland DERM Biodiversity Planning Assessment (BPA) Criteria F – an indication of habitat complexity) **AND**
- Have a very high or high Context and Connection rating (BPA Criteria G – an indication of proximity to and connection with other remnant vegetation and/or waterways) **AND**
- Occur at an altitude of 50 – 350 metres **AND**
- Occur within 3 km of a watercourse (river, stream, wetland or bore, for which geospatial data exists)

If the RE criteria was satisfied, but another criteria was not (i.e. BPA rating(s) medium or low **AND/OR** altitude < 50 m or > 350 m **AND/OR** polygon > 3 km from watercourse), the RE polygon was mapped as 'low value potential habitat'.

The 'regional scale' and 'mine study area (local) scale' potential habitat maps for the black-throated finch (southern) are provided in Figure 1 and Figure 2, respectively.

A discussion of direct and indirect impacts to the black-throated finch (southern) is provided in Section FA.6 of the EPBC Report (Mine). The area of 'high value potential habitat' and 'low value potential habitat' that may experience direct and indirect impacts from the Project is discussed. Measures to manage and mitigate potential impacts are presented.



LEGEND

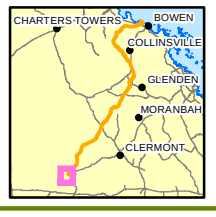
- Town
- Existing Railway
- State Road
- Waterbody
- Watercourse
- Alpha MLA
- Mine Pit
- Direct Disturbance Footprint
- Proposed Alignment

Vegetation Corridor (Brigalow Belt)
- State
- Regional

Vegetation Corridor (Desert Uplands)
- Very High

Black Throated Finch Habitat
- Confirmed
- High Potential
- Low Potential
- Not Suitable

Indirect Impact Buffer Contour
- Vibration
- Light
- Invasive Species
- Groundwater
- Dust
- Noise



Source: See Copyright Details below and for full disclosure please read Section 18.2 - References in the EIS

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0 0.5 1 2 3 4 5

Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

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Alpha Coal Project
Supplementary Environmental Impact Statement

POTENTIAL BLACK THROATED FINCH HABITAT - ALPHA MINE

Job Number	41-23742
Revision	A
Date	28 July 2011

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400,000 450,000 500,000

7,500,000 7,450,000 7,400,000

Edie Creek
Clare Creek
Dunda Creek
Fiery Creek
Fox Creek
Belyando River
Sandy Creek
Lagoon Creek
Tallarenha Creek
Alice River
Jordan Creek
Brumby Gully
May Creek
Rocky Creek
Pebbly Creek
Bottle Tree Creek

100000
75000
50000
25000
0

ALPHA MINE

Clermont - Alpha Road
Capricorn Highway
Blackall - Jericho Road
Alpha - Tambo Road
ALPHA

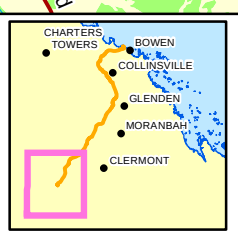
LEGEND

- Town
- Existing Railway
- State Road
- Waterbody
- Watercourse
- Alpha MLA
- Proposed Alignment

Vegetation Corridor (Brigalow Belt)
- State
- Regional

Vegetation Corridor (Desert Uplands)
- Very High

Black Throated Finch Habitat
- Confirmed
- High Potential
- Low Potential
- Not Suitable



Source: See Copyright Details below and for full disclosure please read Section 18.2 - References in the EIS

1:500,000 (at A3)

0 2.5 5 10 15 20 25

Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

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Alpha Coal Project
Supplementary Environmental Impact Statement

POTENTIAL BLACK THROATED FINCH HABITAT - REGIONAL

Job Number	41-23742
Revision	A
Date	28 July 2011

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FA.A.1.3 Squatter Pigeon (southern)

FA.A.1.3.1 EPBC Status

Vulnerable

FA.A.1.3.2 Distribution and Habitat Information

The ground-dwelling squatter pigeon (southern) (*Geophaps scripta scripta*) occurs from the dry tropics of central Queensland to the south east of the state (SEWPAC, 2011b). During the 20th Century the squatter pigeon (southern) experienced a northwards range contraction, and it is now not known to occur in New South Wales (SEWPAC, 2011b). At some locations in the northern part of its current distribution the squatter pigeon (southern) remains locally abundant (SEWPAC, 2011g), and is considered to be common in cattle-grazed country north of the Tropic of Capricorn (SEWPAC, 2011b).

This bird is generally associated with open eucalypt woodland or forest habitat with a grassy understorey, particularly near water (SEWPAC, 2011b). It less frequently inhabits disturbed areas (i.e. around roads, stockyards) (SEWPAC, 2011b). A variety of food items are taken by this ground-dwelling forager, including seeds (grass, legumes, herbs, forbs), insects and ticks (SEWPAC, 2011b).

FA.A.1.3.3 Threatening Processes

The three main threats to the squatter pigeon (southern) are:

- Loss of habitat associated with land clearing (for agriculture and industry)
- Habitat degradation by grazing herbivores
- Predation by native and introduced predators – most notably by cats and foxes (SEWPAC, 2011b)

Key threatening processes listed under the EPBC Act that may be of relevance to this species include:

- Competition and land degradation by rabbits
- Invasion of northern Australia by gamba grass and other introduced grasses
- Land clearance
- Loss of terrestrial climatic habitat caused by anthropogenic emissions of greenhouse gases
- Predation by European red fox
- Predation by feral cats
- Predation, habitat degradation, competition and disease transmission by feral pigs

FA.A.1.3.4 Survey Guidelines and Survey Effort

The Commonwealth Government's *Survey Guidelines for Australia's Threatened Birds* (DEWHA, 2009b) details recommended survey methodologies for detecting the squatter pigeon (southern) - namely searches or transect surveys, and flushing surveys, in suitable habitat. It is recommended that 15 hours over at least 3 days be invested in area searches/transect surveys (for areas less than 50 ha), and 10 hours over at least 3 days be invested in flushing surveys (for areas less than 50 ha).

At the comprehensive and rapid fauna survey sites depicted in Figure FA-5 of the EPBC Report (Mine), standardised bird surveys (2ha for 20 minutes) for all bird species were

undertaken. The bird survey methodology is described in Section FA.4.3.2.6 of the EPBC Report (Mine). In addition, opportunistic diurnal searches were also conducted on foot in areas considered likely to have high avian diversity (e.g. vegetated creek lines, dams), or to contain cryptic or threatened bird species.

FA.A.1.3.5 Desktop Assessment Results

The squatter pigeon (southern) was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool.

The Queensland DERM Wildlife Online database returned a record of this species from the desktop search extent (as defined in Section FA.4.3.1 of the EPBC Report (Mine)).

FA.A.1.3.6 Field Results

The squatter pigeon (southern) was recorded during the field survey for the Project EIS and SEIS, with individuals observed within non-remnant grassland habitat.

FA.A.1.3.7 Habitat Mapping Criteria

Habitat modelling and mapping was undertaken using the methodology described in Section FA.4.4 of the EPBC Report (Mine).

The habitat criteria used to model and map potential habitat for the squatter pigeon (southern) are presented in Table FA.A-2 below.

Table FA.A-2 Habitat Mapping Criteria – Squatter Pigeon (southern)

Mapping category	Known point records	Regional Ecosystems*	Queensland BPA Criteria F - Ecosystem Diversity	Queensland BPA Criteria G - Context and Connection	Proximity to water#
'Confirmed habitat'	Remnant vegetation within 5 km radius of squatter pigeon (southern) records from EIS and SEIS studies for Alpha Coal Project (Mine)	NA			
'High value potential habitat'	NA	Brigalow Belt Bioregion (i.e. Bioregion 11): REs in Landzone 3, 4, 5, 8, 9, 11, 12 - specifically: 11.3.10, 11.3.12, 11.3.14, 11.3.15, 11.3.16, 11.3.17, 11.3.18, 11.3.19, 11.3.2, 11.3.23, 11.3.25, 11.3.26, 11.3.28, 11.3.29, 11.3.3, 11.3.30, 11.3.35, 11.3.36, 11.3.37, 11.3.38, 11.3.39, 11.3.4, 11.3.6, 11.3.7, 11.3.9, 11.4.10, 11.4.12, 11.4.13, 11.4.2, 11.4.7, 11.4.8, 11.5.1, 11.5.12, 11.5.13, 11.5.17, 11.5.2, 11.5.20, 11.5.21, 11.5.3, 11.5.4, 11.5.5, 11.5.7, 11.5.8, 11.5.9, 11.8.1, 11.8.12, 11.8.14, 11.8.15, 11.8.2, 11.8.4, 11.8.5, 11.8.8, 11.9.1, 11.9.10, 11.9.13, 11.9.14, 11.9.2, 11.9.7, 11.9.9, 11.11.1, 11.11.10, 11.11.11, 11.11.12, 11.11.15, 11.11.16, 11.11.19, 11.11.20, 11.11.3, 11.11.4, 11.11.6, 11.11.7, 11.11.8, 11.11.9, 11.12.1, 11.12.10, 11.12.11, 11.12.13, 11.12.14, 11.12.17, 11.12.19, 11.12.2, 11.12.20, 11.12.3, 11.12.5, 11.12.6, 11.12.7, 11.12.8, 11.12.9 Desert Uplands Bioregion (i.e. Bioregion 10): REs in Landzone 3, 4, 5, 9 - specifically: 10.3.10, 10.3.11, 10.3.12, 10.3.13, 10.3.14, 10.3.15, 10.3.2, 10.3.20, 10.3.27,	Very High or High	Very High or High	RE polygon ≤ 3 km from water

Mapping category	Known point records	Regional Ecosystems*	Queensland BPA Criteria F - Ecosystem Diversity	Queensland BPA Criteria G - Context and Connection	Proximity to water#
		10.3.28, 10.3.5, 10.3.6, 10.3.9, 10.4.3, 10.4.9, 10.5.1, 10.5.10, 10.5.11, 10.5.12, 10.5.2, 10.5.4, 10.5.5, 10.5.7, 10.5.8, 10.5.9, 10.9.2, 10.9.3, 10.9.5			
'Low value potential habitat'	NA	Brigalow Belt Bioregion (i.e. Bioregion 11): REs in Landzone 3, 4, 5, 8, 9, 11, 12 - specifically: 11.3.10, 11.3.12, 11.3.14, 11.3.15, 11.3.16, 11.3.17, 11.3.18, 11.3.19, 11.3.2, 11.3.23, 11.3.25, 11.3.26, 11.3.28, 11.3.29, 11.3.3, 11.3.30, 11.3.35, 11.3.36, 11.3.37, 11.3.38, 11.3.39, 11.3.4, 11.3.6, 11.3.7, 11.3.9, 11.4.10, 11.4.12, 11.4.13, 11.4.2, 11.4.7, 11.4.8, 11.5.1, 11.5.12, 11.5.13, 11.5.17, 11.5.2, 11.5.20, 11.5.21, 11.5.3, 11.5.4, 11.5.5, 11.5.7, 11.5.8, 11.5.9, 11.8.1, 11.8.12, 11.8.14, 11.8.15, 11.8.2, 11.8.4, 11.8.5, 11.8.8, 11.9.1, 11.9.10, 11.9.13, 11.9.14, 11.9.2, 11.9.7, 11.9.9, 11.11.1, 11.11.10, 11.11.11, 11.11.12, 11.11.15, 11.11.16, 11.11.19, 11.11.20, 11.11.3, 11.11.4, 11.11.6, 11.11.7, 11.11.8, 11.11.9, 11.12.1, 11.12.10, 11.12.11, 11.12.13, 11.12.14, 11.12.17, 11.12.19, 11.12.2, 11.12.20, 11.12.3, 11.12.5, 11.12.6, 11.12.7, 11.12.8, 11.12.9 Desert Uplands Bioregion (i.e. Bioregion 10): REs in Landzone 3, 4, 5, 9 - specifically: 10.3.10, 10.3.11, 10.3.12, 10.3.13, 10.3.14, 10.3.15, 10.3.2, 10.3.20, 10.3.27, 10.3.28, 10.3.5, 10.3.6, 10.3.9, 10.4.3, 10.4.9, 10.5.1, 10.5.10, 10.5.11, 10.5.12, 10.5.2, 10.5.4, 10.5.5, 10.5.7, 10.5.8, 10.5.9, 10.9.2, 10.9.3, 10.9.5	Medium or Low	Medium or Low	RE polygon > 3 km from water
'Generally not suitable'	NA	All other REs and non-remnant veg			

* No DERM Essential Habitat factors available at time of preparation - Selected REs typically those that feature eucalypt woodland / forest habitat. REs from landzones 6 (dunefields), 7 (ironstone jump-ups) and 10 (sandstone ranges) not considered for analysis - considered to be generally unsuitable habitat. # includes rivers/streams, wetlands and bores for which geospatial data was available

Habitat within approximately 5 km of sighting records from EIS/SEIS studies was mapped as 'confirmed habitat'.

In order to qualify as 'high value potential habitat' for the squatter pigeon (southern), based on the rules of the model, a mapped remnant vegetation unit (RE polygon) needed to:

- Contain an RE listed in Table FA.A-2 above (if a mixed polygon, the RE must comprise at least 20% of that polygon) AND
- Have a very high or high Ecosystem Diversity rating (BPA Criteria F – an indication of habitat complexity) AND
- Have a very high or high Context and Connection rating (BPA Criteria G – an indication of proximity to and connection with other remnant vegetation and/or waterways) AND
- Occur within 3 km of a watercourse (river, stream, wetland or bore, for which geospatial data exists)

If the RE criteria was satisfied, but another criteria was not (i.e. BPA rating(s) medium or low **AND/OR** polygon > 3 km from watercourse), the RE polygon was mapped as 'low value potential habitat'

If a mapped remnant vegetation unit (RE polygon) did not contain an RE nominated in Table FA.A-2, or was non-remnant vegetation, it was mapped as 'generally not suitable' for the subspecies

The 'regional scale' and 'mine study area (local) scale' potential habitat maps for the squatter pigeon (southern) are provided in Figure 3 and Figure 4, respectively.

A discussion of direct and indirect impacts to the squatter pigeon (southern) is provided in Section FA.6 of the EPBC Report (Mine)). The area of 'confirmed habitat', 'high value potential habitat' and 'low value potential habitat' that may experience direct and indirect impacts from the Project (Mine) is discussed. Measures to manage and mitigate potential impacts are presented.

440,000
450,000
7,440,000
7,430,000
7,420,000
Sandy Creek
ALPHA MINE
Lagoon Creek

LEGEND

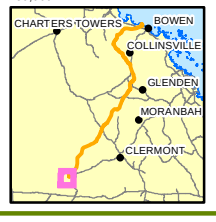
- Town
- Existing Railway
- State Road
- Waterbody
- Watercourse
- Alpha MLA
- Mine Pit
- Direct Disturbance Footprint
- Proposed Alignment

Vegetation Corridor (Brigalow Belt)
- State
- Regional

Vegetation Corridor (Desert Uplands)
- Very High

Squatter Pigeon Habitat
- Confirmed
- High Potential
- Low Potential
- Not Suitable

Indirect Impact Buffer Contour
- Vibration
- Light
- Invasive Species
- Groundwater
- Dust
- Noise



Source: See Copyright Details below and for full disclosure please read Section 18.2 - References in the EIS

1:100,000 (at A3)

0 0.5 1 2 3 4 5

Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

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HANCOCK PROSPECTING PTY LTD

Alpha Coal Project
Supplementary Environmental Impact Statement

POTENTIAL SQUATTER PIGEON HABITAT - ALPHA MINE

Job Number	41-23742
Revision	A
Date	28 July 2011

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400,000 450,000 500,000

7,500,000 7,450,000 7,400,000

Edie Creek
Claire Creek
Dunda Creek
Fiery Creek
Fox Creek
Belyando River
Sandy Creek
Lagoon Creek
Tallarenha Creek
Alice River
May Creek
Rocky Creek
Pebbly Creek
Bottle Tree Creek
Brumby Gully
Jordan Creek

100000
75000
50000
25000
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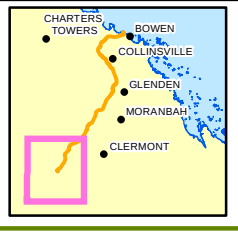
ALPHA MINE

Clermont - Alpha Road
Capricorn Highway
Blackall - Jericho Road
Alpha - Tambo Road
ALPHA

LEGEND

- Town
- Existing Railway
- State Road
- Waterbody
- Watercourse
- Alpha MLA
- Proposed Alignment
- Vegetation Corridor (Brigalow Belt): State, Regional
- Vegetation Corridor (Desert Uplands): Very High
- Squatter Pigeon Habitat: Confirmed, High Potential, Low Potential, Not Suitable



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Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

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Alpha Coal Project
Supplementary Environmental Impact Statement

POTENTIAL SQUATTER PIGEON HABITAT - REGIONAL

Job Number	41-23742
Revision	A
Date	28 July 2011

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FA.A.1.4 Red Goshawk

FA.A.1.4.1 EPBC Act Status

Vulnerable

FA.A.1.4.2 Distribution and Habitat Information

The red goshawk (*Erythrotriorchis radiatus*) is sparsely distributed across northern sub-coastal and coastal Australia (SEWPAC, 2011c). This species inhabits forests and woodlands featuring a mosaic of vegetation types, particularly where these occur near permanent water (Marchant and Higgins, 1993). Forests of intermediate density are particularly favoured, as are ecotones between variably dense habitats (i.e. ecotones between rainforest and sclerophyll forest) (SEWPAC, 2011c). Large bird populations (the primary prey of this species) are also an important determinant of red goshawk distribution (SEWPAC, 2011c). It generally avoids open habitats, and is only rarely encountered over agricultural land (Marchant and Higgins, 1993). Nesting occurs in tall trees within one km of permanent water, generally in open, biologically-rich forest or woodland (Marchant and Higgins, 1993).

FA.A.1.4.3 Threatening Processes

The main threatening process that has historically, and continues to adversely impact the red goshawk, is land clearing and associated habitat loss (SEWPAC, 2011c). Other potential threats to the species include:

- Agricultural practices (application of persistent pesticides, livestock degradation of riparian habitats, overgrazing and resultant impacts to prey densities)
- Altered fire regimes
- Shooting by poultry and pigeon owners
- Extreme natural events (bushfires, cyclones)
- Disturbance by birdwatchers at known nesting sites
- Poisoning
- Genetic bottlenecks (SEWPAC, 2011c)

Key threatening processes listed under the EPBC Act that may be of relevance to this species include:

- Competition and land degradation by rabbits
- Invasion of northern Australia by gamba grass and other introduced grasses
- Land clearance
- Loss of terrestrial climatic habitat caused by anthropogenic emissions of greenhouse gases
- Predation by European red fox
- Predation by feral cats
- Predation, habitat degradation, competition and disease transmission by feral pigs

FA.A.1.4.4 Survey Guidelines and Field Survey Effort

The Commonwealth Government's *Survey Guidelines for Australia's Threatened Birds* (DEWHA, 2009b) details recommended survey methodologies for detecting the red goshawk. Ground surveys for red goshawk nests in tall riparian trees are the suggested technique for detecting the presence of this species. Over a ten day period it is recommended that 80 hours are spent searching for nests in suitable area.

At the comprehensive and rapid fauna survey sites depicted in Figure FA-5 of the EPBC Report (Mine), standardised bird surveys (2ha for 20 minutes) for all bird species were undertaken. The bird survey methodology is described in Section FA.4.3.2.6 of the EPBC Report (Mine). In addition, opportunistic diurnal searches were also conducted on foot in areas considered likely to have high avian diversity (e.g. vegetated creek lines, dams), or to contain cryptic or threatened bird species.

FA.A.1.4.5 Desktop Assessment Results

The red goshawk was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool.

The Queensland DERM Wildlife Online database returned a record of this species from the desktop search extent (as defined in Section FA.4.3.1 of the EPBC Report (Mine)).

FA.A.1.4.6 Field Results

No red goshawks were recorded in the mine study area during seasonal field studies for the Project EIS and SEIS. No red goshawk nests were detected.

FA.A.1.4.7 Habitat Mapping Criteria

Habitat modelling and mapping was undertaken using the methodology described in Section FA.4.4 of the EPBC Report (Mine).

The habitat criteria used to model and map potential habitat for the red goshawk are presented in Table FA.A-3 below.

Table FA.A-3 Habitat Mapping Criteria – Red Goshawk

Mapping category	Known point records	Regional Ecosystems*	Queensland BPA Criteria F - Ecosystem Diversity	Queensland BPA Criteria G - Context and Connection	Proximity to water#
'Confirmed habitat'	5 km radius around known records - sourced from the (Queensland) *Red Goshawk Conservation Management Profile* (Queensland Environmental Protection Agency (EPA), 2006)	NA			
'High value potential habitat'	NA	Brigalow Belt Bioregion (i.e. Bioregion 11): REs in Landzone 3, 4, 5, 8, 9, 11, 12 - specifically: 11.3.10, 11.3.12, 11.3.14, 11.3.15, 11.3.16, 11.3.17, 11.3.18, 11.3.19, 11.3.2, 11.3.23, 11.3.25, 11.3.26, 11.3.28, 11.3.29, 11.3.3, 11.3.30, 11.3.35, 11.3.36, 11.3.37, 11.3.38, 11.3.39, 11.3.4, 11.3.6, 11.3.7, 11.3.9, 11.4.10, 11.4.12, 11.4.13, 11.4.2, 11.4.7, 11.4.8, 11.5.1, 11.5.12, 11.5.13, 11.5.17, 11.5.2, 11.5.20, 11.5.21, 11.5.3, 11.5.4, 11.5.5, 11.5.7, 11.5.8, 11.5.9, 11.8.1, 11.8.12, 11.8.14, 11.8.15, 11.8.2, 11.8.4, 11.8.5, 11.8.8, 11.9.1, 11.9.10, 11.9.13, 11.9.14, 11.9.2, 11.9.7, 11.9.9, 11.11.1, 11.11.10, 11.11.11, 11.11.12, 11.11.15, 11.11.16, 11.11.19, 11.11.20, 11.11.3, 11.11.4, 11.11.6, 11.11.7, 11.11.8, 11.11.9, 11.12.1, 11.12.10, 11.12.11, 11.12.13, 11.12.14, 11.12.17, 11.12.19, 11.12.2, 11.12.20, 11.12.3, 11.12.5, 11.12.6, 11.12.7, 11.12.8, 11.12.9 Desert Uplands Bioregion (i.e. Bioregion 10): REs in Landzone 3, 4, 5, 9 - specifically: 10.3.10, 10.3.11, 10.3.12, 10.3.13, 10.3.14, 10.3.15, 10.3.2, 10.3.20, 10.3.27, 10.3.28, 10.3.5, 10.3.6, 10.3.9, 10.4.3, 10.4.9, 10.5.1, 10.5.10, 10.5.11, 10.5.12,	Very High or High	Very High or High	RE polygon ≤ 1 km from water

Mapping category	Known point records	Regional Ecosystems*	Queensland BPA Criteria F - Ecosystem Diversity	Queensland BPA Criteria G - Context and Connection	Proximity to water#
		10.5.2, 10.5.4, 10.5.5, 10.5.7, 10.5.8, 10.5.9, 10.9.2, 10.9.3, 10.9.5			
'Low value potential habitat'	NA	Brigalow Belt Bioregion (i.e. Bioregion 11): REs in Landzone 3, 4, 5, 8, 9, 11, 12 - specifically: 11.3.10, 11.3.12, 11.3.14, 11.3.15, 11.3.16, 11.3.17, 11.3.18, 11.3.19, 11.3.2, 11.3.23, 11.3.25, 11.3.26, 11.3.28, 11.3.29, 11.3.3, 11.3.30, 11.3.35, 11.3.36, 11.3.37, 11.3.38, 11.3.39, 11.3.4, 11.3.6, 11.3.7, 11.3.9, 11.4.10, 11.4.12, 11.4.13, 11.4.2, 11.4.7, 11.4.8, 11.5.1, 11.5.12, 11.5.13, 11.5.17, 11.5.2, 11.5.20, 11.5.21, 11.5.3, 11.5.4, 11.5.5, 11.5.7, 11.5.8, 11.5.9, 11.8.1, 11.8.12, 11.8.14, 11.8.15, 11.8.2, 11.8.4, 11.8.5, 11.8.8, 11.9.1, 11.9.10, 11.9.13, 11.9.14, 11.9.2, 11.9.7, 11.9.9, 11.11.1, 11.11.10, 11.11.11, 11.11.12, 11.11.15, 11.11.16, 11.11.19, 11.11.20, 11.11.3, 11.11.4, 11.11.6, 11.11.7, 11.11.8, 11.11.9, 11.12.1, 11.12.10, 11.12.11, 11.12.13, 11.12.14, 11.12.17, 11.12.19, 11.12.2, 11.12.20, 11.12.3, 11.12.5, 11.12.6, 11.12.7, 11.12.8, 11.12.9 Desert Uplands Bioregion (i.e. Bioregion 10): REs in Landzone 3, 4, 5, 9 - specifically: 10.3.10, 10.3.11, 10.3.12, 10.3.13, 10.3.14, 10.3.15, 10.3.2, 10.3.20, 10.3.27, 10.3.28, 10.3.5, 10.3.6, 10.3.9, 10.4.3, 10.4.9, 10.5.1, 10.5.10, 10.5.11, 10.5.12, 10.5.2, 10.5.4, 10.5.5, 10.5.7, 10.5.8, 10.5.9, 10.9.2, 10.9.3, 10.9.5	Medium or Low	Medium or Low	RE polygon > 1 km from water
'Generally not suitable'	NA	All other REs and non-remnant veg			

* No Essential Habitat factors available at time of preparation - Selected REs typically those that feature eucalypt woodland / forest habitat. REs from landzones 6 (dunefields), 7 (ironstone jump-ups) and 10 (sandstone ranges) not considered for analysis - generally unsuitable habitat

includes rivers/streams and wetlands for which geospatial data was available

Habitat within approximately 5 km of the center of mapped known records for the red goshawk, as presented in the *Red Goshawk Conservation Management Profile* (EPA, 2006), was mapped as 'confirmed habitat'

In order to qualify as 'high value potential habitat' for the red goshawk, based on the rules of the model, a mapped remnant vegetation unit (RE polygon) needed to:

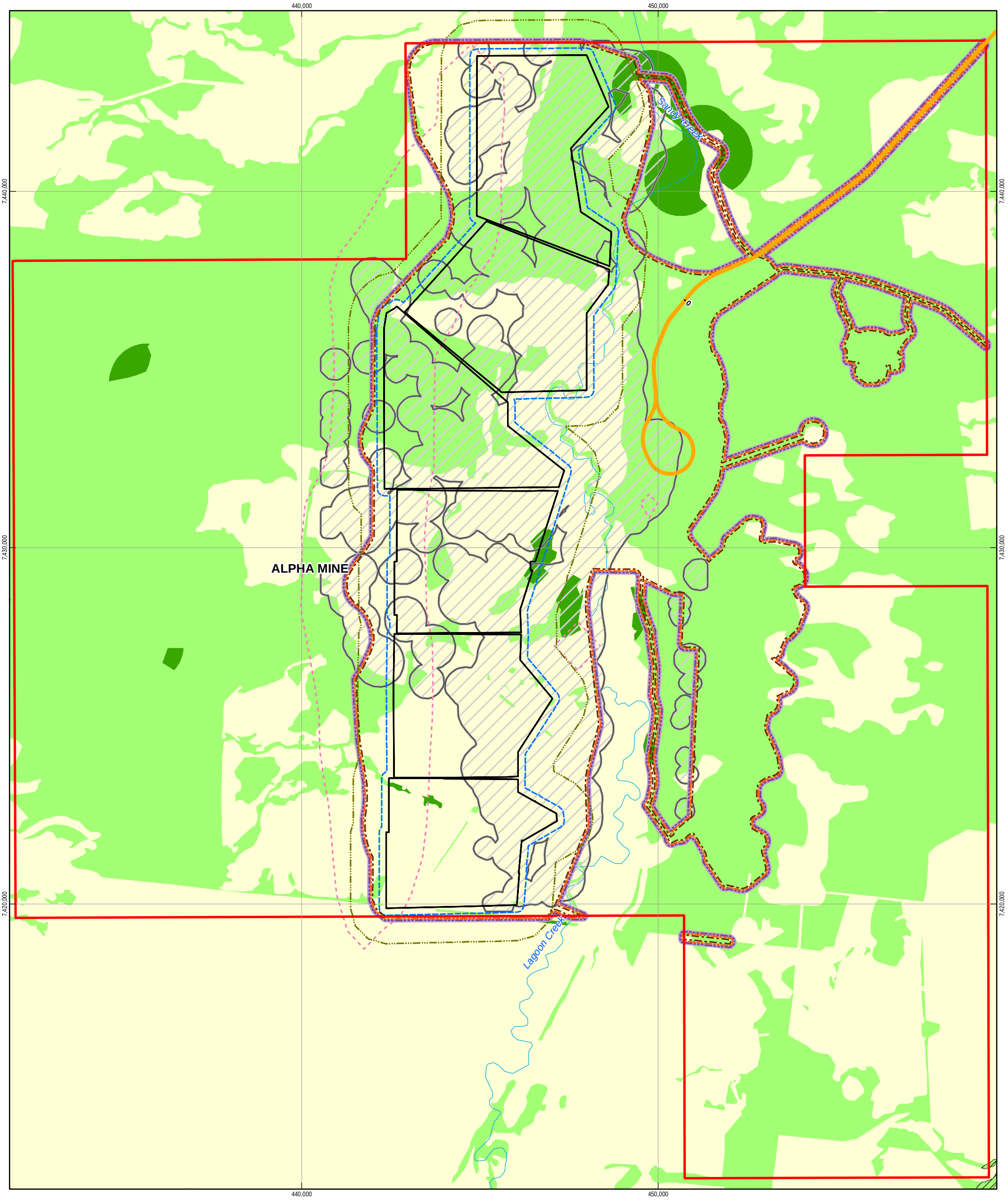
- Contain an RE listed in Table FA.A-3 above (if a mixed polygon, the RE must comprise at least 20% of that polygon) **AND**
- Have a very high or high Ecosystem Diversity rating (BPA Criteria F – an indication of habitat complexity) **AND**
- Have a very high or high Context and Connection rating (BPA Criteria G – an indication of proximity to and connection with other remnant vegetation and/or waterways) **AND**
- Occur within 1 km of a watercourse (river, stream or wetland, for which geospatial data exists)

If the RE criteria was satisfied, but another criteria was not (i.e. BPA rating(s) medium or low **AND/OR** polygon > 1 km from watercourse), the RE polygon was mapped as 'low value potential habitat'.

If a mapped remnant vegetation unit (RE polygon) did not contain an RE nominated in Table FA.A-3 or was non-remnant vegetation, it was mapped as 'generally not suitable' for the species.

The 'regional scale' and 'mine study area (local) scale' potential habitat maps for the red goshawk are provided in Figure 5 and Figure 6, respectively.

A discussion of direct and indirect impacts to the red goshawk is provided in Section FA.6 of the EPBC Report (Mine)). The area of 'confirmed habitat', 'high value potential habitat' and 'low value potential habitat' that may experience direct and indirect impacts from the Project (Mine) is discussed. Measures to manage and mitigate potential impacts are presented.



LEGEND

- Town
- Existing Railway
- State Road
- Waterbody
- Watercourse
- Alpha MLA
- Mine Pit
- Direct Disturbance Footprint
- Proposed Alignment
- Vegetation Corridor (Brigalow Belt): State, Regional
- Vegetation Corridor (Desert Uplands): Very High
- Red Goshawk Habitat: Confirmed, High Potential, Low Potential, Not Suitable
- Indirect Impact Buffer Contour: Vibration, Light, Invasive Species, Groundwater, Dust, Noise

Source: See Copyright Details below and for full disclosure please read Section 18.2 - References in the EIS

1:100,000 (at A3)

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Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

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Alpha Coal Project
Supplementary Environmental Impact Statement

POTENTIAL RED GOSHAWK HABITAT - ALPHA MINE

Job Number	41-23742
Revision	A
Date	28 July 2011

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7,400,000

Edie Creek
Clare Creek
Dunda Creek
Fiery Creek
Fox Creek
Belyando River
Sandy Creek
Lagoon Creek
Tallarenha Creek
Alice River
Jordan Creek
Brumby Gully
May Creek
Rocky Creek
Pebbly Creek
Bottle Tree Creek
Belyando River

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ALPHA MINE

Clermont - Alpha Road
Capricorn Highway
ALPHA
Blackall - Jericho Road
Alpha - Tambo Road

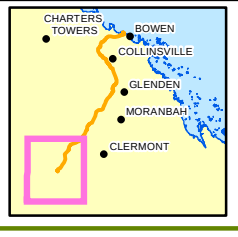
LEGEND

- Town
- Existing Railway
- State Road
- Waterbody
- Watercourse
- Alpha MLA
- Proposed Alignment

Vegetation Corridor (Brigalow Belt)
- State
- Regional

Vegetation Corridor (Desert Uplands)
- Very High

Red Goshawk Habitat
- Confirmed
- High Potential
- Low Potential
- Not Suitable



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Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

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Alpha Coal Project
Supplementary Environmental Impact Statement

POTENTIAL RED GOSHAWK HABITAT - REGIONAL

Job Number	41-23742
Revision	A
Date	28 July 2011

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FA.A.1.5 Star Finch

FA.A.1.5.1 EPBC Act Status

Endangered

FA.A.1.5.2 Distribution and Habitat Information

The distribution of star finch (*Neochmia ruficauda ruficauda*) populations is limited to central Queensland (Threatened Species Scientific Committee, 2008). The few accepted records suggest distribution of the star finch extends north to Bowen, west to beyond Winton and, based on recent records, south to near Wowan. Typical habitat favoured by the star finch (eastern) includes grasslands and grassy woodlands located close to bodies of fresh water (Garnett 1993; Gould 1865; Holmes 1996) as well as woodland areas associated with permanent water or those areas regularly inundated (SEWPaC, 2011). Occasionally, star finch (eastern) has also been recorded in cleared or suburban areas such as along roadsides and in towns (Baldwin 1975; Cayley 1932; Holmes 1996, 1998; Marshall 1932).

FA.A.1.5.3 Threatening Processes

Several factors are thought to have contributed to the decline in star finch populations over the last several decades. Collection for the bird trade in the early 20th century coupled with impacts from prolonged drought on their preferred water-related habitat, resulted in an initial decline in the star finch population. Today, impacts include habitat degradation caused by over-grazing and trampling of habitat by livestock (Garnett & Crowley, 2000).

Currently, threats to the star finch as published by the Threatened Species Scientific Committee include:

- continued degradation of habitat by livestock;
- predation by introduced species such as feral cats (*Felis catus*) and European red foxes (*Vulpes vulpes*);
- invasive weeds threatening preferred habitat; and
- poisoning by contaminants, such as cyanide, employed in mining operations (Holmes, 1998; Garnett & Crowley, 2000).

FA.A.1.5.4 Survey Guidelines and Field Survey Effort

The Commonwealth Government's *Survey Guidelines for Australia's Threatened Birds* (DEWHA, 2009b) details recommended survey methodologies for detecting the star finch (eastern). As a guide, it is recommended that 15 hours per day are spent searching for the subspecies (in suitable habitat) over a five day period, for areas less than 50 ha (DEWHA, 2009b). In addition, surveys targeting waterholes, particularly during dry season are recommended to be carried out over four days for a minimum of ten hours per day (DEWHA, 2009).

Surveys should consist of area searches or transect-point surveys in suitable habitat such as rank grasses in riparian areas with pandanus or corypha palm as well as within flocks of other finches. Detection by calls and sighting with broadcast (playback) surveys especially in the morning and evening are appropriate. Targeted searches and subsequent watches of waterholes in the dry season may prove useful.

At the comprehensive and rapid fauna survey sites depicted in Figure FA-5 of the EPBC Report (Mine), standardised bird surveys (2ha for 20 minutes) for all bird species were undertaken. The bird survey methodology is described in Section FA.4.3.2.6 of the EPBC Report (Mine). In addition, opportunistic diurnal searches were also conducted on foot in areas considered likely to have high avian diversity (e.g. vegetated creek lines, dams), or to contain cryptic or threatened bird species.

FA.A.1.5.5 Desktop Assessment Results

The star finch was predicted to occur in the region of the mine study area by the Commonwealth Protected Matters Search Tool as well as searches of historical records (Wildlife Online Database). This combined desktop survey effort indicated a moderate potential for this species to exist within the proposed mine region.

A detailed description of the desktop studies undertaken can be found within Section FA.4.3.1 of the EPBC Report (Mine).

FA.A.1.5.6 Field Results

The star finch (eastern) was not recorded in the mine study area during field studies for the Alpha Coal Project (Mine) EIS and SEIS.

FA.A.1.5.7 Habitat Mapping Criteria

Habitat modelling and mapping was undertaken using the methodology described in Section FA.4.4 of the EPBC Report (Mine).

The habitat criteria used to model and map potential habitat for the star finch (eastern) are presented in Table FA.A-4 below.

Table FA.A-4 Habitat Mapping Criteria – Star Finch

Mapping category	Known point records	Regional Ecosystems	Queensland BPA Criteria F- Ecosystem Diversity	Queensland BPA Criteria G – Context and Connection	Altitude*	Proximity to water#
'Confirmed habitat'	NA	NA				
'High value potential habitat'	NA	Landzone 3	Very High or High	Very High or High	NA	RE polygon < 1 km from water
'Low value potential habitat'	NA	Landzone 3	Medium or Low	Medium or Low	NA	RE polygon > 1 km from water
'Generally not suitable'	NA	All other REs and non-remnant vegetation				

*sourced from Queensland Department of Environment and Resource Management (DERM) Essential Habitat Factors for black-throated finch (southern)

includes rivers/streams, wetlands and bores for which geospatial data was available

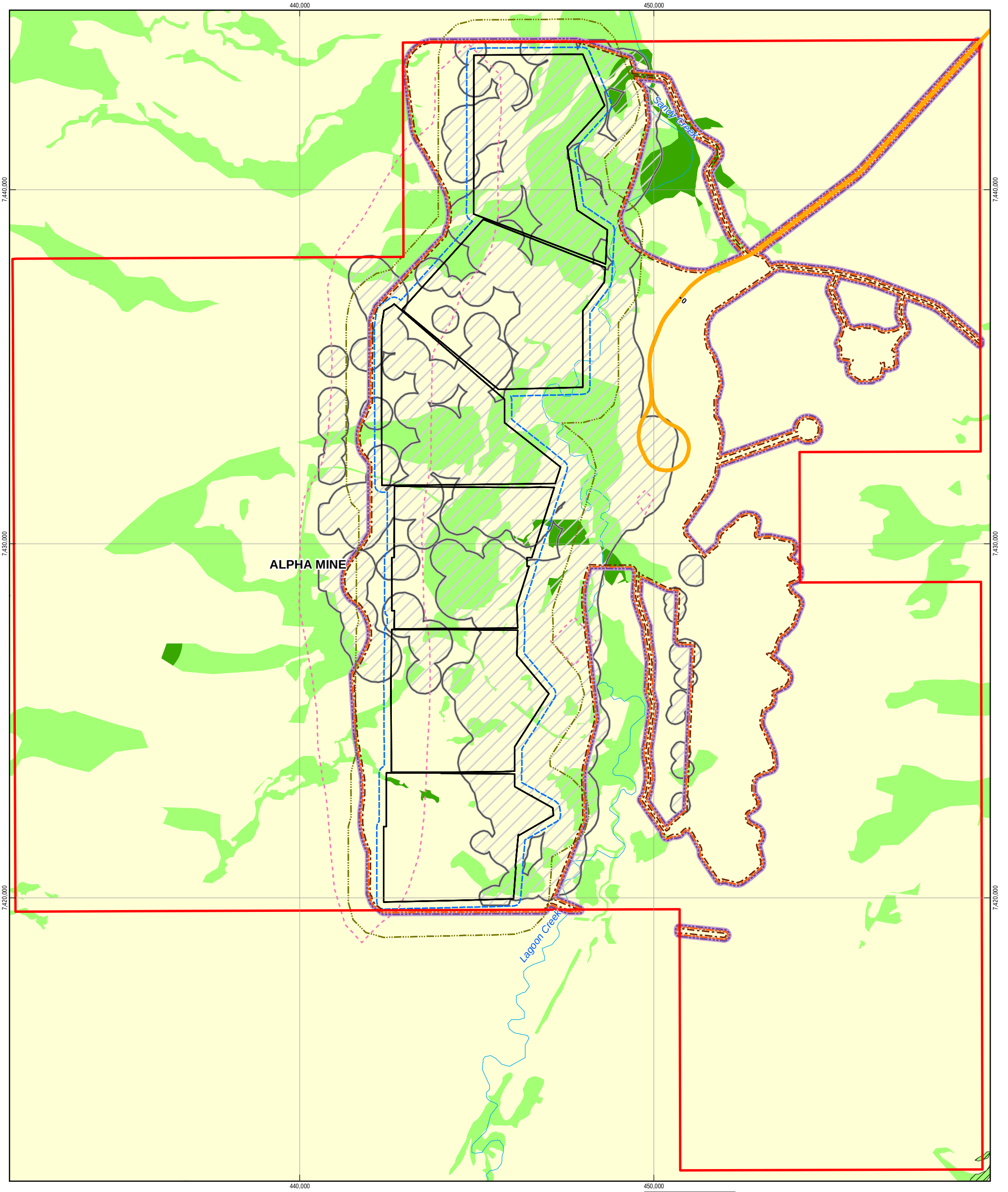
In order to qualify as 'high value potential habitat' for the star finch, based on the rules of the model, a mapped remnant vegetation unit (RE polygon) needed to:

- Contain a Regional Ecosystem (RE) listed in Table FA.A-4 above (if a mixed polygon, the RE must comprise at least 20% of that polygon) **AND**
- Have a very high or high Ecosystem Diversity rating (Queensland DERM Biodiversity Planning Assessment (BPA) Criteria F – an indication of habitat complexity) AND
- Have a very high or high Context and Connection rating (BPA Criteria G – an indication of proximity to and connection with other remnant vegetation and/or waterways) AND
- Occur within 1 km of a watercourse (river, stream, wetland or bore, for which geospatial data exists)

If the RE criteria was satisfied, but another criteria was not (i.e. BPA rating(s) medium or low **AND/OR** polygon > 1 km from watercourse), the RE polygon was mapped as 'low value potential habitat'.

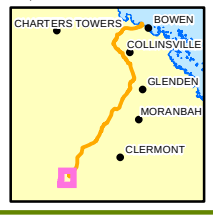
The 'regional scale' and 'mine study area (local) scale' potential habitat maps for the star finch are provided in Figure 7 and Figure 8, respectively.

A discussion of direct and indirect impacts to the star finch is provided in Section FA.6 of the EPBC Report (Mine). The area of 'high value potential habitat' and 'low value potential habitat' that may experience direct and indirect impacts from the Project is discussed. Measures to manage and mitigate potential impacts are presented.



LEGEND

- Town
- Existing Railway
- State Road
- Waterbody
- Watercourse
- Alpha MLA
- Mine Pit
- Direct Disturbance Footprint
- Proposed Alignment
- Vegetation Corridor (Brigalow Belt): State, Regional
- Vegetation Corridor (Desert Uplands): Very High
- Star Finch Habitat: Confirmed, High Potential, Low Potential, Not Suitable
- Indirect Impact Buffer Contour: Vibration, Light, Invasive Species, Groundwater, Dust, Noise



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Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

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Supplementary Environmental Impact Statement

POTENTIAL STAR FINCH HABITAT - ALPHA MINE

Job Number	41-23742
Revision	A
Date	28 July 2011

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Edie Creek
Clare Creek
Dunda Creek
Fiery Creek
Fox Creek
Belyando River
Sandy Creek
Lagoon Creek
Tallarenha Creek
Alice River
Jordan Creek
Brumby Gully
May Creek
Rocky Creek
Pebbly Creek
Bottle Tree Creek

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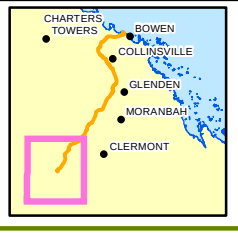
ALPHA MINE

Clermont - Alpha Road
Capricorn Highway
Blackall - Jericho Road
Alpha - Tambo Road
ALPHA

LEGEND

- Town
- Existing Railway
- State Road
- Waterbody
- Watercourse
- Alpha MLA
- Proposed Alignment
- Vegetation Corridor (Brigalow Belt)
  - State
  - Regional
- Vegetation Corridor (Desert Uplands)
  - Very High
- Star Finch Habitat
  - Confirmed
  - High Potential
  - Low Potential
  - Not Suitable



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1:500,000 (at A3)

0 2.5 5 10 15 20 25

Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
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POTENTIAL START FINCH HABITAT - REGIONAL

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FA.A.1.6 Australian Painted Snipe

FA.A.1.6.1 EPBC Act Status

Vulnerable

FA.A.1.6.2 Distribution and Habitat Information

The Australian painted snipe (*Rostratula australis*) has a scattered distribution across eastern and northern Australia (SEWPAC, 2011d). It has been recorded from wetlands in all Australian states, although it is most prevalent in eastern Australia (SEWPAC, 2011d).

Shallow freshwater wetlands are the main habitat for the Australian painted snipe (Marchant and Higgins, 1993). Such wetlands may include lakes, swamps, claypans, inundated/waterlogged grassland, dams, irrigated crop land and sewage ponds (Marchant and Higgins, 1993). Preferred wetland habitats boast emergent vegetation (including tussocks, grasses, sedges, rushses, reeds, canegrass and/or Melaleuca) (Marchant and Higgins, 1993). Nesting occurs amongst vegetation in or adjacent to wetlands (SEWPAC, 2011d).

FA.A.1.6.3 Threatening Processes

The major threat to the Australian painted snipe is the loss or alteration of wetland habitats (SEWPAC, 2011d). Degradation may result from changes to water quality, livestock (trampling and overgrazing), altered flow regimes, altered fire regimes and invasive weeds (SEWPAC, 2011d). While not recognised as a contributing factor to the species' decline, predation by introduced predators such as foxes and cats may pose a potential threat to the Australian painted snipe (SEWPAC, 2011d).

Key threatening processes listed under the EPBC Act that may be of relevance to this species include:

- Competition and land degradation by rabbits
- Invasion of northern Australia by gamba grass and other introduced grasses
- Land clearance
- Loss of terrestrial climatic habitat caused by anthropogenic emissions of greenhouse gases
- Predation by European red fox
- Predation by feral cats
- Predation, habitat degradation, competition and disease transmission by feral pigs

FA.A.1.6.4 Survey Guidelines

The Commonwealth Government's *Survey Guidelines for Australia's Threatened Birds* (DEWHA, 2009b) details recommended survey methodologies for detecting the Australian painted snipe. This includes targeted stationary observations at dawn and dusk of suitable wetland habitat, for a minimum of 10 hours over five days. Land-based area searches or line transects through wetland habitat are also recommended, for a minimum of 10 hours over three days. For both techniques the recommended times relate to sites less than 50 ha, where a wetland is present and holding water (but not flooded).

During field surveys for the Project (Mine), a minimum of one hour was invested in bird searches at the 20 comprehensive survey sites, and a minimum of 20 minutes was spent

searching at each rapid assessment site. At the comprehensive and rapid fauna survey sites depicted in Figure FA-5 of the EPBC Report (Mine), standardised bird surveys (2ha for 20 minutes) for all bird species were undertaken. The bird survey methodology is described in Section FA.4.3.2.6 EPBC Report (Mine). In addition, opportunistic diurnal searches were also conducted on foot in areas considered likely to have high avian diversity (e.g. vegetated creek lines, dams), or to contain cryptic or threatened bird species.

FA.A.1.6.5 Desktop Assessment Results

The Australian painted snipe was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool.

No historical records of this species were returned from a query of relevant databases in the desktop search extent (as defined in Section FA.4.3.1 of the EPBC Report (Mine)).

FA.A.1.6.6 Field Results

The Australian painted snipe was not recorded in the mine study area during seasonal field studies for the Alpha Coal Project (Mine) EIS and SEIS.

FA.A.1.6.7 Habitat Mapping Criteria

Habitat modelling and mapping was undertaken using the methodology described in Section FA.4.4 of the EPBC Report (Mine).

The habitat criteria used to model and map potential habitat for the Australian painted snipe are presented in Table FA.A-5 below.

Table FA.A-5 Habitat Mapping Criteria – Australian Painted Snipe

Mapping category	Known point records	Regional Ecosystems*	Queensland BPA Criteria F - Ecosystem Diversity	Queensland BPA Criteria G - Context and Connection
'Confirmed habitat'	No sighting records / point data available	NA		
'High value potential habitat'	NA	RE 11.3.27 OR Habitat patch (i.e. remnant vegetation polygon) within 0.5 km of a water source (i.e. river, lake, wetland)	Very High or High	Very High or High
'Low value potential habitat'	NA	RE 11.3.27 OR Habitat patch (i.e. remnant vegetation polygon) within 0.5 km of a water source (i.e. river, lake, wetland)	Medium or Low	Medium or Low
'Generally not suitable'	NA	NA		

* No DERM Essential Habitat factors available at time of preparation - habitats associated with wetlands (i.e. rivers/streams and wetlands) for which geospatial data was available was mapped

No sighting records or point data for the Australian painted snipe was available and as such no 'confirmed habitat' was mapped for the species.

In order to qualify as 'high value potential habitat' for the Australian painted snipe, based on the rules of the model, a mapped remnant vegetation unit (RE polygon) needed to:

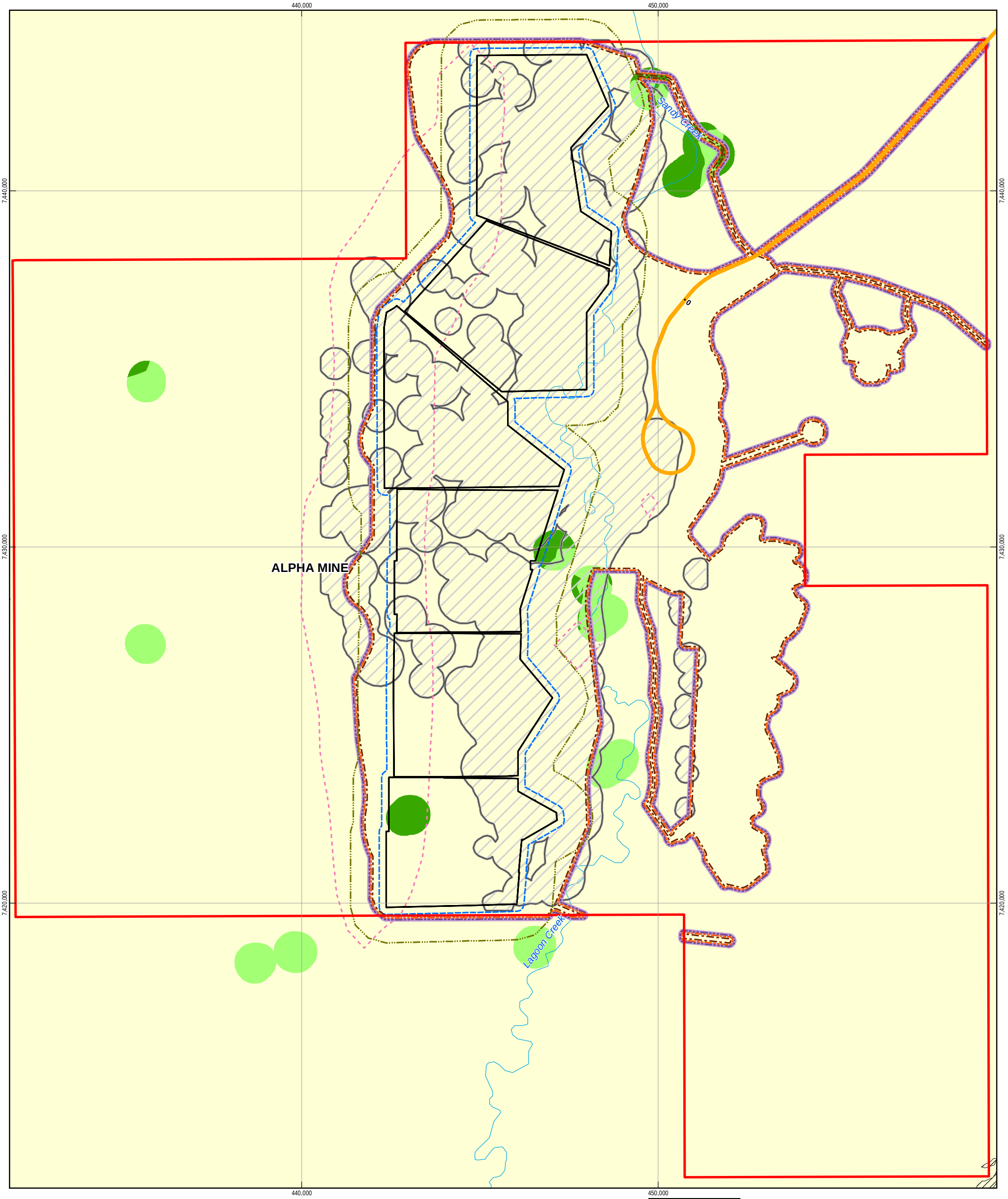
- Contain an RE listed in Table FA.A-5 above (if a mixed polygon, the RE must comprise at least 20% of that polygon) **OR** any other RE occurring within 0.5 km of water source **AND**
- Have a very high or high Ecosystem Diversity rating (BPA Criteria F – an indication of habitat complexity) AND
- Have a very high or high Context and Connection rating (BPA Criteria G – an indication of proximity to and connection with other remnant vegetation and/or waterways)

If the RE criteria was satisfied, but another criteria was not (i.e. BPA rating(s) medium or low), the RE polygon was mapped as 'low value potential habitat'

If a mapped remnant vegetation unit (RE polygon) did not contain an RE nominated in Table FA.A-5, or was non-remnant vegetation, it was mapped as 'generally not suitable' for the species

The 'regional scale' and 'mine study area (local) scale' potential habitat maps for the Australian painted snipe are provided in Figure 9 and Figure 10, respectively.

A discussion of direct and indirect impacts to the Australian painted snipe is provided in Section FA.6 of the EPBC Report (Mine)). The area of 'high value potential habitat' and 'low value potential habitat' that may experience direct and indirect impacts from the Project (Mine) is discussed. Measures to manage and mitigate potential impacts are presented.



LEGEND

- Town
- Existing Railway
- State Road
- Waterbody
- Watercourse
- Alpha MLA
- Mine Pit
- Direct Disturbance Footprint
- Proposed Alignment
- Vegetation Corridor (Brigalow Belt)
  - State
  - Regional
- Vegetation Corridor (Desert Uplands)
  - Very High
- A. Painted Snipe Habitat
  - Confirmed
  - High Potential
  - Low Potential
  - Not Suitable
- Indirect Impact Buffer Contour
  - Vibration
  - Light
  - Invasive Species
  - Groundwater
  - Dust
  - Noise

Source: See Copyright Details below and for full disclosure please read Section 18.2 - References in the EIS

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Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

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Alpha Coal Project
Supplementary Environmental Impact Statement

POTENTIAL A. PAINTED SNIPE HABITAT - ALPHA MINE

Job Number	41-23742
Revision	A
Date	04 Aug 2011

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Edie Creek
Clare Creek
Dunda Creek
Fiery Creek
Fox Creek
Belyando River
Sandy Creek
Goonyella Creek
Tallarenha Creek
Alice River
Jordan Creek
Brumby Gully
Blackall - Jericho Road
Alpha - Tambo Road
Capricorn Highway
Clermont - Alpha Road
May Creek
Rocky Creek
Pebbly Creek
Bottle Tree Creek
ALPHA
ALPHA MINE
100000
75000
50000
25000
0

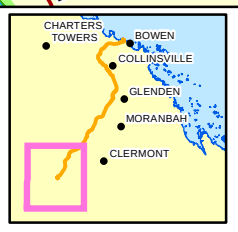
LEGEND

- Town
- Existing Railway
- State Road
- Waterbody
- Watercourse
- Alpha MLA
- Proposed Alignment

Vegetation Corridor (Brigalow Belt)
- State
- Regional

Vegetation Corridor (Desert Uplands)
- Very High

A. Painted Snipe Habitat
- Confirmed
- High Potential
- Low Potential
- Not Suitable



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Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

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Supplementary Environmental Impact Statement

POTENTIAL A. PAINTED SNIPE HABITAT - REGION

Job Number	41-23742
Revision	A
Date	28 July 2011

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FA.A.1.7 Ornamental Snake

FA.A.1.7.1 EPBC Act Status

Vulnerable

FA.A.1.7.2 Distribution and Habitat Information

The ornamental snake (*Denisonia maculata*) is known from the Brigalow Belt North and parts of the Brigalow Belt South bioregions (SEWPAC, 2011h). This species' distribution is associated with the drainage system of the Fitzroy and Dawson Rivers (SEWPAC, 2011h).

Suitable habitat for this species occurs in remnant vegetation on, or surrounding gilgai mounds and depressions, with the maintenance of these environments important for the persistence of this species (SEWPAC, 2011h). Habitat for the ornamental snake is likely to be found in brigalow (*Acacia harpophylla*), gidgee (*Acacia cambagei*), blackwood (*Acacia argyrodendron*) and coolabah (*Eucalyptus coolabah*) dominated vegetation communities as well as grasslands associated with gilgais (SEWPAC, 2011h). The ornamental snake's preferred habitat is within woodlands and open forests associated with moist areas, similar to the habitat of frogs, which are its favoured prey (SEWPAC, 2011h). Microhabitat for this species includes logs, coarse woody debris, and ground litter (SEWPAC, 2011h).

FA.A.1.7.3 Threatening Processes

Ornamental snake populations have experienced declines in abundance throughout recent decades, possibly due to a number of factors (SEWPAC, 2011h). The primary threats to the persistence of this species include:

- Habitat loss through land clearing for development
- Habitat fragmentation
- Habitat degradation by cattle overgrazing and alteration of soil structure
- Alteration of landscape hydrology in gilgai environments
- Alteration of water quality through pollution of watercourses (SEWPAC, 2011h)

Other threats include:

- Interactions with the cane toad (*Rhinella marina*)
- Invasive weeds
- Predation by feral species (SEWPAC, 2011h)

Key threatening processes listed under the EPBC Act that may be of relevance to this species include:

- Competition and land degradation by rabbits
- Invasion of northern Australia by gamba grass and other introduced grasses
- Land clearance
- Loss of terrestrial climatic habitat caused by anthropogenic emissions of greenhouse gases
- Predation by European red fox
- Predation by feral cats
- Predation, habitat degradation, competition and disease transmission by feral pigs
- The biological effects, including lethal toxic ingestion, caused by cane toads (*Bufo marinus* (now *Rhinella marina*))

FA.A.1.7.4 Survey Guidelines

The Commonwealth Government's *Survey Guidelines for Australia's Threatened Reptiles* (SEWPAC, 2011i) details recommended survey methodologies for detecting the ornamental snake. The survey guidelines state that no survey methods are known to reliably detect ornamental snakes during dry weather/seasons (SEWPAC, 2011i). Searches conducted around suitable gilgai habitat while frogs are active is the most reliable method to encounter this species - if wet weather inhibits access to gilgai habitats, driving roads at night while frogs are active is also identified as a survey method (SEWPAC, 2011i). Diurnal searches under logs, coarse woody debris, ground litter and other sheltering sites could also be employed (SEWPAC, 2011i). The survey guidelines also state that pitfall and funnel trap complexes could be trialled, however that these methods are likely to return low yields (SEWPAC, 2011i).

The Commonwealth Government's *Draft Referral guidelines for the nationally listed Brigalow Belt Reptiles* (SEWPAC, 2011j) also identify targeted survey efforts and techniques required to detect the ornamental snake. In summary, the survey techniques suitable for detecting the ornamental snake include:

- One-off diurnal searches of microhabitats during the coolest parts of the day surveying a minimum of 1.5 person hours per hectare of suitably complex habitats over a minimum of three days
- Spotlighting inundated gilgais, riparian habitats, and large logs between dusk and early morning hours surveying a minimum of 1.5 person hours per hectare of suitably complex habitats over a minimum of three nights
- Pitfall and funnel trapping using six 20 litre buckets distributed under a 30 m drift fence where suitable microhabitats occur. Funnel traps should be placed at the end of each pitfall line, with at least two replicates for each habitat type

As outlined in section FA.4.3.2 of this Alpha Coal Project EPBC Report (Mine), a total of 36 fauna transect sites were established on and surrounding the Project site. Each site was subject to trapping regimes of up to four consecutive nights for pitfall (in combination with funnel) traps and five consecutive nights for Cage and Elliot Traps. This trapping was conducted in conjunction with spotlighting (walking and driving), opportunistic diurnal micro-habitat searches, scat and track searched as well as incidental recording.

FA.A.1.7.5 Desktop Assessment Results

The ornamental snake was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool.

The Queensland DERM Wildlife Online database returned a record of this species from the desktop search extent (as defined in Section FA.4.3.1 of the EPBC Report (Mine)).

FA.A.1.7.6 Field Results

The ornamental snake was not detected during field studies for the Project.

FA.A.1.7.7 Habitat Mapping Criteria

Habitat modelling and mapping was undertaken using the methodology described in Section FA.4.4 of the EPBC Report (Mine).

The habitat criteria used to model and map potential habitat for ornamental snake are presented in Table FA.A-6 below.

Table FA.A-6 Habitat Mapping Criteria – Ornamental Snake

Mapping category	Known point records	Regional Ecosystems*	Queensland BPA Criteria F- Ecosystem Diversity	Queensland BPA Criteria G – Context and Connection	Altitude*
'Confirmed habitat'	Remnant vegetation within 5 km radius of ornamental snake record from Alpha Coal Project (Mine) SEIS field studies	NA			
'High value potential habitat'	NA	11.1.4, 11.2.1, 11.2.2, 11.2.5, 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.5, 11.3.6, 11.3.7, 11.3.8, 11.3.9, 11.3.10, 11.3.12, 11.3.13, 11.3.14, 11.3.15, 11.3.16, 11.3.17, 11.3.18, 11.3.19, 11.3.20, 11.3.23, 11.3.25, 11.3.26, 11.3.27, 11.3.28, 11.3.29, 11.3.30, 11.3.32, 11.3.33, 11.3.34, 11.3.35, 11.3.36, 11.3.37, 11.3.38, 11.3.39, 11.4.2, 11.4.3, 11.4.5, 11.4.7, 11.4.8, 11.4.9, 11.4.10, 11.4.12, 11.4.13, 11.5.1, 11.5.2, 11.5.3, 11.5.4, 11.5.5, 11.5.7, 11.5.8, 11.5.9, 11.5.10, 11.5.11, 11.5.12, 11.5.13, 11.5.14, 11.5.16, 11.5.17, 11.5.18, 11.5.20, 11.5.21, 11.7.1, 11.7.2, 11.7.3, 11.7.4, 11.7.5, 11.7.6, 11.7.7, 11.8.1, 11.8.2, 11.8.4, 11.8.5, 11.8.7, 11.8.8, 11.8.9, 11.8.11, 11.8.12, 11.8.14, 11.8.15, 11.9.1, 11.9.2, 11.9.3, 11.9.5, 11.9.6, 11.9.7, 11.9.9, 11.9.10, 11.9.13, 11.9.14, 11.10.1, 11.10.2, 11.10.3, 11.10.4, 11.10.5, 11.10.6, 11.10.7, 11.10.9, 11.10.11, 11.10.12, 11.10.13, 11.11.1, 11.11.2, 11.11.3, 11.11.4, 11.11.6, 11.11.7, 11.11.8, 11.11.9, 11.11.10, 11.11.11, 11.11.12, 11.11.13, 11.11.14, 11.11.15, 11.11.16, 11.11.17, 11.11.19, 11.11.20, 11.12.1, 11.12.2, 11.12.3, 11.12.5, 11.12.6, 11.12.7, 11.12.8, 11.12.9, 11.12.10, 11.12.11, 11.12.12, 11.12.13, 11.12.14, 11.12.15, 11.12.16, 11.12.17, 11.12.18, 11.12.19, 11.12.20, 11.12.21	Very High or High	Very High or High	100 – 450 m
'Low value potential habitat'	NA	11.1.4, 11.2.1, 11.2.2, 11.2.5, 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.5, 11.3.6,	Medium or	Medium or	Altitude < 100m

Mapping category	Known point records	Regional Ecosystems*	Queensland BPA Criteria F- Ecosystem Diversity	Queensland BPA Criteria G – Context and Connection	Altitude*
		11.3.7, 11.3.8, 11.3.9, 11.3.10, 11.3.12, 11.3.13, 11.3.14, 11.3.15, 11.3.16, 11.3.17, 11.3.18, 11.3.19, 11.3.20, 11.3.23, 11.3.25, 11.3.26, 11.3.27, 11.3.28, 11.3.29, 11.3.30, 11.3.32, 11.3.33, 11.3.34, 11.3.35, 11.3.36, 11.3.37, 11.3.38, 11.3.39, 11.4.2, 11.4.3, 11.4.5, 11.4.7, 11.4.8, 11.4.9, 11.4.10, 11.4.12, 11.4.13, 11.5.1, 11.5.2, 11.5.3, 11.5.4, 11.5.5, 11.5.7, 11.5.8, 11.5.9, 11.5.10, 11.5.11, 11.5.12, 11.5.13, 11.5.14, 11.5.16, 11.5.17, 11.5.18, 11.5.20, 11.5.21, 11.7.1, 11.7.2, 11.7.3, 11.7.4, 11.7.5, 11.7.6, 11.7.7, 11.8.1, 11.8.2, 11.8.4, 11.8.5, 11.8.7, 11.8.8, 11.8.9, 11.8.11, 11.8.12, 11.8.14, 11.8.15, 11.9.1, 11.9.2, 11.9.3, 11.9.5, 11.9.6, 11.9.7, 11.9.9, 11.9.10, 11.9.13, 11.9.14, 11.10.1, 11.10.2, 11.10.3, 11.10.4, 11.10.5, 11.10.6, 11.10.7, 11.10.9, 11.10.11, 11.10.12, 11.10.13, 11.11.1, 11.11.2, 11.11.3, 11.11.4, 11.11.6, 11.11.7, 11.11.8, 11.11.9, 11.11.10, 11.11.11, 11.11.12, 11.11.13, 11.11.14, 11.11.15, 11.11.16, 11.11.17, 11.11.19, 11.11.20, 11.12.1, 11.12.2, 11.12.3, 11.12.5, 11.12.6, 11.12.7, 11.12.8, 11.12.9, 11.12.10, 11.12.11, 11.12.12, 11.12.13, 11.12.14, 11.12.15, 11.12.16, 11.12.17, 11.12.18, 11.12.19, 11.12.20, 11.12.21	Low	Low	or Altitude > 450m
'Generally not suitable'	NA	All other REs and non-remnant vegetation			

*sourced from DERM Essential Habitat Factors for ornamental snake

Remnant vegetation within 5 km of the one ornamental snake record from Project (Mine) field studies was mapped as 'confirmed habitat'.

In order to qualify as 'high value potential habitat' for the ornamental snake, based on the rules of the model, a mapped remnant vegetation unit (RE polygon) needed to:

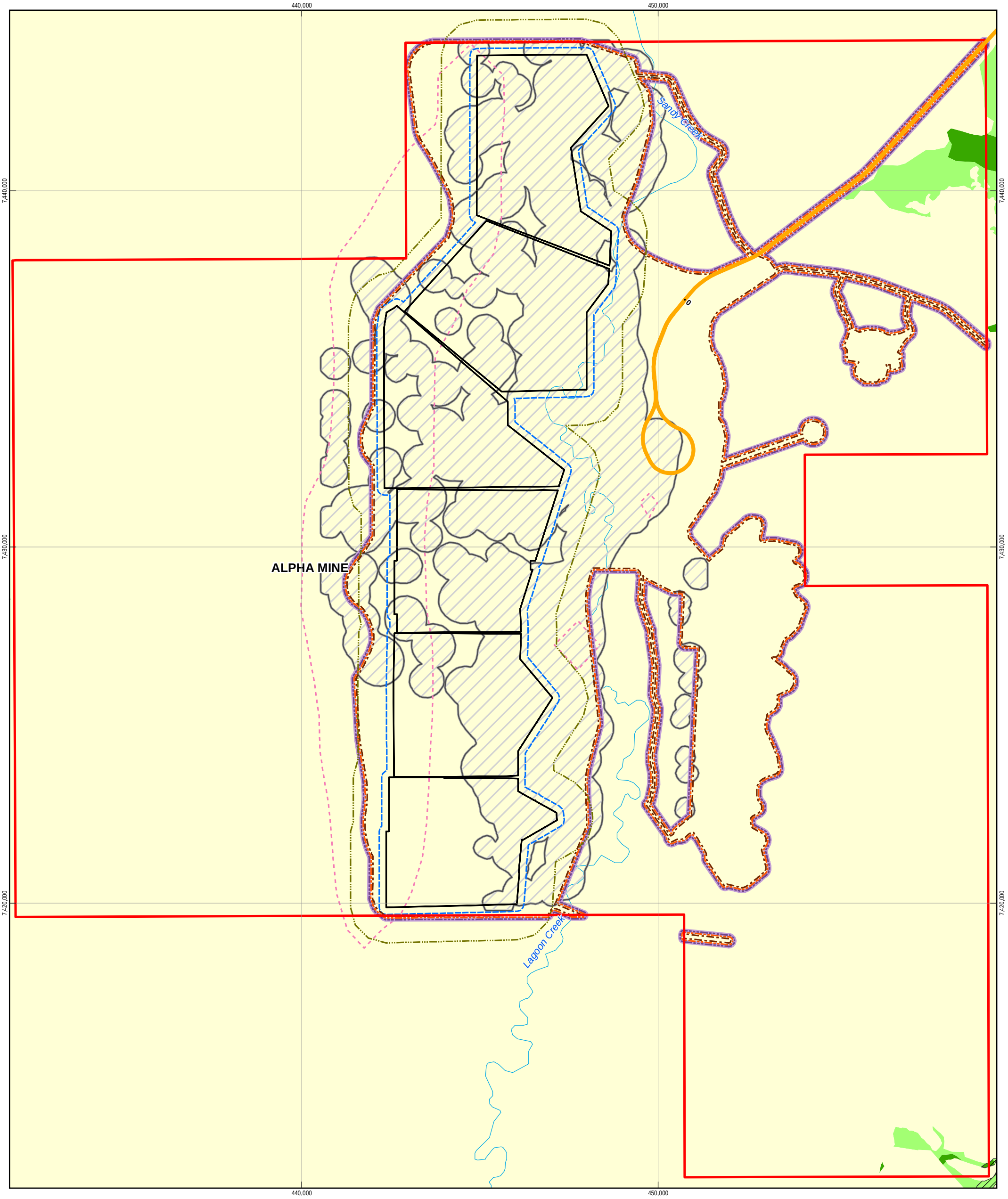
- Contain an RE listed in Table FA.A-6 above (if a mixed polygon, the RE must comprise at least 20% of that polygon) **AND**
- Have a very high or high Ecosystem Diversity rating (BPA Criteria F – an indication of habitat complexity) **AND**
- Have a very high or high Context and Connection rating (BPA Criteria G – an indication of proximity to and connection with other remnant vegetation and/or waterways) **AND**
- Occur at an altitude of 100 – 450 metres

If the RE criteria was satisfied, but another criteria was not (i.e. BPA rating(s) medium or low **AND/OR** altitude < 100 m or > 450 m, the RE polygon was mapped as 'low value potential habitat'.

If a mapped remnant vegetation unit (RE polygon) did not contain an RE nominated in Table FA.A-6 or was non-remnant vegetation, it was mapped as 'generally not suitable' for the species.

The 'regional scale' and 'mine study area (local) scale' potential habitat maps for the ornamental snake are provided in Figure 11 and Figure 12, respectively.

A discussion of direct and indirect impacts to the ornamental snake is provided in Section FA.6 of the EPBC Report (Mine)). The area of 'high value potential habitat' and 'low value potential habitat' that may experience direct and indirect impacts from the Project (Mine) is discussed. Measures to manage and mitigate potential impacts are presented.



LEGEND

- Town
- Existing Railway
- State Road
- Waterbody
- Watercourse
- Alpha MLA
- Mine Pit
- Direct Disturbance Footprint
- Proposed Alignment
- Vegetation Corridor (Brigalow Belt): State, Regional
- Vegetation Corridor (Desert Uplands): Very High
- Ornamental Snake Habitat: Confirmed, High Potential, Low Potential, Not Suitable
- Indirect Impact Buffer Contour: Vibration, Light, Invasive Species, Groundwater, Dust, Noise

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Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

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Alpha Coal Project
Supplementary Environmental Impact Statement

POTENTIAL ORNAMENTAL SNAKE HABITAT - ALPHA MINE

Job Number	41-23742
Revision	A
Date	04 Aug 2011

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Edie Creek
Clare Creek
Dunda Creek
Fiery Creek
Fox Creek
Belyando River
Sandy Creek
Lagoon Creek
Tallarenha Creek
Alice River
Jordan Creek
Brumby Gully
May Creek
Rocky Creek
Pebbly Creek
Bottle Tree Creek
Belyando River

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ALPHA MINE

Clermont - Alpha Road
Capricorn Highway
Blackall - Jericho Road
Alpha - Tambo Road
ALPHA

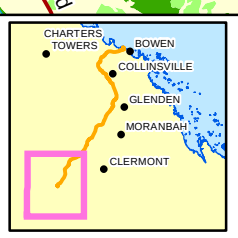
LEGEND

- Town
- Existing Railway
- State Road
- Waterbody
- Watercourse
- Alpha MLA
- Proposed Alignment

Vegetation Corridor (Brigalow Belt)
- State
- Regional

Vegetation Corridor (Desert Uplands)
- Very High

Ornamental Snake Habitat
- Confirmed
- High Potential
- Low Potential
- Not Suitable



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Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

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Supplementary Environmental Impact Statement

POTENTIAL ORNAMENTAL SNAKE HABITAT - REGION

Job Number	41-23742
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FA.A.1.8 Dunmall's Snake

FA.A.1.8.1 EPBC Act Status

Vulnerable

FA.A.1.8.2 Distribution and Habitat Information

Dunmall's Snake (*Furina dunmalli*) has a highly fragmented distribution from Yeppoon in Queensland to the New South Wales border and as far south as Ashford in New South Wales. The snake is very rare or secretive with limited existing records (SEWPAC, 2011k).

Records indicate the species occurs at elevations of 200–500 m above sea level. Dunmall's snake is known to occur in forest and woodland habitats dominated by the following species:

- Brigalow (*Acacia harpophylla*) on black alluvial cracking clay and clay loams
- Wattles (*A. burowii, A. deanii, A. leioclyx*)
- Cypress (*Callitris* spp.)
- Bull-oak (*Allocasuarina luehmannii*)
- Spotted Gum (*Corymbia citriodora*)
- Ironbark (*Eucalyptus crebra* and *E. melanophloia*) on coarse-grained sediments (SEWPAC, 2011k)

Little is known about the species' microhabitat requirements. Individuals have been found sheltering under fallen timber and ground litter, and the species may use cracks in alluvial clay soils (SEWPAC, 2011k).

FA.A.1.8.3 Threatening Processes

The distribution of Dunmall's snake is highly fragmented and the species has experienced dramatic declines. The major threats to Dunmall's snake are identified as:

- Habitat loss through land clearing for development (mining, urban and agriculture)
- Habitat degradation by overgrazing of domestic stock
- Loss of microhabitats in the form of fallen timber and ground litter
- Invasion of weeds
- Predation by feral species
- Alteration of landscape hydrology in gilgai and swamp environments

Key threatening processes listed under the EPBC Act that may be of relevance to this species include:

- Competition and land degradation by rabbits
- Invasion of northern Australia by gamba grass and other introduced grasses
- Land clearance
- Loss of terrestrial climatic habitat caused by anthropogenic emissions of greenhouse gases
- Predation by European red fox
- Predation by feral cats
- Predation, habitat degradation, competition and disease transmission by feral pigs
- The biological effects, including lethal toxic ingestion, caused by cane toads (*Bufo marinus* (now *Rhinella marina*)).

FA.A.1.8.4 Survey Guidelines

Dunmall's snake is secretive, difficult to detect and commonly misidentified. Whilst no survey methods are known to reliably detect the species, the Commonwealth Government's *Survey Guidelines for Australia's Threatened Reptiles* (SEWPAC, 2011i) details recommended survey methodologies for detecting the Dunmall's snake. These methods include active searching of sheltering microhabitat sites (woody debris and leaf litter), pitfall trapping and spotlighting along roads. It should be noted that these methods are considered likely to return low yields.

The Commonwealth Government's *Draft Referral guidelines for the nationally listed Brigalow Belt Reptiles* (SEWPAC, 2011j) also identify targeted survey effort and techniques required to detect the Dunmall's snake. In summary, the survey techniques suitable for detecting the Dunmall's snake include:

- One-off diurnal searches of microhabitats during the coolest parts of the day surveying a minimum of 1.5 person hours per hectare of suitably complex habitats over a minimum of three days
- Spotlighting inundated gilgais, riparian habitats, and large logs between dusk and early morning hours surveying a minimum of 1.5 person hours per hectare of suitably complex habitats over a minimum of three nights
- Pitfall and funnel trapping using six 20 L buckets distributed under a 30 m drift fence where suitable microhabitats occur. Funnel traps should be placed at the end of each pitfall line, with at least 2 replicates for each habitat type.

As outlined in section FA.4.3.2 of this Alpha Coal Project EPBC Report (Mine), a total of 36 fauna transect sites were established on and surrounding the Project site. Each site was subject to trapping regimes of up to four consecutive nights for pitfall (in combination with funnel) traps and five consecutive nights for Cage and Elliot Traps. This trapping was conducted in conjunction with spotlighting (walking and driving), opportunistic diurnal micro-habitat searches, scat and track searched as well as incidental recording.

FA.A.1.8.5 Desktop Assessment Results

Dunmall's snake was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool.

No historical records of this species were returned from a query of relevant databases in the desktop search extent (as defined in Section FA.4.3.1 of the EPBC Report (Mine)).

FA.A.1.8.6 Field Results

Dunmall's snake was not recorded in the mine study area during seasonal field studies for the Alpha Coal Project (Mine) EIS and SEIS.

FA.A.1.8.7 Habitat Mapping Criteria

Habitat modelling and mapping was undertaken using the methodology described in Section FA.4.4 of the EPBC Report (Mine).

The habitat criteria used to model and map potential habitat for Dunmall's snake are presented in Table FA.A-7 below.

Table FA.A-7 Habitat Mapping Criteria – Dunmall's Snake

Mapping category	Known point records	Regional Ecosystems*	Queensland BPA Criteria F - Ecosystem Diversity	Queensland BPA Criteria G - Context and Connection	Altitude*	Modelled distribution (SEWPAC, 2011j)#
'Confirmed habitat'	No sighting records / point data available	NA				
'High value potential habitat'	NA	11.1.4, 11.2.1, 11.2.2, 11.2.5, 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.5, 11.3.6, 11.3.7, 11.3.8, 11.3.9, 11.3.10, 11.3.12, 11.3.13, 11.3.14, 11.3.15, 11.3.16, 11.3.17, 11.3.18, 11.3.19, 11.3.20, 11.3.23, 11.3.25, 11.3.26, 11.3.27, 11.3.28, 11.3.29, 11.3.30, 11.3.32, 11.3.33, 11.3.34, 11.3.35, 11.3.36, 11.3.37, 11.3.38, 11.3.39, 11.4.2, 11.4.3, 11.4.5, 11.4.7, 11.4.8, 11.4.9, 11.4.10, 11.4.12, 11.4.13, 11.5.1, 11.5.2, 11.5.3, 11.5.4, 11.5.5, 11.5.7, 11.5.8, 11.5.9, 11.5.10, 11.5.11, 11.5.12, 11.5.13, 11.5.14, 11.5.16, 11.5.17, 11.5.18, 11.5.20, 11.5.21, 11.7.1, 11.7.2, 11.7.3, 11.7.4, 11.7.5, 11.7.6, 11.7.7, 11.8.1, 11.8.2, 11.8.4, 11.8.5, 11.8.7, 11.8.8, 11.8.9, 11.8.11, 11.8.12, 11.8.14, 11.8.15, 11.9.1, 11.9.2, 11.9.3, 11.9.5, 11.9.6, 11.9.7, 11.9.9, 11.9.10, 11.9.13, 11.9.14, 11.10.1, 11.10.2, 11.10.3, 11.10.4, 11.10.5, 11.10.6, 11.10.7, 11.10.9, 11.10.11, 11.10.12, 11.10.13, 11.11.1, 11.11.2, 11.11.3, 11.11.4, 11.11.6, 11.11.7, 11.11.8, 11.11.9, 11.11.10, 11.11.11, 11.11.12, 11.11.13, 11.11.14, 11.11.15, 11.11.16, 11.11.17, 11.11.19, 11.11.20, 11.12.1, 11.12.2, 11.12.3, 11.12.5, 11.12.6, 11.12.7, 11.12.8, 11.12.9, 11.12.10, 11.12.11, 11.12.12, 11.12.13, 11.12.14, 11.12.15, 11.12.16, 11.12.17, 11.12.18, 11.12.19, 11.12.20, 11.12.21	Very High or High	Very High or High	200-500 m	Within SEWPA,(2011j) modelled distribution ('likely to occur' and 'may occur')
'Low value potential habitat'	NA	11.1.4, 11.2.1, 11.2.2, 11.2.5, 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.5, 11.3.6, 11.3.7, 11.3.8, 11.3.9, 11.3.10, 11.3.12, 11.3.13, 11.3.14, 11.3.15, 11.3.16, 11.3.17, 11.3.18, 11.3.19, 11.3.20, 11.3.23, 11.3.25, 11.3.26, 11.3.27, 11.3.28,	Medium or	Medium or	<200m >500 m	Within SEWPA,(2011j) modelled distribution ('likely to occur' and

Mapping category	Known point records	Regional Ecosystems*	Queensland BPA Criteria F - Ecosystem Diversity	Queensland BPA Criteria G - Context and Connection	Altitude*	Modelled distribution (SEWPAC, 2011j)#
		11.3.29, 11.3.30, 11.3.32, 11.3.33, 11.3.34, 11.3.35, 11.3.36, 11.3.37, 11.3.38, 11.3.39, 11.4.2, 11.4.3, 11.4.5, 11.4.7, 11.4.8, 11.4.9, 11.4.10, 11.4.12, 11.4.13, 11.5.1, 11.5.2, 11.5.3, 11.5.4, 11.5.5, 11.5.7, 11.5.8, 11.5.9, 11.5.10, 11.5.11, 11.5.12, 11.5.13, 11.5.14, 11.5.16, 11.5.17, 11.5.18, 11.5.20, 11.5.21, 11.7.1, 11.7.2, 11.7.3, 11.7.4, 11.7.5, 11.7.6, 11.7.7, 11.8.1, 11.8.2, 11.8.4, 11.8.5, 11.8.7, 11.8.8, 11.8.9, 11.8.11, 11.8.12, 11.8.14, 11.8.15, 11.9.1, 11.9.2, 11.9.3, 11.9.5, 11.9.6, 11.9.7, 11.9.9, 11.9.10, 11.9.13, 11.9.14, 11.10.1, 11.10.2, 11.10.3, 11.10.4, 11.10.5, 11.10.6, 11.10.7, 11.10.9, 11.10.11, 11.10.12, 11.10.13, 11.11.1, 11.11.2, 11.11.3, 11.11.4, 11.11.6, 11.11.7, 11.11.8, 11.11.9, 11.11.10, 11.11.11, 11.11.12, 11.11.13, 11.11.14, 11.11.15, 11.11.16, 11.11.17, 11.11.19, 11.11.20, 11.12.1, 11.12.2, 11.12.3, 11.12.5, 11.12.6, 11.12.7, 11.12.8, 11.12.9, 11.12.10, 11.12.11, 11.12.12, 11.12.13, 11.12.14, 11.12.15, 11.12.16, 11.12.17, 11.12.18, 11.12.19, 11.12.20, 11.12.21	Low	Low		‘may occur’)
‘Generally not suitable’	NA	REs from all other land zones and non-remnant vegetation Outside of modelled distribution (SEWPAC, 2011j) all habitat will be generally not suitable				

*No Essential Habitat Factors were available for Dunmall’s snake. Those REs from the Brigalow Belt Bioregion that are Essential Habitat factors for the ornamental snake (which shares similar habitat preferences to Dunmall’s snake) were used to map habitat for this species. Altitude criteria derived from information presented in Commonwealth Government Species Profile and Threats (SPRAT) database profile of Dunmall’s snake (SEWPAC, 2011k)

Modelled distribution mapping, presented in the *Draft Referral Guidelines for the Nationally Listed Brigalow Belt Reptiles* (SEWPAC, 2011j), available at: http://www.environment.gov.au/epbc/publications/brigalow-belt-reptiles.html

No sighting records or point data for the Dunmall's snake was available and as such no 'confirmed habitat' was mapped for the species

In order to qualify as 'high value potential habitat' for Dunmall's snake, based on the rules of the model, a mapped remnant vegetation unit (RE polygon) needed to:

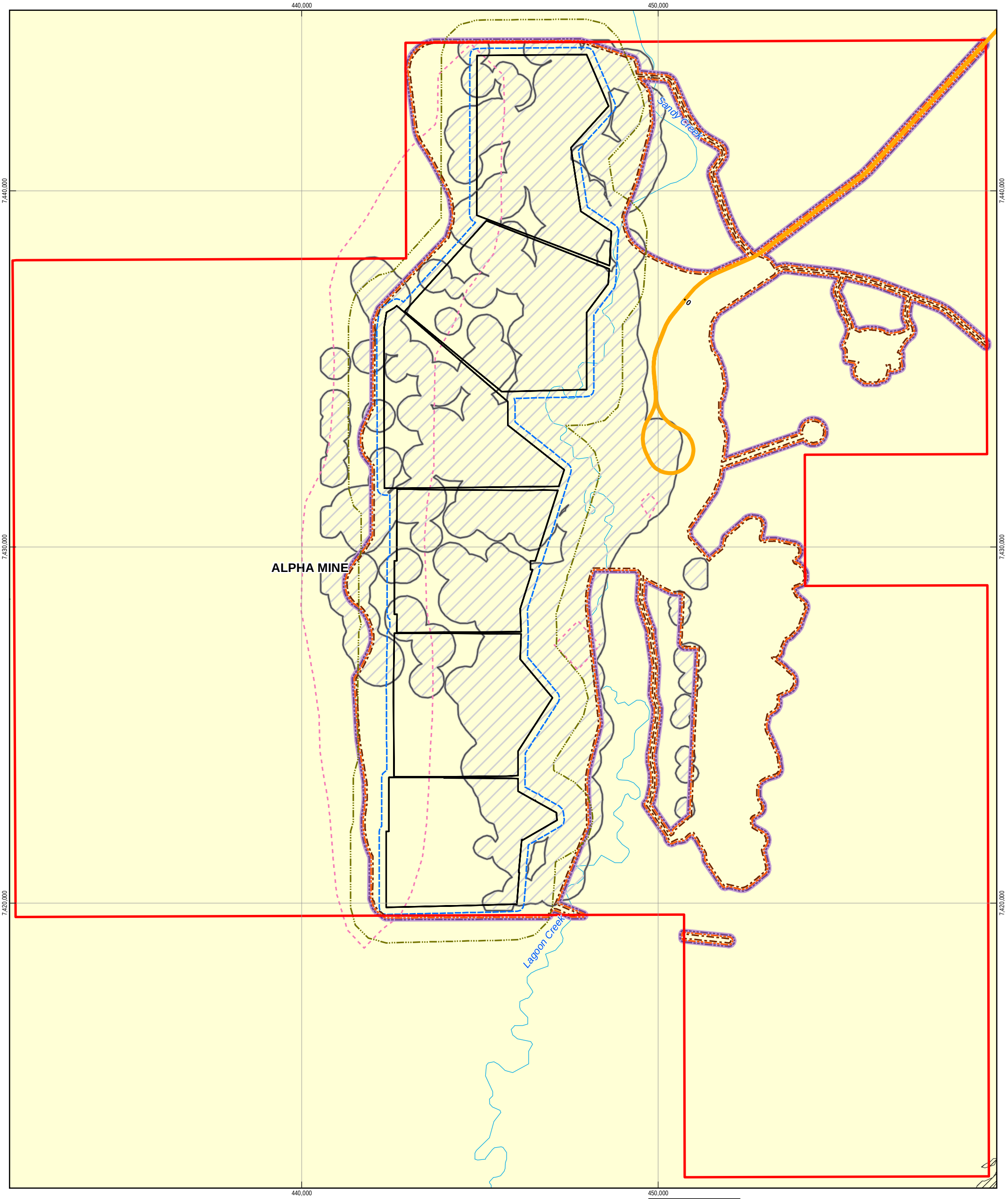
- Contain an RE listed in Table FA.A-7 above (if a mixed polygon, the RE must comprise at least 20% of that polygon) **AND**
- Have a very high or high Ecosystem Diversity rating (BPA Criteria F – an indication of habitat complexity) **AND**
- Have a very high or high Context and Connection rating (BPA Criteria G – an indication of proximity to and connection with other remnant vegetation and/or waterways) **AND**
- Occur at an altitude of 200 – 500 metres **AND**
- Occur within the modelled distribution of the species

If the RE criteria was satisfied, but another criteria was not (i.e. BPA rating(s) medium or low **AND/OR** altitude < 200 m or > 500 m), the RE polygon was mapped as 'low value potential habitat'.

If a mapped remnant vegetation unit (RE polygon) did not contain an RE nominated in Table FA.A-7, or was non-remnant vegetation, or was outside the modelled distribution for the Dunmall's snake, it was mapped as 'generally not suitable' for the species.

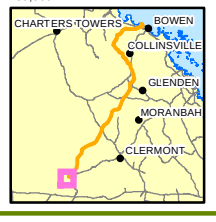
The 'regional scale' and 'mine study area (local) scale' potential habitat maps for Dunmall's snake are provided in Figure 13 and Figure 14, respectively.

A discussion of direct and indirect impacts to the Dunmall's snake is provided in Section FA.6 of the EPBC Report (Mine)). The area of 'high value potential habitat' and 'low value potential habitat' that may experience direct and indirect impacts from the Project (Mine) is discussed. Measures to manage and mitigate potential impacts are presented.



LEGEND

- Town
- Existing Railway
- State Road
- Waterbody
- Watercourse
- Alpha MLA
- Mine Pit
- Direct Disturbance Footprint
- Proposed Alignment
- Vegetation Corridor (Brigalow Belt): State, Regional
- Vegetation Corridor (Desert Uplands): Very High
- Dunmall's Snake Habitat: Confirmed, High Potential, Low Potential, Not Suitable
- Indirect Impact Buffer Contour: Vibration, Light, Invasive Species, Groundwater, Dust, Noise



Source: See Copyright Details below and for full disclosure please read Section 18.2 - References in the EIS

1:100,000 (at A3)

0 0.5 1 2 3 4 5

Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

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HANCOCK PROSPECTING PTY LTD

Alpha Coal Project
Supplementary Environmental Impact Statement

POTENTIAL DUNMALL'S SNAKE HABITAT - ALPHA MINE

Job Number	41-23742
Revision	A
Date	04 Aug 2011

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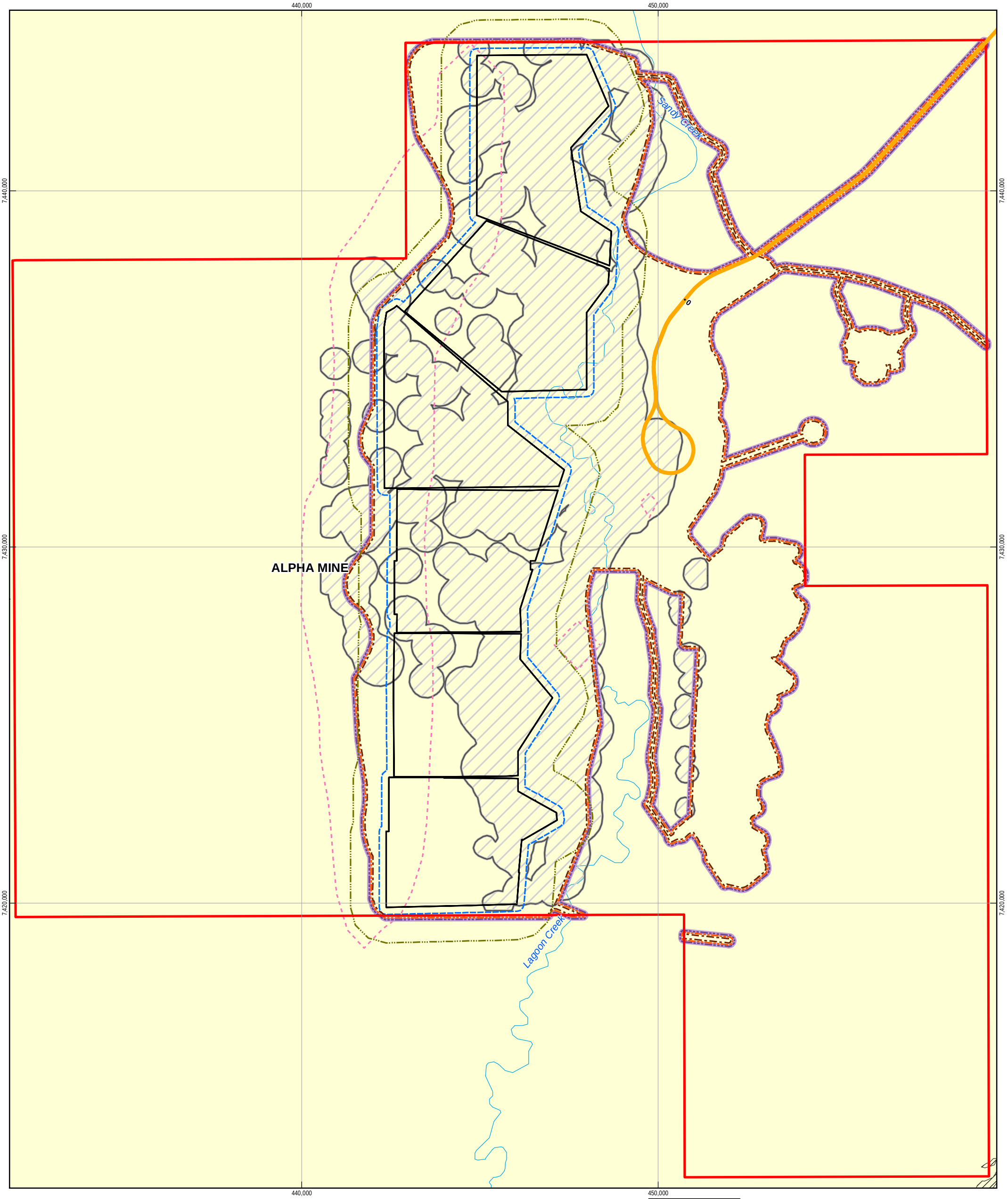
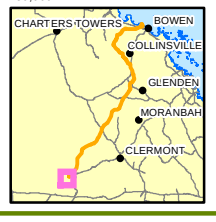


LEGEND

- Town
- Existing Railway
- State Road
- Waterbody
- Watercourse
- Alpha MLA
- Mine Pit
- Direct Disturbance Footprint
- Proposed Alignment
- Vegetation Corridor (Brigalow Belt): State, Regional
- Vegetation Corridor (Desert Uplands): Very High
- Dunmall's Snake Habitat: Confirmed, High Potential, Low Potential, Not Suitable
- Indirect Impact Buffer Contour: Vibration, Light, Invasive Species, Groundwater, Dust, Noise



Source: See Copyright Details below and for full disclosure please read Section 18.2 - References in the EIS

1:100,000 (at A3)

0 0.5 1 2 3 4 5

Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

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HANCOCK PROSPECTING PTY LTD

Alpha Coal Project
Supplementary Environmental Impact Statement

POTENTIAL DUNMALL'S SNAKE HABITAT - ALPHA MINE

Job Number	41-23742
Revision	A
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FA.A.1.9 Yakka Skink

FA.A.1.9.1 EPBC Act Status

Vulnerable

FA.A.1.9.2 Distribution and Habitat Information

The yakka skink (*Egernia rugosa*) has a discontinuous and patchy distribution stretching from Cape York Peninsula to south east Queensland. The Brigalow Belt (North and South) bioregions are within this species' distribution (SEWPAC, 2011l).

The yakka skink is known to occur in the EPBC Act-listed Brigalow (*Acacia harpophylla* dominant and co-dominant) Threatened Ecological Community and in the Queensland Regional Ecosystem (RE) 11.3.2 which may coincide with the EPBC Act-listed Endangered Weeping Myall Woodlands Threatened Ecological Community.

The yakka skink is commonly associated with the following woodland and open forest types:

- Brigalow (*Acacia harpophylla*)
- Mulga (*A. aneura*)
- Bendee (*A. catenulata*)
- Lancewood (*A. shirleyi*)
- Belah (*Casuarina cristata*)
- Poplar box (*Eucalyptus populnea*)
- Ironbark (*Eucalyptus spp.)*
- White cypress pine (*Callitris glaucophylla*).

The yakka skink is commonly found sheltering under and between partly buried rocks, logs or tree stumps, root cavities and abandoned animal burrows. This species is not generally found in trees or rocky habitats. The species often takes refuge in hollow logs, dense ground vegetation and deep burrow systems. The yakka skink can persist in cleared habitats where shelter is provided by log piles, deep gullies, tunnel erosion/sinkholes and rabbit warrens. Yakka skinks will create communal defecation sites or scat piles near the entrance to their burrows (SEWPAC, 2011l).

FA.A.1.9.3 Threatening Processes

Yakka skink populations, like other reptiles in the Brigalow Belt bioregion, have experienced declines, possibly due to a number of factors. Threats to the persistence of this species include:

- Habitat reduction through land clearing for development
- Habitat degradation
- Removal of microhabitats
- Inappropriate roadside management
- Predation by feral species (SEWPAC, 2011l).

Key threatening processes listed under the EPBC Act that may be of relevance to this species include:

- Competition and land degradation by rabbits
- Invasion of northern Australia by gamba grass and other introduced grasses
- Land clearance

- Loss of terrestrial climatic habitat caused by anthropogenic emissions of greenhouse gases
- Predation by European red fox
- Predation by feral cats
- Predation, habitat degradation, competition and disease transmission by feral pigs

FA.A.1.9.4 Survey Guidelines

The Commonwealth Government's *Survey Guidelines for Australia's Threatened Reptiles* (SEWPAC, 2011i) details recommended survey methodologies for detecting the yakka skink. The most reliable method of detection for this species is active searches for burrow systems and communal defecation sites. Once these locations have been identified the species can be confirmed through trapping around burrows, observations from a distance and shining a torch down the burrow at night (SEWPAC, 2011i).

The Commonwealth Government's *Draft Referral guidelines for the nationally listed Brigalow Belt Reptiles* (SEWPAC, 2011j) also identify targeted survey effort and techniques required to detect the yakka skink. In summary, the survey techniques suitable for detecting the yakka skink include:

- One-off diurnal searches of microhabitats during the coolest parts of the day surveying a minimum of 1.5 person hours per hectare of suitably complex habitats over a minimum of three days
- Spotlighting inundated gilgais, riparian habitats, and large logs between dusk and early morning hours surveying a minimum of 1.5 person hours per hectare of suitably complex habitats over a minimum of three nights
- Cage and Elliot traps should be places close as possible to burrow entrances

As outlined in section 4.3.2 of this Alpha Coal Project EPBC Report (Mine), a total of 36 fauna transect sites were established on and surrounding the Project site. Each site was subject to trapping regimes of up to four consecutive nights for pitfall (in combination with funnel) traps and five consecutive nights for Cage and Elliot Traps. This trapping was conducted in conjunction with spotlighting (walking and driving), opportunistic diurnal micro-habitat searches, scat and track searched as well as incidental recording.

FA.A.1.9.5 Desktop Assessment Results

The yakka skink was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool.

The Queensland DERM Wildlife Online database returned a record of this species from the desktop search extent (as defined in Section FA.4.3.1 of the EPBC Report (Mine)).

FA.A.1.9.6 Field Results

The yakka skink was not recorded in the mine study area during seasonal field studies for the Project EIS and SEIS.

FA.A.1.9.7 Habitat Mapping Criteria

Habitat modelling and mapping was undertaken using the methodology described in Section FA.4.4 of the EPBC Report (Mine). The habitat criteria used to model and map potential habitat for yakka skink are presented in Table FA.A-8 below.

Table FA.A-8 Habitat Mapping Criteria – Yakka Skink

Mapping category	Known point records	Regional Ecosystems*	Queensland BPA Criteria F - Ecosystem Diversity	Queensland BPA Criteria G - Context and Connection	Altitude*
'Confirmed habitat'	No sighting records / point data available	NA			
'High value potential habitat'	NA	10.3.1, 10.3.2, 10.3.3, 10.3.4, 10.3.5, 10.3.6, 10.3.9, 10.3.10, 10.3.11, 10.3.12, 10.3.13, 10.3.14, 10.3.15, 10.3.16, 10.3.17, 10.3.19, 10.3.20, 10.3.21, 10.3.22, 10.3.23, 10.3.25, 10.3.27, 10.3.28, 10.3.30, 10.3.31, 10.4.1, 10.4.2, 10.4.3, 10.4.4, 10.4.5, 10.4.6, 10.4.7, 10.4.9, 10.5.1, 10.5.2, 10.5.4, 10.5.5, 10.5.7, 10.5.8, 10.5.9, 10.5.10, 10.5.11, 10.5.12, 10.7.1, 10.7.2, 10.7.3, 10.7.4, 10.7.5, 10.7.6, 10.7.7, 10.7.8, 10.7.9, 10.7.10, 10.7.11, 10.7.12, 10.9.1, 10.9.2, 10.9.3, 10.9.5, 10.9.6, 10.9.8, 10.10.1, 10.10.2, 10.10.3, 10.10.4, 10.10.5, 10.10.7, 11.1.4, 11.2.1, 11.2.2, 11.2.5, 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.5, 11.3.6, 11.3.7, 11.3.8, 11.3.9, 11.3.10, 11.3.12, 11.3.13, 11.3.14, 11.3.15, 11.3.16, 11.3.17, 11.3.18, 11.3.19, 11.3.20, 11.3.23, 11.3.25, 11.3.26, 11.3.27, 11.3.28, 11.3.29, 11.3.30, 11.3.32, 11.3.33, 11.3.34, 11.3.35, 11.3.36, 11.3.37, 11.3.38, 11.3.39, 11.4.2, 11.4.3, 11.4.5, 11.4.6, 11.4.7, 11.4.8, 11.4.9, 11.4.10, 11.4.12, 11.4.13, 11.5.1, 11.5.2, 11.5.3, 11.5.4, 11.5.5, 11.5.7, 11.5.8, 11.5.9, 11.5.12, 11.5.13, 11.5.14, 11.5.15, 11.5.16, 11.5.17, 11.5.20, 11.5.21, 11.7.1, 11.7.2, 11.7.3, 11.7.4, 11.7.6, 11.7.7, 11.8.1, 11.8.2, 11.8.3, 11.8.4, 11.8.5, 11.8.6, 11.8.8, 11.8.9, 11.8.11, 11.8.12, 11.8.14, 11.8.15, 11.9.1, 11.9.2, 11.9.3, 11.9.4, 11.9.5, 11.9.6, 11.9.7, 11.9.8, 11.9.9, 11.9.10, 11.9.13, 11.9.14, 11.10.1, 11.10.2, 11.10.3, 11.10.4, 11.10.5, 11.10.6, 11.10.7, 11.10.9, 11.10.11, 11.10.12, 11.10.13, 11.11.1, 11.11.2, 11.11.3, 11.11.4, 11.11.6, 11.11.7, 11.11.8, 11.11.9, 11.11.10, 11.11.11, 11.11.12, 11.11.13, 11.11.14, 11.11.15, 11.11.16, 11.11.17, 11.11.19, 11.11.20, 11.11.21, 11.12.1, 11.12.2, 11.12.3, 11.12.5, 11.12.6, 11.12.7, 11.12.8, 11.12.9, 11.12.10, 11.12.11, 11.12.12, 11.12.13, 11.12.14, 11.12.15, 11.12.16, 11.12.17, 11.12.19, 11.12.20, 11.12.21	Very High or High	Very High or High	100 – 1000 m

Mapping category	Known point records	Regional Ecosystems*	Queensland BPA Criteria F - Ecosystem Diversity	Queensland BPA Criteria G - Context and Connection	Altitude*
'Low value potential habitat'	NA	10.3.1, 10.3.2, 10.3.3, 10.3.4, 10.3.5, 10.3.6, 10.3.9, 10.3.10, 10.3.11, 10.3.12, 10.3.13, 10.3.14, 10.3.15, 10.3.16, 10.3.17, 10.3.19, 10.3.20, 10.3.21, 10.3.22, 10.3.23, 10.3.25, 10.3.27, 10.3.28, 10.3.30, 10.3.31, 10.4.1, 10.4.2, 10.4.3, 10.4.4, 10.4.5, 10.4.6, 10.4.7, 10.4.9, 10.5.1, 10.5.2, 10.5.4, 10.5.5, 10.5.7, 10.5.8, 10.5.9, 10.5.10, 10.5.11, 10.5.12, 10.7.1, 10.7.2, 10.7.3, 10.7.4, 10.7.5, 10.7.6, 10.7.7, 10.7.8, 10.7.9, 10.7.10, 10.7.11, 10.7.12, 10.9.1, 10.9.2, 10.9.3, 10.9.5, 10.9.6, 10.9.8, 10.10.1, 10.10.2, 10.10.3, 10.10.4, 10.10.5, 10.10.7, 11.1.4, 11.2.1, 11.2.2, 11.2.5, 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.5, 11.3.6, 11.3.7, 11.3.8, 11.3.9, 11.3.10, 11.3.12, 11.3.13, 11.3.14, 11.3.15, 11.3.16, 11.3.17, 11.3.18, 11.3.19, 11.3.20, 11.3.23, 11.3.25, 11.3.26, 11.3.27, 11.3.28, 11.3.29, 11.3.30, 11.3.32, 11.3.33, 11.3.34, 11.3.35, 11.3.36, 11.3.37, 11.3.38, 11.3.39, 11.4.2, 11.4.3, 11.4.5, 11.4.6, 11.4.7, 11.4.8, 11.4.9, 11.4.10, 11.4.12, 11.4.13, 11.5.1, 11.5.2, 11.5.3, 11.5.4, 11.5.5, 11.5.7, 11.5.8, 11.5.9, 11.5.12, 11.5.13, 11.5.14, 11.5.15, 11.5.16, 11.5.17, 11.5.20, 11.5.21, 11.7.1, 11.7.2, 11.7.3, 11.7.4, 11.7.6, 11.7.7, 11.8.1, 11.8.2, 11.8.3, 11.8.4, 11.8.5, 11.8.6, 11.8.8, 11.8.9, 11.8.11, 11.8.12, 11.8.14, 11.8.15, 11.9.1, 11.9.2, 11.9.3, 11.9.4, 11.9.5, 11.9.6, 11.9.7, 11.9.8, 11.9.9, 11.9.10, 11.9.13, 11.9.14, 11.10.1, 11.10.2, 11.10.3, 11.10.4, 11.10.5, 11.10.6, 11.10.7, 11.10.9, 11.10.11, 11.10.12, 11.10.13, 11.11.1, 11.11.2, 11.11.3, 11.11.4, 11.11.6, 11.11.7, 11.11.8, 11.11.9, 11.11.10, 11.11.11, 11.11.12, 11.11.13, 11.11.14, 11.11.15, 11.11.16, 11.11.17, 11.11.19, 11.11.20, 11.11.21, 11.12.1, 11.12.2, 11.12.3, 11.12.5, 11.12.6, 11.12.7, 11.12.8, 11.12.9, 11.12.10, 11.12.11, 11.12.12, 11.12.13, 11.12.14, 11.12.15, 11.12.16, 11.12.17, 11.12.19, 11.12.20, 11.12.21	Medium or Low	Medium or Low	Altitude < 100 m or Altitude > 1000 m
'Generally not suitable'	NA	All other REs and non-remnant vegetation			

*sourced from DERM Essential Habitat Factors for yakka skink

No sighting records or point data for the yakka skink was available and as such no 'confirmed habitat' was mapped for the species.

In order to qualify as 'high value potential habitat' for the yakka skink, based on the rules of the model, a mapped remnant vegetation unit (RE polygon) needed to:

- Contain an RE listed in Table FA.A-8 above (if a mixed polygon, the RE must comprise at least 20% of that polygon) **AND**
- Have a very high or high Ecosystem Diversity rating (BPA Criteria F – an indication of habitat complexity) **AND**
- Have a very high or high Context and Connection rating (BPA Criteria G – an indication of proximity to and connection with other remnant vegetation and/or waterways) **AND**
- Occur at an altitude of 100 – 1000 metres

If the RE criteria was satisfied, but another criteria was not (i.e. BPA rating(s) medium or low **AND/OR** altitude < 100 m or > 1000 m, the RE polygon was mapped as 'low value potential habitat'.

If a mapped remnant vegetation unit (RE polygon) did not contain an RE nominated in Table FA.A-8, or was non-remnant vegetation, it was mapped as 'generally not suitable' for the species.

The 'regional scale' and 'mine study area (local) scale' potential habitat maps for the yakka skink are provided in Figure 15 and Figure 16, respectively.

A discussion of direct and indirect impacts to the yakka skink is provided in Section FA.6 of the EPBC Report (Mine)). The area of 'high value potential habitat' and 'low value potential habitat' that may experience direct and indirect impacts from the Project is discussed. Measures to manage and mitigate potential impacts are presented.

440,000
450,000
7,440,000
7,430,000
7,420,000
Sandy Creek
ALPHA MINE
Lagoon Creek

LEGEND

- Town
- Existing Railway
- State Road
- Waterbody
- Watercourse
- Alpha MLA
- Mine Pit
- Direct Disturbance Footprint
- Proposed Alignment

Vegetation Corridor (Brigalow Belt)
- State
- Regional

Vegetation Corridor (Desert Uplands)
- Very High

Yakka Skink Habitat
- Confirmed
- High Potential
- Low Potential
- Not Suitable

Indirect Impact Buffer Contour
- Vibration
- Light
- Invasive Species
- Groundwater
- Dust
- Noise

Source: See Copyright Details below and for full disclosure please read Section 18.2 - References in the EIS

1:100,000 (at A3)

0 0.5 1 2 3 4 5

Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

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Alpha Coal Project
Supplementary Environmental Impact Statement

POTENTIAL YAKKA SKINK HABITAT - ALPHA MINE

Job Number	41-23742
Revision	A
Date	28 July 2011

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400,000 450,000 500,000

7,500,000 7,450,000 7,400,000

Edie Creek
Claire Creek
Dunda Creek
Fiery Creek
Fox Creek
Belyando River
Sandy Creek
Lagoon Creek
Tallarenha Creek
Alice River
Jordan Creek
Brumby Gully
May Creek
Rocky Creek
Pebbly Creek
Bottle Tree Creek
Belyando River

100000
75000
50000
25000

Clermont - Alpha Road
Capricorn Highway
Blackall - Jericho Road
Alpha - Tambo Road

ALPHA MINE
ALPHA

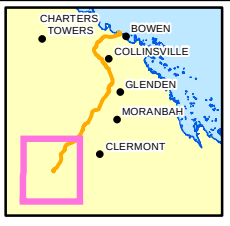
LEGEND

- Town
- Existing Railway
- State Road
- Waterbody
- Watercourse
- Alpha MLA
- Proposed Alignment

Vegetation Corridor (Brigalow Belt)
- State
- Regional

Vegetation Corridor (Desert Uplands)
- Very High

Yakka Skink Habitat
- Confirmed
- High Potential
- Low Potential
- Not Suitable



Source: See Copyright Details below and for full disclosure please read Section 18.2 - References in the EIS

1:500,000 (at A3)

0 2.5 5 10 15 20 25

Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

N

HANCOCK PROSPECTING PTY LTD

Alpha Coal Project
Supplementary Environmental Impact Statement

POTENTIAL YAKKA SKINK HABITAT - REGIONAL

Job Number	41-23742
Revision	A
Date	28 July 2011

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FA.A.1.10 Brigalow Scaly-Foot

FA.A.1.10.1 EPBC Act Status

Vulnerable

FA.A.1.10.2 Distribution and Habitat Information

The brigalow scaly-foot's (*Paradelma orientalis*) distribution is highly fragmented throughout its Queensland range. The species' distribution is centred on the Brigalow Belt of Queensland. The species occurs in the Brigalow Belt North and South bioregions, the southern parts of the Desert Uplands bioregion and the Mulga Lands bioregion (SEWPAC, 2011m).

The species is found on sandstone ridges to undulating plains in a wide diversity of remnant and non-remnant open forest and woodland habitats including:

- Brigalow (*Acacia harpophylla*) communities
- Gidgee (*Acacia cambagei*)
- Bendee (*Acacia catenulata*)
- Lancewood (*Acacia shirleyi*)
- Broad-leafed hickory wattle (*Acacia falciformis*)
- Blue spotted gum (*Corymbia citriodora*)
- Narrow-leaved ironbark (*Eucalyptus crebra*)
- Bimble/poplar box (*Eucalyptus populnea*)
- Belah (*Casuarina cristata*)
- Cypress pine (*Callitris columellaris*)
- Buloke/bull oak (*Allocasuarina luehmannii*).

The species is also known to persist in highly disturbed vegetation types. Brigalow scaly-foot microhabitats are known to include sandstone slabs, surface debris and grass hummocks.

FA.A.1.10.3 Threatening Processes

Brigalow scaly-foot populations have experienced declines in abundance possibly due to a number of factors (SEWPAC, 2011m). Threats to the persistence of this species include:

- Habitat loss through land clearing for development
- Habitat fragmentation
- Inappropriate roadside burns, slashing and road widening
- Introduction of roadside lighting
- Inappropriate fire
- Predation by feral species (SEWPAC, 2011m)

Key threatening processes listed under the EPBC Act that may be of relevance to this species include:

- Competition and land degradation by rabbits
- Invasion of northern Australia by gamba grass and other introduced grasses
- Land clearance
- Loss of terrestrial climatic habitat caused by anthropogenic emissions of greenhouse gases

- Predation by European red fox
- Predation by feral cats
- Predation, habitat degradation, competition and disease transmission by feral pigs

FA.A.1.10.4 Survey Guidelines

The Commonwealth Government's *Survey Guidelines for Australia's Threatened Reptiles* (SEWPAC, 2011i) details recommended survey methodologies for detecting the brigalow scaly-foot. The most appropriate survey methods for this species are diurnal hand searches under potential microhabitat such as rocks, fallen bark, leaf litter and timber combined with nocturnal spotlighting searches on the ground and the lower portion of rough barked, sap exuding trees (SEWPAC, 2011i).

The Commonwealth Government's *Draft Referral guidelines for the nationally listed Brigalow Belt Reptiles* (SEWPAC, 2011j) also identify targeted survey effort and techniques required to detect the brigalow scaly-foot. In summary, the survey techniques suitable for detecting the brigalow scaly-foot include:

- One-off diurnal searches of microhabitats during the coolest parts of the day surveying a minimum of 1.5 person hours per hectare of suitably complex habitats over a minimum of three days
- Spotlighting inundated gilgais, riparian habitats, and large logs between dusk and early morning hours surveying a minimum of 1.5 person hours per hectare of suitably complex habitats over a minimum of three nights
- Pitfall and funnel trapping using six 20 L buckets distributed under a 30 m drift fence where suitable microhabitats occur. Funnel traps should be placed at the end of each pitfall line, with at least 2 replicates for each habitat type

As outlined in section FA.4.3.2 of this Alpha Coal Project EPBC Report (Mine), a total of 36 fauna transect sites were established on and surrounding the Project site. Each site was subject to trapping regimes of up to four consecutive nights for pitfall (in combination with funnel) traps and five consecutive nights for Cage and Elliot Traps. This trapping was conducted in conjunction with spotlighting (walking and driving), opportunistic diurnal micro-habitat searches, scat and track searched as well as incidental recording.

FA.A.1.10.5 Desktop Assessment Results

The brigalow scaly-foot was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool.

The Queensland DERM Wildlife Online database returned a record of this species from the desktop search extent (as defined in Section FA.4.3.1 of the EPBC Report (Mine)).

FA.A.1.10.6 Field Results

The brigalow scaly-foot was not recorded in the mine study area during seasonal field studies for the Project EIS and SEIS.

FA.A.1.10.7 Habitat Mapping Criteria

Habitat modelling and mapping was undertaken using the methodology described in Section FA.4.4of the EPBC Report (Mine). The habitat criteria used to model and map potential habitat for ornamental snake are presented in Table FA.A-9 below.

Table FA.A-9 Habitat Mapping Criteria – Brigalow Scaly-foot

Mapping category	Known point records	Regional Ecosystems*	Queensland BPA Criteria F - Ecosystem Diversity	Queensland BPA Criteria G - Context and Connection	Altitude*	Modelled distribution (SEWPAC, 2011j)#
'Confirmed habitat'	No sighting records / point data available	NA				
'High value potential habitat'	NA	10.3.1, 10.3.2, 10.3.3, 10.3.4, 10.3.5, 10.3.6, 10.3.7, 10.3.9, 10.3.10, 10.3.11, 10.3.12, 10.3.13, 10.3.14, 10.3.15, 10.3.16, 10.3.17, 10.3.19, 10.3.20, 10.3.21, 10.3.22, 10.3.23, 10.3.25, 10.3.27, 10.3.28, 10.3.29, 10.3.30, 10.3.31, 10.4.1, 10.4.2, 10.4.3, 10.4.4, 10.4.5, 10.4.6, 10.4.7, 10.4.9, 10.5.1, 10.5.2, 10.5.4, 10.5.5, 10.5.6, 10.5.7, 10.5.8, 10.5.9, 10.5.10, 10.5.11, 10.5.12, 10.7.1, 10.7.2, 10.7.3, 10.7.4, 10.7.5, 10.7.6, 10.7.7, 10.7.8, 10.7.9, 10.7.10, 10.7.11, 10.7.12, 10.9.1, 10.9 .2, 10.9.3, 10.9.5, 10.9.6, 10.9.7, 10.9.8, 10.10.1, 10.10.2, 10.10.3, 10.10.4, 10.10.5, 10.10.7, 11.1.4, 11.2.1, 11.2.2, 11.2.3, 11.2.5, 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.5, 11.3.6, 11.3.7, 11.3.8, 11.3.9, 11.3.10, 11.3.11, 11.3.12, 11.3.13, 11.3.14, 11.3.15, 11.3.16, 11.3.17, 11.3.18, 11.3.19, 11.3.20, 11.3.23, 11.3.25, 11.3.26, 11.3.27, 11.3.28, 11.3.29, 11.3.30, 11.3.32, 11.3.33, 11.3.34, 11.3.35, 11.3.36, 11.3.37, 11.3.38, 11.3.39, 11.4.1, 11.4.2, 11.4.3, 11.4.5, 11.4.7, 11.4.8, 11.4.9, 11.4.10, 11.4.12, 11.4.13, 11.5.1, 11.5.2, 11.5.3, 11.5.4, 11.5.5, 11.5.7, 11.5.8, 11.5.9, 11.5.10, 11.5.11, 11.5.12, 11.5.13, 11.5.14, 11.5.16, 11.5.17, 11.5.18, 11.5.20, 11.5.21, 11.7.1, 11.7.2, 11.7.3, 11.7.4, 11.7.5, 11.7.6, 11.7.7, 11.8.1, 11.8.2, 11.8.4, 11.8.5, 11.8.7, 11.8.8, 11.8.9, 11.8.11, 11.8.12, 11.8.13, 11.8.14, 11.8.15, 11.9.1, 11.9.2, 11.9.3, 11.9.4, 11.9.5, 11.9.6, 11.9.7, 11.9.9, 11.9.10, 11.9.13, 11.9.14, 11.10.1, 11.10.2, 11.10.3,	Very High or High	Very High or High	0 – 800 m	Within SEWPAC (2011j) modelled distribution ('likely to occur' and 'may occur')

Mapping category	Known point records	Regional Ecosystems*	Queensland BPA Criteria F - Ecosystem Diversity	Queensland BPA Criteria G - Context and Connection	Altitude*	Modelled distribution (SEWPAC, 2011j)#
		11.10.4, 11.10.5, 11.10.6, 11.10.7, 11.10.8, 11.10.9, 11.10.11, 11.10.12, 11.10.13, 11.11.1, 11.11.2, 11.11.3, 11.11.4, 11.11.5, 11.11.6, 11.11.7, 11.11.8, 11.11.9, 11.11.10, 11.11.11, 11.11.12, 11.11.13, 11.11.14, 11.11.15, 11.11.16, 11.11.17, 11.11.18, 11.11.19, 11.11.20, 11.12.1, 11.12.2, 11.12.3, 11.12.4, 11.12.5, 11.12.6, 11.12.7, 11.12.8, 11.12.9, 11.12.10, 11.12.11, 11.12.12, 11.12.13, 11.12.14, 11.12.15, 11.12.16, 11.12.17, 11.12.18, 11.12.19, 11.12.20, 11.12.21				
'Low value potential habitat'	NA	10.3.1, 10.3.2, 10.3.3, 10.3.4, 10.3.5, 10.3.6, 10.3.7, 10.3.9, 10.3.10, 10.3.11, 10.3.12, 10.3.13, 10.3.14, 10.3.15, 10.3.16, 10.3.17, 10.3.19, 10.3.20, 10.3.21, 10.3.22, 10.3.23, 10.3.25, 10.3.27, 10.3.28, 10.3.29, 10.3.30, 10.3.31, 10.4.1, 10.4.2, 10.4.3, 10.4.4, 10.4.5, 10.4.6, 10.4.7, 10.4.9, 10.5.1, 10.5.2, 10.5.4, 10.5.5, 10.5.6, 10.5.7, 10.5.8, 10.5.9, 10.5.10, 10.5.11, 10.5.12, 10.7.1, 10.7.2, 10.7.3, 10.7.4, 10.7.5, 10.7.6, 10.7.7, 10.7.8, 10.7.9, 10.7.10, 10.7.11, 10.7.12, 10.9.1, 10.9 .2, 10.9.3, 10.9.5, 10.9.6, 10.9.7, 10.9.8, 10.10.1, 10.10.2, 10.10.3, 10.10.4, 10.10.5, 10.10.7, 11.1.4, 11.2.1, 11.2.2, 11.2.3, 11.2.5, 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.5, 11.3.6, 11.3.7, 11.3.8, 11.3.9, 11.3.10, 11.3.11, 11.3.12, 11.3.13, 11.3.14, 11.3.15, 11.3.16, 11.3.17, 11.3.18, 11.3.19, 11.3.20, 11.3.23, 11.3.25, 11.3.26, 11.3.27, 11.3.28, 11.3.29, 11.3.30, 11.3.32, 11.3.33, 11.3.34, 11.3.35, 11.3.36, 11.3.37, 11.3.38, 11.3.39, 11.4.1, 11.4.2, 11.4.3, 11.4.5, 11.4.7, 11.4.8, 11.4.9, 11.4.10, 11.4.12, 11.4.13, 11.5.1, 11.5.2, 11.5.3, 11.5.4, 11.5.5, 11.5.7, 11.5.8, 11.5.9, 11.5.10, 11.5.11, 11.5.12, 11.5.13, 11.5.14, 11.5.16, 11.5.17, 11.5.18, 11.5.20, 11.5.21, 11.7.1, 11.7.2, 11.7.3, 11.7.4, 11.7.5, 11.7.6, 11.7.7,	Medium or Low	Medium or Low	>800 m	Within SEWPAC (2011j) modelled distribution ('likely to occur' and 'may occur')

Mapping category	Known point records	Regional Ecosystems*	Queensland BPA Criteria F - Ecosystem Diversity	Queensland BPA Criteria G - Context and Connection	Altitude*	Modelled distribution (SEWPAC, 2011j)#
		11.8.1, 11.8.2, 11.8.4, 11.8.5, 11.8.7, 11.8.8, 11.8.9, 11.8.11, 11.8.12, 11.8.13, 11.8.14, 11.8.15, 11.9.1, 11.9.2, 11.9.3, 11.9.4, 11.9.5, 11.9.6, 11.9.7, 11.9.9, 11.9.10, 11.9.13, 11.9.14, 11.10.1, 11.10.2, 11.10.3, 11.10.4, 11.10.5, 11.10.6, 11.10.7, 11.10.8, 11.10.9, 11.10.11, 11.10.12, 11.10.13, 11.11.1, 11.11.2, 11.11.3, 11.11.4, 11.11.5, 11.11.6, 11.11.7, 11.11.8, 11.11.9, 11.11.10, 11.11.11, 11.11.12, 11.11.13, 11.11.14, 11.11.15, 11.11.16, 11.11.17, 11.11.18, 11.11.19, 11.11.20, 11.12.1, 11.12.2, 11.12.3, 11.12.4, 11.12.5, 11.12.6, 11.12.7, 11.12.8, 11.12.9, 11.12.10, 11.12.11, 11.12.12, 11.12.13, 11.12.14, 11.12.15, 11.12.16, 11.12.17, 11.12.18, 11.12.19, 11.12.20, 11.12.21				
'Generally not suitable'	NA	REs from all other land zones and non-remnant vegetation Outside of modelled distribution (SEWPAC, 2011j) all habitat will be generally not suitable				

*sourced from DERM Essential Habitat Factors for brigalow scaly-foot

modelled distribution mapping, presented in the *Draft Referral Guidelines for the Nationally Listed Brigalow Belt Reptiles* (SEWPAC, 2011j), available at: http://www.environment.gov.au/epbc/publications/brigalow-belt-reptiles.html

No sighting records or point data for the brigalow scaly-foot was available and as such no 'confirmed habitat' was mapped for the species.

In order to qualify as 'high value potential habitat' for the brigalow scaly-foot, based on the rules of the model, a mapped remnant vegetation unit (RE polygon) needed to:

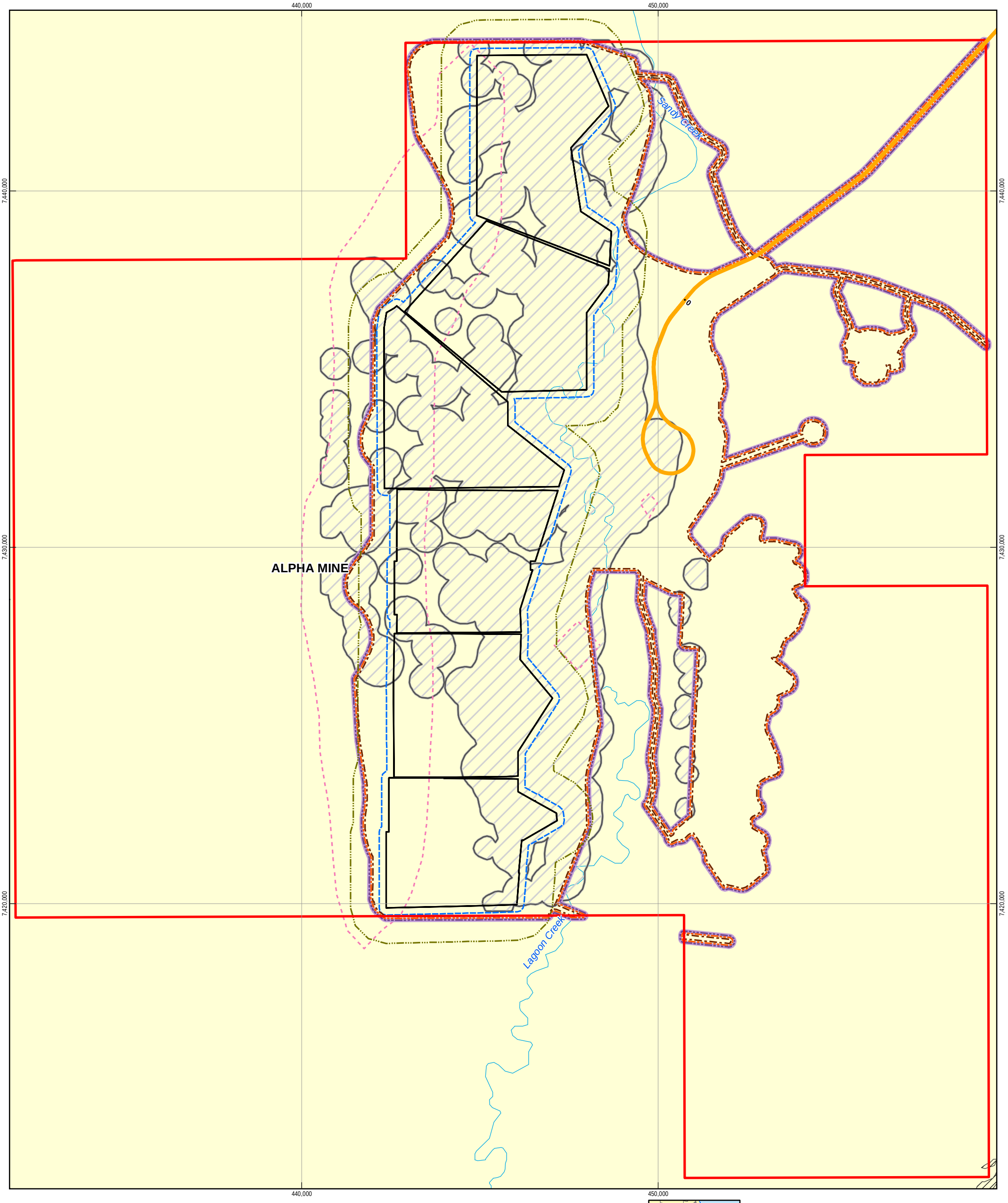
- Contain an RE listed in Table FA.A-9 above (if a mixed polygon, the RE must comprise at least 20% of that polygon) **AND**
- Have a very high or high Ecosystem Diversity rating (BPA Criteria F – an indication of habitat complexity) **AND**
- Have a very high or high Context and Connection rating (BPA Criteria G – an indication of proximity to and connection with other remnant vegetation and/or waterways) **AND**
- Occur at an altitude of 0 – 800 metres **AND**
- Occur within the modelled distribution of the species

If the RE criteria was satisfied, but another criteria was not (i.e. BPA rating(s) medium or low **AND/OR** altitude > 800 m), the RE polygon was mapped as 'low value potential habitat'.

If a mapped remnant vegetation unit (RE polygon) did not contain an RE nominated in Table FA.A-9, or was non-remnant vegetation, or was outside the modelled distribution for the brigalow scaly-foot, it was mapped as 'generally not suitable' for the species.

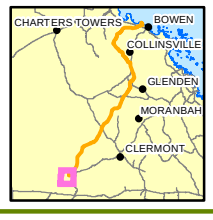
The 'regional scale' and 'mine study area (local) scale' potential habitat maps for the brigalow scaly-foot are provided in Figure 17 and Figure 18, respectively.

A discussion of direct and indirect impacts to the brigalow scaly-foot is provided in Section FA.6 of the EPBC Report (Mine)). The area of 'high value potential habitat' and 'low value potential habitat' that may experience direct and indirect impacts from the Project (Mine) is discussed. Measures to manage and mitigate potential impacts are presented.



LEGEND

- Town
- Existing Railway
- State Road
- Waterbody
- Watercourse
- Alpha MLA
- Mine Pit
- Direct Disturbance Footprint
- Proposed Alignment
- Vegetation Corridor (Brigalow Belt)
  - State
  - Regional
- Vegetation Corridor (Desert Uplands)
  - Very High
- Brigalow Scaly-foot Habitat
  - Confirmed
  - High Potential
  - Low Potential
  - Not Suitable
- Indirect Impact Buffer Contour
  - Vibration
  - Light
  - Invasive Species
  - Groundwater
  - Dust
  - Noise



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0 0.5 1 2 3 4 5

Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

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Alpha Coal Project
Supplementary Environmental Impact Statement

POTENTIAL BRIGALOW SCALY-FOOT HABITAT - ALPHA MINE

Job Number	41-23742
Revision	A
Date	04 Aug 2011

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POTENTIAL BRIGALOW SCALY-FOOT HABITAT - REGIONAL

HANCOCK PROSPECTING PTY LTD

Alpha Coal Project
Supplementary Environmental Impact Statement

Job Number	41-23742
Revision	A
Date	28 July 2011

1:500,000 (at A3)

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Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

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LEGEND

- Town
- Existing Railway
- State Road
- Waterbody
- Watercourse
- Alpha MLA
- Proposed Alignment
- Vegetation Corridor (Brigalow Belt)
  - State
  - Regional
- Vegetation Corridor (Desert Uplands)
  - Very High
- Brigalow Scaly-foot Habitat
  - Confirmed
  - High Potential
  - Low Potential
  - Not Suitable

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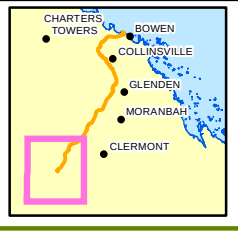

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FA.A.1.11 Greater long-eared bat

FA.A.1.11.1 EPBC Act status

Vulnerable

FA.A.1.11.2 Distribution and Habitat Information

In Queensland, the greater long-eared bat (*Nytopholis timoriensis)* is found primarily in the Brigalow Belt South Bioregion, extending eastwards to the Bunya Mountains National Park, with presence recorded as far north as the Expedition Range and Dawson River areas and a westerly range extending into the Mulgalands Bioregion and west of Bollon. There are limited records in Victoria, with patchy distributions in the Northern Plains and Mallee regions and more trapping surveys in the Hattah-Kulkyne National Park and Nowingi area, north-west Victoria, than elsewhere in the state (Koehler 2006; Lumsden 1994; Lumsden et al. 2008).

The Greater Long-eared Bat occurs in a range of inland woodland vegetation types, including box, ironbark and cypress pine woodlands. Throughout inland Queensland, the species habitat is dominated by various eucalypt and bloodwood species, and various types of tree mallee with it being most abundant in vegetation with a distinct canopy and a dense cluttered shrub layer (Dominelli 2000; Ellis et al. 1999; Koehler 2006; Lumsden 1994; McFarland et al. 1999; Parnaby 1995; Turbill & Ellis 2006).

FA.A.1.11.3 Threatening Processes

There is a lack of data available in order to accurately assess the population decline of the greater long-eared bat thereby determining past and current threats (SEWPaC, 2011). It is thought however, past tree clearing is likely to be a major factor in the species' decline.

Schulz and Lumsden (2010) suggest that current potential threats could include habitat loss and fragmentation, fire, forestry activities, overgrazing and exposure to agrichemicals, predation by feral species, tree hollow competition and climate change.

FA.A.1.11.4 Survey Guidelines and Field Survey Effort

The Commonwealth Government's *Survey Guidelines for Australia's Threatened Bats* (DEWHA, 2009b) details recommended survey methodologies for detecting the greater long-eared bat

It is recommended that passive acoustic detection methods (e.g. Anabat detectors) are used to identify areas potentially used by long-eared bats even if species level discrimination is not possible. Acoustic detection of long-eared bats can then be followed up by an appropriate trapping regime (e.g. Harptraps, mistnests). Surveys are best conducted on warmer nights from October to April.

Bat surveys were undertaken at the sites depicted in Figure FA-5 of the MNES Report (Mine), standardised. The bat survey methodology is described in Section FA.4.3.2.5 of the MNES Report (Mine).

FA.A.1.11.5 Desktop Assessment Results

The greater long-eared bat was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool.

No historical records of this species were returned from a query of relevant databases in the desktop search extent (as defined in Section FA.4.3.1 of the MNES Report (Mine)).

FA.A.1.11.6 Field Results

The greater long-eared bat was not recorded in the mine study area during field studies for the Alpha Coal Project (Mine) EIS and SEIS.

FA.A.1.11.7 Habitat Mapping Criteria

Habitat modelling and mapping was undertaken using the methodology described in Section FA.4.4 of the MNES Report (Mine).

The habitat criteria used to model and map potential habitat for the greater long-eared bat are presented in Table FA.A-10 below.

Table FA.A-10 Habitat Mapping Criteria – greater long-eared bat

Mapping category	Known point records	Regional Ecosystems*	Queensland BPA Criteria F - Ecosystem Diversity	Queensland BPA Criteria G - Context and Connection	Distance to water	Modelled distribution (SEWPAC, 2011j)#
'Confirmed habitat'	NA	**Not confirmed**				
'High value potential habitat'	NA	All remnant vegetation	– Very high – High	– Very high – High	Habitat patch (i.e. remnant vegetation polygon) within 1km of a permanent water source (i.e. river, large lake, wetland).	Permanent water sources identified through rivers / streams data layer and wetland data layers: – Directory of Important Wetlands mapping layer; DERM WetlandInfo mapping laye – DERM Wetland Protection Area mapping layer; and – DERM Wetland Management Are mapping layer.
'Low value potential habitat'	NA	All remnant vegetation	– Medium – Low	– Medium – Low	Habitat patch (i.e. remnant vegetation polygon) further than 1km of a permanent water source (i.e. river, large lake, wetland).	
'Generally not suitable'	NA	All other REs and non-remnant vegetation				

No sighting records or point data for the greater long-eared bat was available and as such no 'confirmed habitat' was mapped for the species.

In order to qualify as 'high value potential habitat' for the greater long-eared bat, based on the rules of the model, a mapped remnant vegetation unit (RE polygon) needed to:

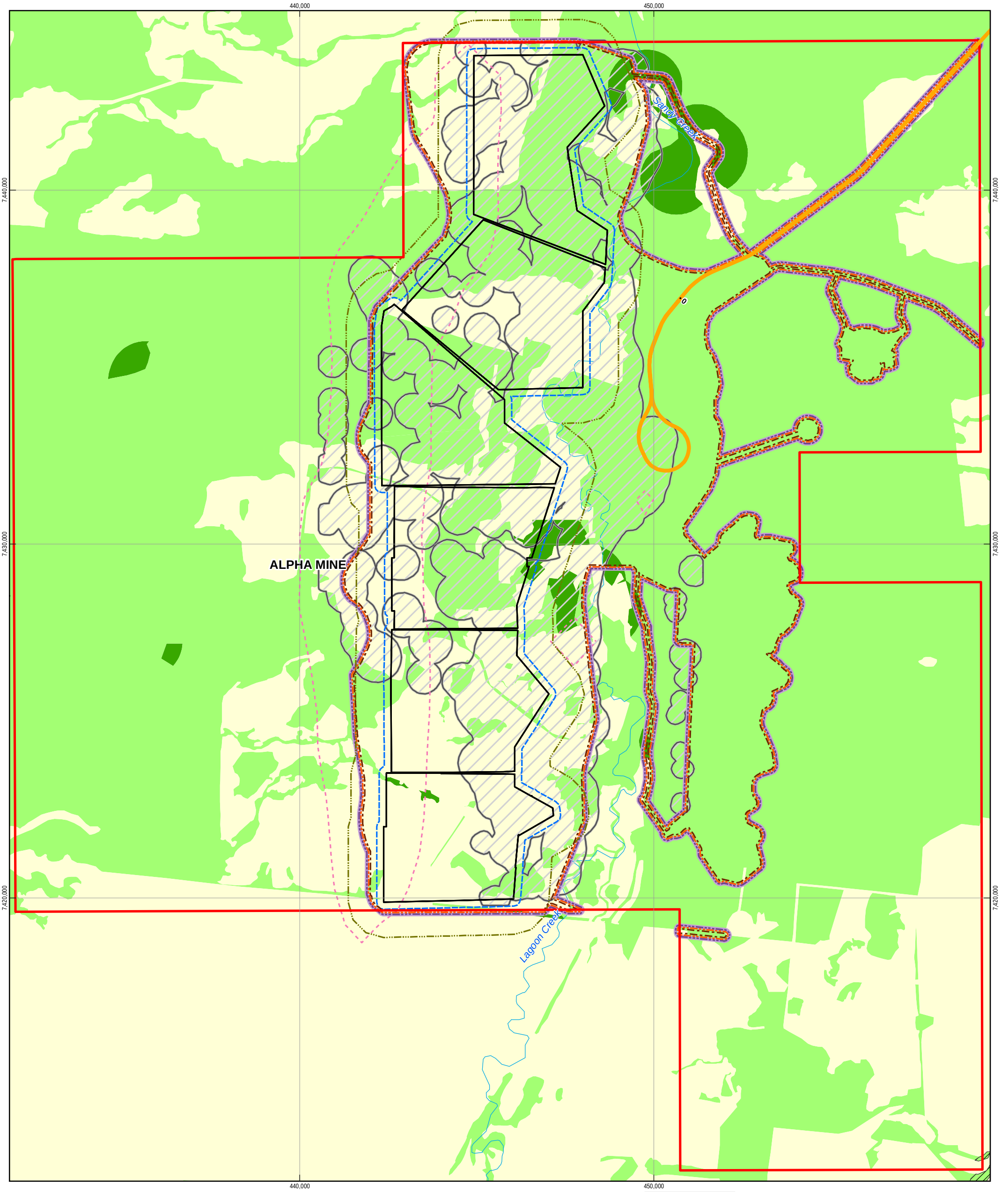
- Contain an RE listed in 10 above (if a mixed polygon, the RE must comprise at least 20% of that polygon) **AND**
- Have a very high or high Ecosystem Diversity rating (BPA Criteria F – an indication of habitat complexity) **AND**
- Have a very high or high Context and Connection rating (BPA Criteria G – an indication of proximity to and connection with other remnant vegetation and/or waterways) **AND**
- Have a habitat patch (i.e. remnant vegetation polygon) within 1km of a permanent water source (i.e. river, large lake, wetland)
- Occur within the modelled distribution of the species

If the RE criteria was satisfied, but another criteria was not (i.e. BPA rating(s) medium or low **AND/OR** habitat patch > 1000 m), the RE polygon was mapped as 'low value potential habitat'.

If a mapped remnant vegetation unit (RE polygon) did not contain an RE nominated in Table FA.A-10, or was non-remnant vegetation, or was outside the modelled distribution for the greater long-eared bat, it was mapped as 'generally not suitable' for the species.

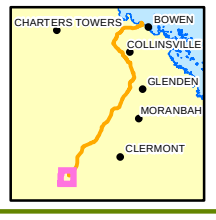
The 'regional scale' and 'mine study area (local) scale' potential habitat maps for the brigalow scaly-foot are provided in Figure 19 and Figure 20, respectively.

A discussion of direct and indirect impacts to the greater long-eared bat is provided in Section FA.6 of the EPBC Report (Mine)). The area of 'high value potential habitat' and 'low value potential habitat' that may experience direct and indirect impacts from the Project (Mine) is discussed. Measures to manage and mitigate potential impacts are presented.



LEGEND

- Town
- Existing Railway
- State Road
- Waterbody
- Watercourse
- Alpha MLA
- Mine Pit
- Direct Disturbance Footprint
- Proposed Alignment
- Vegetation Corridor (Brigalow Belt)
  - State
  - Regional
- Vegetation Corridor (Desert Uplands)
  - Very High
- Greater Long Eared Bat Habitat
  - Confirmed
  - High Potential
  - Low Potential
  - Not Suitable
- Indirect Impact Buffer Contour
  - Vibration
  - Light
  - Invasive Species
  - Groundwater
  - Dust
  - Noise



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Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

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Alpha Coal Project
Supplementary Environmental Impact Statement

POTENTIAL GREATER LONG EARED BAT HABITAT - ALPHA MINE

Job Number	41-23742
Revision	A
Date	28 July 2011

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400,000
450,000
500,000
7,500,000
7,450,000
7,400,000

Edie Creek
Clare Creek
Dunda Creek
Fiery Creek
Fox Creek
Belyando River
Sandy Creek
Lagoon Creek
Tallarenha Creek
Alice River
Jordan Creek
Brumby Gully
Blackall - Jericho Road
Alpha - Tambo Road
Capricorn Highway
Clermont - Alpha Road
May Creek
Rocky Creek
Pebbly Creek
Bottle Tree Creek
ALPHA
ALPHA MINE
100000
75000
50000
25000
0

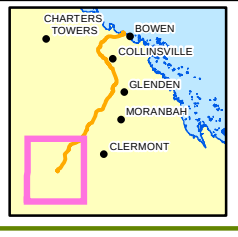
LEGEND

- Town
- Existing Railway
- State Road
- Waterbody
- Watercourse
- Alpha MLA
- Proposed Alignment

Vegetation Corridor (Brigalow Belt)
- State
- Regional

Vegetation Corridor (Desert Uplands)
- Very High

Greater Long Eared Bat Habitat
- Confirmed
- High Potential
- Low Potential
- Not Suitable



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1:500,000 (at A3)

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Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

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FA.A.1.12 Dicanthium queenslandicum

FA.A.1.12.1 EPBC Act Status

Vulnerable

FA.A.1.12.2 Distribution and Habitat Information

Limited information on the ecology of this species is available. It is broadly distributed across central eastern Queensland. Habitat known to be utilised by this species includes self-mulching cracking black clay soils.

FA.A.1.12.3 Threatening Processes

As this species occurs in broadly similar habitats to *Dichanthium setosum*, it is considered that the threatening processes applicable to the latter species will also be relevant to *Dichanthium queenslandicum*, namely:

- Heavy grazing by domestic stock
- Habitat loss (clearing for agricultural purposes)
- Inappropriate fire regimes
- Weeds
- Road widening

Key threatening processes listed under the EPBC Act that may be of relevance to this species include:

- Competition and land degradation by rabbits
- Invasion of northern Australia by gamba grass and other introduced grasses
- Land clearance
- Loss of terrestrial climatic habitat caused by anthropogenic emissions of greenhouse gases

FA.A.1.12.4 Survey Guidelines

Specific survey guidelines are not available for this species.

Flora surveys at the sites depicted in Figure FA-4 of the EPBC Report (Mine) sought to document the presence of *Dichanthium queenslandicum* (and/or the occurrence of suitable habitat), through the methodologies outlined in Section FA.4.2 of the EPBC Report (Mine).

FA.A.1.12.5 Desktop Assessment Results

The species was predicted to occur in the mine study area by the Commonwealth Protected Matters Search Tool.

This species has been previously recorded from the desktop search extent (as defined in Section FA.4.3.1 of the EPBC Report (Mine)), as catalogued by the Queensland DERM Wildlife Online search.

FA.A.1.12.6 Field Results

Dichanthium queenslandicum was not recorded in the mine study area during seasonal field studies for the Project EIS and SEIS.

FA.A.1.12.7 Habitat Mapping Criteria

Habitat modelling and mapping was undertaken using the methodology described in Section FA.4.4 of the EPBC Report (Mine).

The habitat criteria used to model and map potential habitat for *Dichanthium queenslandicum* are presented in Table FA.A-11 below.

Table FA.A-11 Habitat Mapping Criteria – *Dichanthium queenslandicum*

Mapping category	Known point records	Regional Ecosystems*	Queensland BPA Criteria F - Ecosystem Diversity	Queensland BPA Criteria G - Context and Connection
'Confirmed habitat'	No sighting records / point data available	NA		
'High value potential habitat'	NA	11.3.21, 11.4.4, 11.8.5, 11.8.11	Very High or High	Very High or High
'Low value potential habitat'	NA	11.3.21, 11.4.4, 11.8.5, 11.8.11	Medium or Low	Medium or Low
'Generally not suitable'	All other REs and non-remnant vegetation			

*No DERM Essential Habitat factors were sourced at time of preparation of model. REs with potential to support *Dichanthium queenslandicum* identified from the DERM Regional Ecosystem Description Database.

No sighting records or point data for *Dichanthium queenslandicum* was available and as such no 'confirmed habitat' was mapped for the species.

In order to qualify as 'high value potential habitat' for *Dichanthium queenslandicum*, based on the rules of the model, a mapped remnant vegetation unit (RE polygon) needed to:

- Contain an RE listed in Table FA.A-11 (if a mixed polygon, the RE must comprise at least 20% of that polygon) **AND**
- Have a very high or high Ecosystem Diversity rating (BPA Criteria F) **AND**
- Have a very high or high Context and Connection rating (BPA Criteria G)

If the RE criteria was satisfied, but another criteria was not (i.e. BPA rating(s) medium or low), the RE polygon was mapped as 'low value potential habitat'.

If a mapped remnant vegetation unit (RE polygon) did not contain an RE nominated in Table FA.A-11, or was non-remnant vegetation, it was mapped as 'generally not suitable' for the species.

The 'regional scale' and 'mine study area (local) scale' potential habitat maps for *Dichanthium queenslandicum* are provided in Figure 21 and Figure 22, respectively.

A discussion of direct and indirect impacts to *Dichanthium queenslandicum* is provided in Section FA.6 of the EPBC Report (Mine)). The area of 'high value potential habitat' and 'low value potential habitat' that may experience direct and indirect impacts from the Project is discussed. Measures to manage and mitigate potential impacts are presented.

440,000

450,000

7,440,000

7,430,000

7,420,000

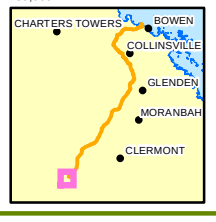
Sandy Creek

ALPHA MINE

Lagoon Creek

LEGEND

- Town
- Existing Railway
- State Road
- Waterbody
- Watercourse
- Alpha MLA
- Mine Pit
- Direct Disturbance Footprint
- Proposed Alignment
- Vegetation Corridor (Brigalow Belt)
  - State
  - Regional
- Vegetation Corridor (Desert Uplands)
  - Very High
- Dicanthium queenslandicum Habitat
  - Confirmed
  - High Potential
  - Low Potential
  - Not Suitable
- Indirect Impact Buffer Contour
  - Vibration
  - Light
  - Invasive Species
  - Groundwater
  - Dust
  - Noise



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Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

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Supplementary Environmental Impact Statement

POTENTIAL DICANTHIUM QUEENSLANDICUM HABITAT - ALPHA MINE

Job Number	41-23742
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400,000
450,000
500,000
7,500,000
7,450,000
7,400,000

Edie Creek
Clare Creek
Dunda Creek
Fiery Creek
Fox Creek
Belyando River
Sandy Creek
Lagoon Creek
Tallarenha Creek
Alice River
Jordan Creek
Brumby Gully
May Creek
Rocky Creek
Pebbly Creek
Bottle Tree Creek

100000
75000
50000
25000
0

ALPHA MINE

Clermont - Alpha Road
Capricorn Highway
ALPHA
Blackall - Jericho Road
Alpha - Tambo Road

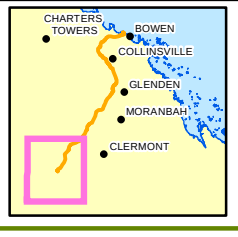
LEGEND

- Town
- Existing Railway
- State Road
- Waterbody
- Watercourse
- Alpha MLA
- Proposed Alignment

Vegetation Corridor (Brigalow Belt)
- State
- Regional

Vegetation Corridor (Desert Uplands)
- Very High

Dicanthium queenslandicum Habitat
- Confirmed
- High Potential
- Low Potential
- Not Suitable



Source: See Copyright Details below and for full disclosure please read Section 18.2 - References in the EIS

1:500,000 (at A3)

0 2.5 5 10 15 20 25

Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

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HANCOCK PROSPECTING PTY LTD

Alpha Coal Project
Supplementary Environmental Impact Statement

POTENTIAL DICANTHIUM QUEENSLANDICUM HABITAT - REGIONAL

Job Number	41-23742
Revision	A
Date	28 July 2011

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FA.A.1.13 References

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