ENVIRONMENTAL IMPACT STATEMENT

RED HILL
MINING LEASE

Appendix Q2
EPBC Act Report

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Abbreviations

Abbreviation	Definition
ACT	Australian Capital Territory
AS	Australian Standard
ASL	Above Sea Level
BA	Birds Australia
BMA	BHP Billiton Mitsubishi Alliance
BRM	Broadmeadow underground mine
CHPP	coal handling and preparation plant
DEWHA	Department of Environment, Water, Heritage and the Arts
EA	environmental authority
EC	ecological community
EHP	Department of Environment and Heritage Protection
EIS	environmental impact statement
EPA	Environment Protection Agency
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EPC	exploration permit for coal
GRB	Goonyella Riverside and Broadmeadow
GLS	Goonyella Lower Seam
GMS	Goonyella Middle Seam
GRM	Goonyella Riverside Mine
GUS	Goonyella Upper Seam
IMG	incidental mine gas
MDL	mineral development licence
MIA	mine industrial area
MLA	mining lease application
MNES	matters of national environmental significance
MR Act	*Mineral Resources Act 1993*
NC Act	*Nature Conservation Act 1992*
NSW	New South Wales
Qld	Queensland
RE	regional ecosystem
REDD	Regional Ecosystem Description Database
RHM	Red Hill Mine
RSPCA	Royal Society for the Prevention of Cruelty to Animals
SDPWO Act	*State Development and Public Works Organisation Act 1971*

Abbreviation	Definition
SIS	surface-in-seam
SPRAT	species profile and threats
TEC	threatened ecological community
TOR	Terms of Reference
TSSC	Threatened Species Scientific Committee
VM Act	*Vegetation Management Act 1999*

Units

Unit	Definition
ha	hectares
m	metre
mm	millimetre
mtpa	million tonnes per annum
spp.	species (plural)

Section 01 Executive Summary

BHP Billiton Mitsubishi Alliance, through its joint venture manager, BM Alliance Coal Operations Pty Ltd, proposes to convert the existing Red Hill Mining Lease Application (MLA) 70421 to enable the continuation of existing mining operations associated with the Goonyella, Riverside and Broadmeadow (GRB) mine complex. Specifically, the mining lease conversion will allow for:

- An extension of three longwall panels (14, 15 and 16) of the existing Broadmeadow underground mine (BRM).
- A future incremental expansion option of the existing Goonyella Riverside Mine (GRM).
- A future Red Hill Mine (RHM) underground expansion option located to the east of the GRM.

The three project elements described above are collectively referred to as ôthe projectõ

The Terms of Reference for the projectõs environmental impact statement (EIS) require the preparation of a stand-alone report addressing the potential impact of the project on Matters of National Environmental Significance (MNES) as identified in the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and associated regulations. The report is required to address, exclusively and fully, the issues relevant to the controlling provisions in the EPBC Act. This report has been prepared to address this requirement.

The project was referred to the Commonwealth Minister for the Department of the Environment on the basis of its potential impact on MNES, namely listed species and communities. On 20 June 2013, the Department of the Environment (formerly the Department of Sustainability, Environment, Water, Population and Communities) determined the project to be a controlled action under the EPBC Act (referral 2013/6865). The relevant controlling provisions under the EPBC Act are sections 18 and 18A (listed threatened species and communities).

Desktop analysis and field surveys were completed to determine the known and likely suite of EPBC Act listed species and communities across the EIS study area. The desktop analysis involved the collection and review of relevant surveys and ecological literature with relevance to the EIS study area and database records, including a search conducted of the Commonwealth Protected Matters database in June 2013 (**Appendix A**). Field surveys were completed in 2005, 2009 and 2011, and these supplemented the results of previous surveys undertaken in the area.

The desktop analysis and field surveys indicated that three EPBC Act listed plant species have been recorded or are expected to occur in the EIS study area (*Dichanthium setosum, D. queenslandicum* and *Digitaria porrecta*). Two threatened ecological communities (TECs) were confirmed through field surveys as occurring in the EIS study area: *Natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin*, and *Brigalow (Acacia harpophylla dominant and co-dominant)*.

Desktop analysis and field surveys also indicated that three EPBC Act listed fauna species have been recorded or are expected to occur within the EIS study area: the squatter pigeon (*Geophaps scripta scripta*); ornamental snake (*Denisonia maculata*), and koala (*Phascolarctos cinereus*).

Brigalow and natural grassland TECs and the three flora and three fauna species, all falling within the definitions of MNES, have been assessed with respect to their potential impact from the project.

The areas impacted by development of the RHM underground footprint and Broadmeadow extension are considered as a maximum worst case. In reality, the actual disturbance will be significantly less as

the clearing works required for IMG drainage are anticipated to only disturb a maximum of 50 per cent of the mapped areas. A worst case 100 per cent has been assessed for each MNES.

The project has followed the approach of avoiding impacts on vegetation in the first instance, minimising impacts on remnant vegetation where clearing is unavoidable and rehabilitating areas of remnant vegetation where possible. Following the preparation of assessments against relevant significant impact criteria, it is concluded that MNES are unlikely to be subject to significant adverse impacts as a result of the proposed action.

Section 02 Introduction

2.1 Background

BHP Billiton Mitsubishi Alliance (BMA) operates the existing Goonyella Riverside and Broadmeadow (GRB) mine complex. Environmental approval for the GRB mine complex is authorised under environmental authority (EA) EPML0085413 (formerly EA MIN100921609). The layout of the existing GRB mine complex is shown in **Figure 2-1**. The Goonyella Riverside Mine (GRM) is an open-cut operation. The Broadmeadow underground mine (BRM) is a punch longwall underground mine, which has is accessed from former open cut mine pits in the adjacent open-cut operation.

BMA, through its joint venture manager, BM Alliance Coal Operations Pty Ltd, proposes to convert the existing Red Hill Mining Lease Application (MLA) 70421 to enable the continuation of existing mining operations associated with the GRB mine complex. Specifically, the mining lease conversion will allow for:

- An extension of three longwall panels (14, 15 and 16) of the existing BRM.
- A future incremental expansion option of the existing GRM.
- A future Red Hill Mine (RHM) underground expansion option located to the east of the GRM which includes development of key infrastructure as detailed in **Section 3.3**.

The three project elements described above are collectively referred to as ótheprojectô

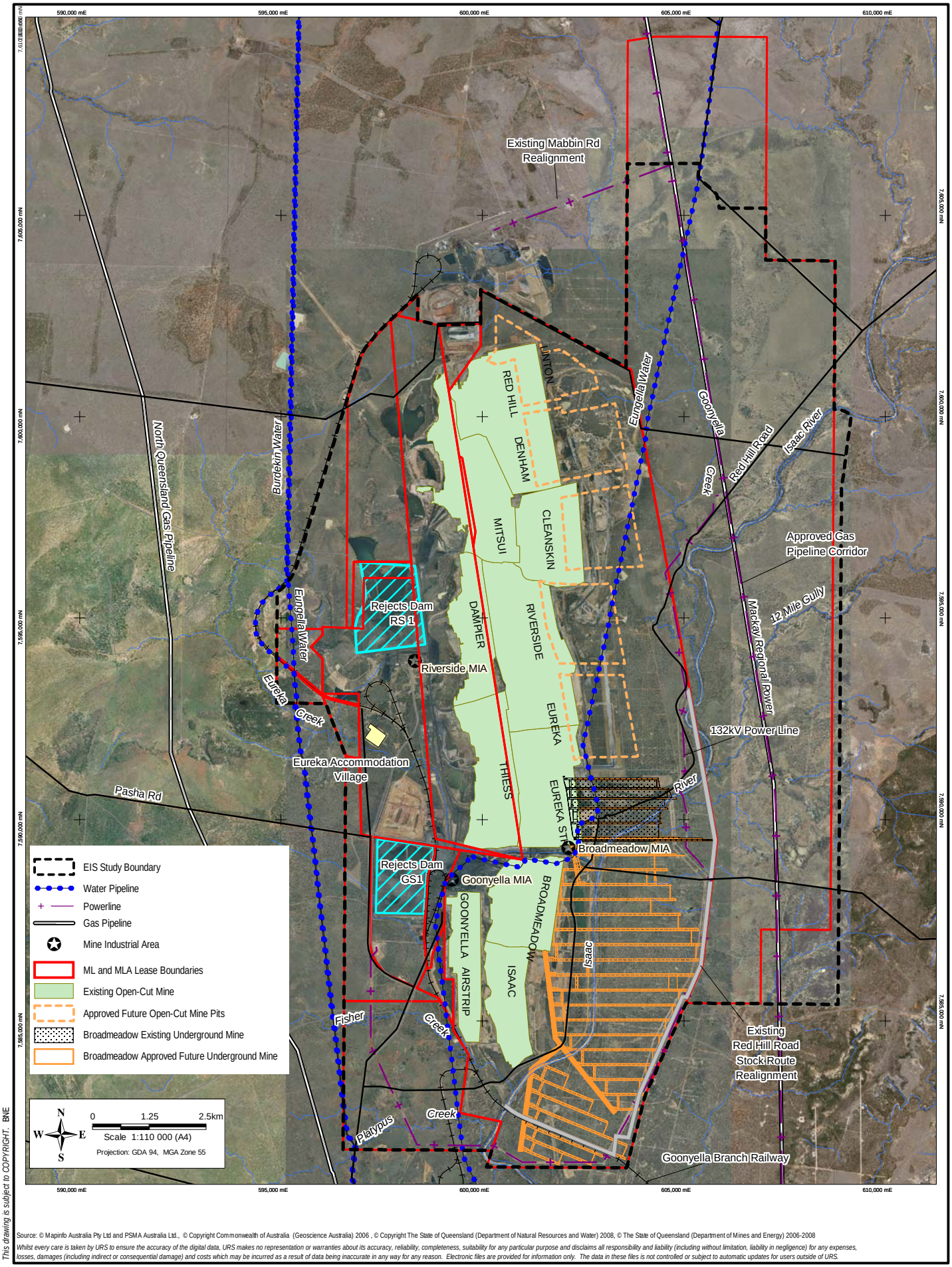
2.2 Statutory Context

On 17 June 2013 the Coordinator-General declared the project to be a ôco-ordinated projectôunder section 26 of the Queensland *State Development and Public Works Organisation Act 1971* (SDPWO Act). This declaration initiated the statutory environmental impact assessment procedure of Part 4 of the SDPWO Act, which requires the proponent to prepare an EIS for the project.

The project was referred to the Commonwealth Minister (the Minister) for the Department of the Environment. On 20 June 2013, the Minister determined that the project is a ôcontrolled actionôunder the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The relevant controlling provisions under the EPBC Act are sections 18 and 18A (listed threatened species and communities).

As a consequence, the project requires assessment and approval under the EPBC Act. The Commonwealth Government has accredited the EIS process, to be conducted under the SDPWO Act, under a bilateral agreement between the Commonwealth and Queensland Governments. This will enable the EIS to meet the impact assessment requirements under both Commonwealth and Queensland legislation. The Terms of Reference (TOR) for the project reflect issues that the Minister would expect to be addressed as part of an assessment under an EIS process.

The project will require approval from the Commonwealth Government Minister for the Environment under Part 9 of the EPBC Act, before it can proceed. The Department of State Development, Infrastructure and Planning has invited relevant Commonwealth, State and local government representatives, and other relevant authorities, to participate in the impact assessment process as advisory agencies.



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LAYOUT OF EXISTING GRB MINE COMPLEX

The TOR for the EIS specifically require that a stand-alone report be prepared to address potential impacts of the project on matters of national environmental significance (MNES). This report has been prepared to address this requirement.

2.3 The Proponent

BMA was formed in 2001 as a 50:50 unincorporated joint venture between BHP Billiton and Mitsubishi Corporation. The joint venture is known as the Central Queensland Coal Associates Joint Venture. BM Alliance Coal Operations Pty Ltd operates as the duly appointed constituted attorney for the Central Queensland Coal Associates Joint Venture Agreement and a Strategic Alliance Agreement dated 28 June 2001.

BMAôs operational mines are Blackwater, Broadmeadow, Goonyella Riverside, Peak Downs, Saraji, Crinum and Daunia. The Norwich Park and Gregory Open Cut Mines ceased production in May and October 2012 respectively, and remain in care and maintenance. BMA also owns and operates the Hay Point coal export terminal near Mackay.

BMAôs seven operational mines have a combined production capacity of up to 68 million tonnes per annum (mtpa). The Caval Ridge Mine (5.5 mtpa) will be operational in 2014.

BMA supplies high quality coking coals, pulverized coal injection coals and thermal coals to domestic and international customers.

BMA is committed to the communities in which it operates. In 2012, BMA invested around $38 million across the Bowen Basin townships to support local services and community development programs.

2.3.1 Environmental Record

BMA has an excellent record of responsible environmental management and a strong commitment to continual improvement of environmental performance.

All existing BMA mine sites operate under an ISO14001 certified Environmental Management System.

BMA strives to achieve the efficient use of resources, including reducing and preventing pollution, and enhancing biodiversity protection by assessing ecological values and land use in our activities. Our stewardship approach is designed to ensure that the lifecycle health, safety, environment and community impacts associated with resources, materials, processes and products related to our businesses are minimised and managed.

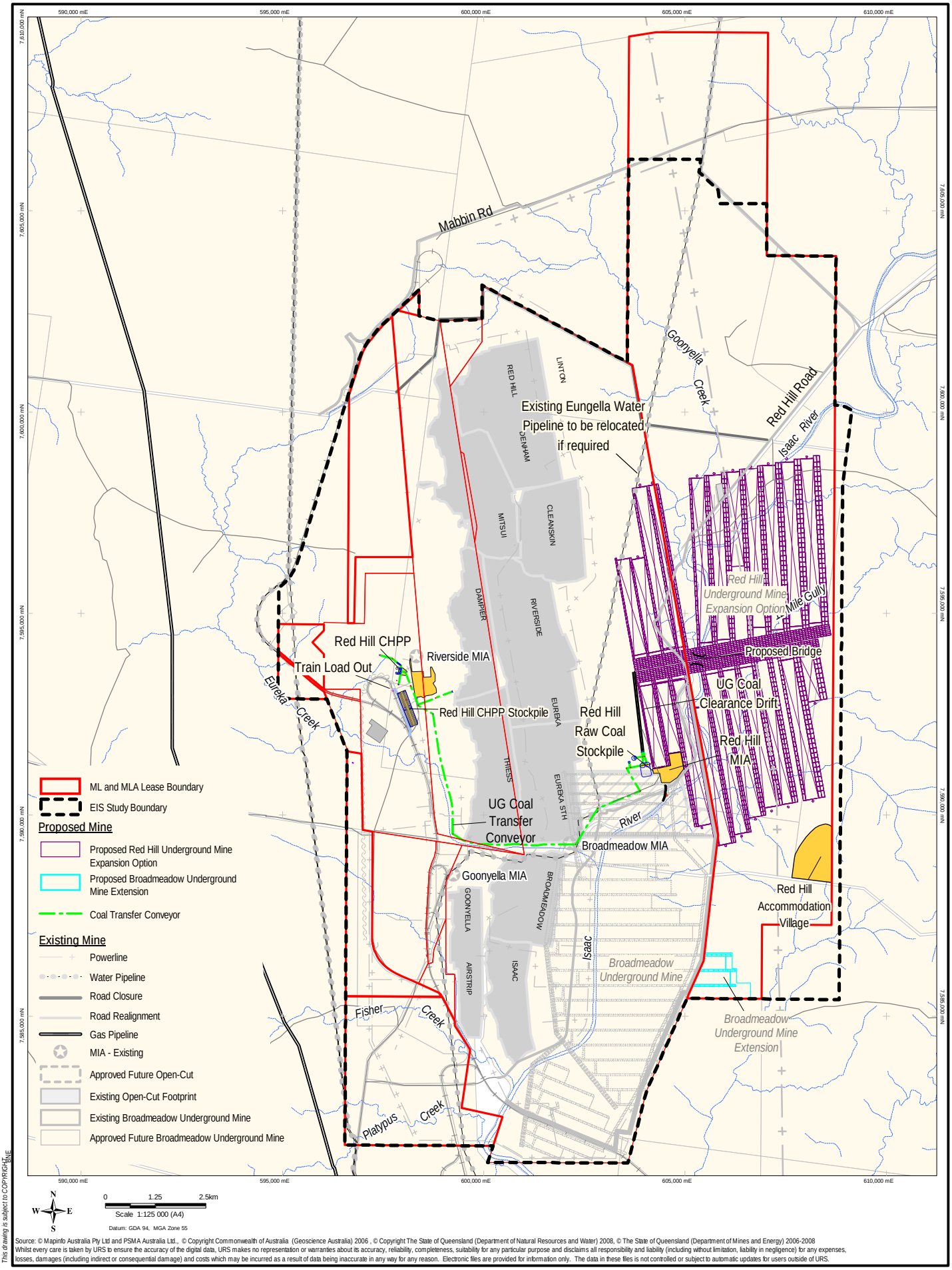
BMA has not been subject to any environmental related proceedings in any of the following Courts - High Court, Federal Court, Supreme Court, District Court, and Planning and Environment Court.

The project will be conducted in accordance with an Environmental Management System, the BHP Billiton Charter, and internal governance processes and standards (e.g. Code of Conduct, BHP Billiton Environment Standard).

BHP Billitonôs approach to environmental management is incorporated in the Charter, which outlines ôan overriding commitment to health, safety, environmental responsibility and sustainable developmentô

2.4 EIS Study Area

For the purposes of this report, the area within the EIS study boundary will be referred to as the 'EIS study area' (**Figure 2-2**). The 'survey area' refers to the boundaries of each of the terrestrial ecology surveys for 2005, 2009 and 2011. The 'survey area' for these various studies extends beyond the EIS study area.



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EIS STUDY AREA AND PROJECT DESCRIPTION

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Section 03 Description of the Proposed Action

3.1 Overview of the Proposed Project

The Red Hill Mining Lease is located adjacent to the existing Goonyella Riverside and Broadmeadow (GRB) mine complex in the Bowen Basin, approximately 20 kilometres north of Moranbah and 135 kilometres south-west of Mackay, Queensland. The key objectives of the project are to:

- Utilise BMA owned land on the GRB mine complex mining leases to minimise the environmental impacts from additional infrastructure and to provide project efficiencies.
- Maximise resource recovery and sustain existing operations.
- Operate a profitable project to provide high-quality hard coking coal to the export market.
- Design, construct and operate a project that:
  - minimises adverse impacts on the social environment; and
  - complies with all relevant statutory obligations and continues to improve processes, which enhance sound environmental management.

The conversion of the Red Hill Mining Lease is of strategic importance to the planning and development of existing operations within and around the existing GRB mine complex. It is anticipated that development work for mining of panels 14 and 15 associated with the BRM will commence in Financial Year 2016. The existing BRM workforce will complete all work associated with the extensions. The mining of these extensions will use existing mine infrastructure and extend the life of mine by approximately one year. Surface gas drainage infrastructure may be required.

The timing for commencement, the rate of development and scale of future production for the GRM incremental expansion and the RHM underground expansion option have not been determined and are subject to the ownerôs approvals. At full production, the future RHM has the potential to produce up to 14 mtpa of high quality hard coking coal over a life of 20 to 25 years from the Goonyella Middle Seam (GMS). Under this scenario, the potential capacity of the extended complex (GRB mine complex and RHM) would be up to approximately 32.5 mtpa.

Coal extraction will be by longwall mining using a thick seam mining technique to maximise resource recovery. Coal will be processed on site in a coal handling and preparation plant (CHPP) and then loaded onto trains for shipment to a coal export terminal for export to overseas markets.

While the future RHM is likely to be operated as an independent mine in terms of workforce, the proposed RHM will interface with the existing GRB mine complex in the following areas:

- Water for processing RHM coal will be sourced from the GRB mine complex and mine water generated from the RHM will be transferred to the GRB mine complex water management network. This interface will provide greater efficiency, maximise reuse, ensure mine water releases are managed holistically and reduce water related risks.
- CHPP, stockpiles and train load-out facilities will be co-located with the existing Riverside Mine coal handling facilities.

Waste from coal processing will be dewatered and disposed of in mine waste disposal facilities established for the GRB mine complex.

3.1.1 Project Components

The project will include the following components (depicted in **Figure 2-2**):

- The extension of BRM longwall panels 14, 15, and 16 into MLA70421. Key aspects include:
  - ï No new mining infrastructure is proposed other than infrastructure required for drainage of incidental mine gas (IMG) to enable safe and efficient mining.
  - ï Management of waste and water produced from drainage of IMG will be integrated with the existing BRM waste and water management systems.
  - ï The mining of the Broadmeadow extension is to sustain existing production rates of the BRM and will extend the life of mine by approximately one year.
  - ï The existing BRM workforce will complete all work associated with the extensions.
- The incremental expansion of the GRM. Key aspects include:
  - ï underground mining associated with the RHM underground expansion option to target the GMS on mine lease (ML)1763;
  - ï a new mine industrial area (MIA);
  - ï a CHPP adjacent to the Riverside MIA on MLA1764 and ML1900 ī the Red Hill CHPP will consist of up to three 1,200 tonne per hour modules;
  - ï construction of a drift for mine access;
  - ï a conveyor system linking RHM to the Red Hill CHPP;
  - ï associated coal handling infrastructure and stockpiles;
  - ï a new conveyor linking product coal stockpiles to a new rail load-out facility located on ML1900; and
  - ï means for providing flood protection to the mine access and MIA, potentially requiring a levee along the west bank of the Isaac River.
- A potential new Red Hill underground mine expansion option to the east of the GRB mine complex, to target the GMS on MLA 70421. Key aspects include:
  - ï the proposed mine layout consists of a main drive extending approximately west to east with longwall panels ranging to the north and south;
  - ï a network of bores and associated surface infrastructure over the underground mine footprint for mine gas pre-drainage (IMG) and management of goaf methane drainage to enable the safe extraction of coal;
  - ï a ventilation system for the underground workings;
  - ï a bridge across the Isaac River for all-weather access. This will be located above the main headings, and will also provide a crossing point for other mine related infrastructure including water pipelines and power supply;
  - ï a new accommodation village (Red Hill accommodation village) for the up to 100 per cent remote construction and operational workforces with capacity for up to 3,000 workers; and
  - ï potential production capacity of 14 mtpa of high quality hard coking coal over a life of 20 to 25 years.

Note that the Broadmeadow extension does not require any expansion of the Broadmeadow MIA, CHPP, stockpile or load-out facilities and is to sustain existing production rates.

Product coal from the new RHM will be transported by train to Hay Point, Dalrymple Bay and Abbot Point Coal Terminals.

3.2 Proposed Underground Mining Operations

3.2.1 Overview

The project covers the Broadmeadow extension, the GRM incremental expansion and the RHM underground expansion option as shown in **Figure 3-1**. See **Table 3-1** for a summary of the approximate areas of project components.

Table 3-1 Summary of Approximate Areas for Project Components

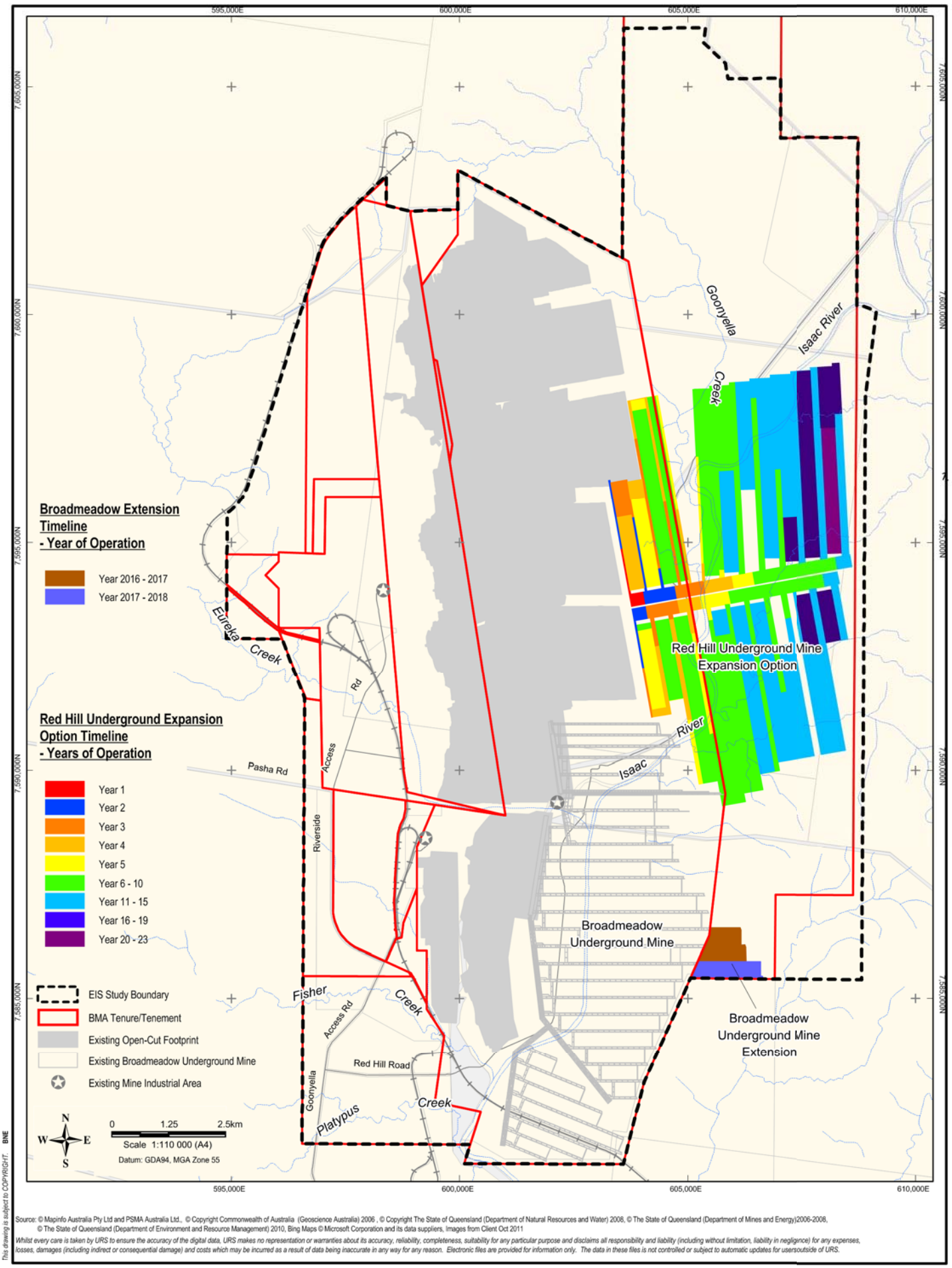
Description	Area (ha)	Comment
RHM underground footprint	3,600	Includes mining activities on both ML1763 and MLA70421.
Broadmeadow extension	121	Broadmeadow extension is located on MLA70421.
Red Hill MIA	30	Located on ML1763.
Red Hill CHPP	53	Located on existing ML1900.
Red Hill conveyor	55	Crosses ML1763, ML1764 and ML1900.
Red Hill accommodation village	108	Located on MLA70421.

For the Broadmeadow extension, mining of the new areas will occur through extension of longwall panels 14, 15 and 16 of the existing BRM.

The future RHM is a proposed longwall operation mining the GMS to the north of the existing BRM. The mine development scenario provided in this EIS describes development as a conventional underground operation with drifts for access and services, and two sets of main headings for longwall access and coal transport. The main headings and longwall panel orientation is illustrated in **Figure 3-1** and is influenced both by the need to manage IMG, as well as maximising extraction given geological constraints such as faults (offsets) and dips in the coal seam. Some further optimisation of the longwall panel positioning may occur.

Thick seam mining (TSM) technology will be used for resource extraction. This is described further in **Section 3.2.2**. As coal is extracted from the GMS, subsidence will occur in the overlying strata, including the Goonyella Upper Seam (GUS). This is discussed further in **Section 3.2.5**.

Due to the gas content in the GMS and adjacent seams, a combination of gas drainage management techniques will be required. This is discussed further in **Section 3.4**.



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INDICATIVE UNDERGROUND PRODUCTION SEQUENCE

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3.2.2 Mine Access

For the Broadmeadow extension, mining into MLA70421 will occur through extension of longwall panels 14, 15 and 16 of the existing BRM.

For the future RHM, access to the underground workings is proposed to be part of the GRM incremental expansion via construction of a drift of approximately 2,000 metres in length which will intersect the GMS at an approximate depth of 200 metres. Construction of the drift would most likely commence with a cut and cover style construction method, progressing to an underground tunnelling construction method such as road header machinery. Alternatively, a more conventional drill and blast technique may be utilised. Drift construction is expected to take up to two years. Spoil will be disposed of to the existing GRB mine complex stockpiles or used on site, subject to suitability. Further information on spoil disposal from drift and mine access construction is provided in **Section 6** of the Red Hill Mining Lease EIS.

Once the target depth has been reached, the main entrance to the mine, known as pit bottom, will be established and transportation and ventilation systems installed. Conveyors will be installed in the drift to bring coal to the surface, and roadways and other infrastructure requirements will also be established.

3.2.3 Proposed Mining Methodology

Both the RHM and the Broadmeadow extension will be longwall mines, and will utilise thick seam mining techniques to maximise resource recovery and efficiency. Mining will commence from the main heading, with panels extending along strike, roughly north and south, of the main heading. An indicative mine sequence for underground mining is shown in **Figure 3-1**. The mine schedule is likely to vary depending on product demand and other factors.

The longwall panels are created by driving parallel development headings known as gate roads on either side of the panel from the main heading to the extent of the longwall block. The headings are then connected together across the end of the longwall panel, which allows the longwall machinery to be installed and the ventilation circuit to be set up.

The current layout for the proposed RHM has development headings running approximately north-south at 320 metre spacing. This spacing is subject to optimisation in future planning and the detailed design phases. Roadways are separated by sections of unmined coal called pillars, which remain in place after mining is completed. The pillars provide roof support for the roadways, which are developed by continuous miners. Roadways form passages for access, ventilation, machinery, electrical supply, communication systems, water, and compressed air lines. The roadways connect to main east-west headings, which connect to inclined drifts providing access to the surface. Vertical shafts provide ventilation and emergency access to the surface if required.

For the Broadmeadow extension, the initial extensions will be undertaken for panels 14 and 15. Panel 16 is also proposed to be extended but is subject to further planning and detailed design. These panels are accessed directly from adjacent open-cut highwalls on ML1763 and hence a drift and main headings are not required.

3.2.4 Groundwater

3.2.4.1 Groundwater Occurrence

The site specific (local) groundwater regime is considered to include:

- Quaternary alluvial aquifers associated with local creeks and the Isaac River;
- Tertiary sediment aquifers;
- Tertiary basalt aquifers; and
- Permian-Triassic sedimentary fractured rock aquifers.

The EIS study area is located within the declared Isaac Connors Groundwater Management Area (GMA), as defined in the Water Resources (Fitzroy Basin) Plan 2011. Within the Isaac Connors GMA, aquifers in the Quaternary alluvium are known as the Isaac Connors Groundwater Unit 1, with all other aquifers grouped together as the Isaac Connors Groundwater Unit 2. The alluvium associated with the Isaac River in the survey area is defined as the Isaac Connors Alluvium groundwater sub-area of the Isaac Connors GMA. Groundwater supply is not considered to be a major water source in the groundwater study area. Based on a review of available data, the beneficial use of groundwater in the groundwater study area is considered to be low due to low sustainable yields and poor groundwater quality.

The occurrence and continuity of the above mentioned aquifers will be highly dependent on the spatial distribution of the corresponding geological units in the area.

3.2.4.2 Groundwater Inflow

Groundwater ingress will vary over the life of the mine depending on the characteristics of the particular part of the coal seam being mined, the number of panels targeted, and the rate of mining. Estimates undertaken as part of groundwater modelling for the project indicate that groundwater ingress could reach a peak of around two gigalitres per year during the last five years of operation. Some groundwater will be removed prior to interception by mining through pre-drainage of IMG, which has the potential to reduce inflows to the underground. It is estimated that up to 800 megalitres (ML) per annum of groundwater may be derived from IMG pre-drainage.

Groundwater inflow will be pumped from the RHM to the GRB mine water management network described in **Section 7** of the Red Hill Mining Lease EIS.

3.2.5 Predicted Subsidence

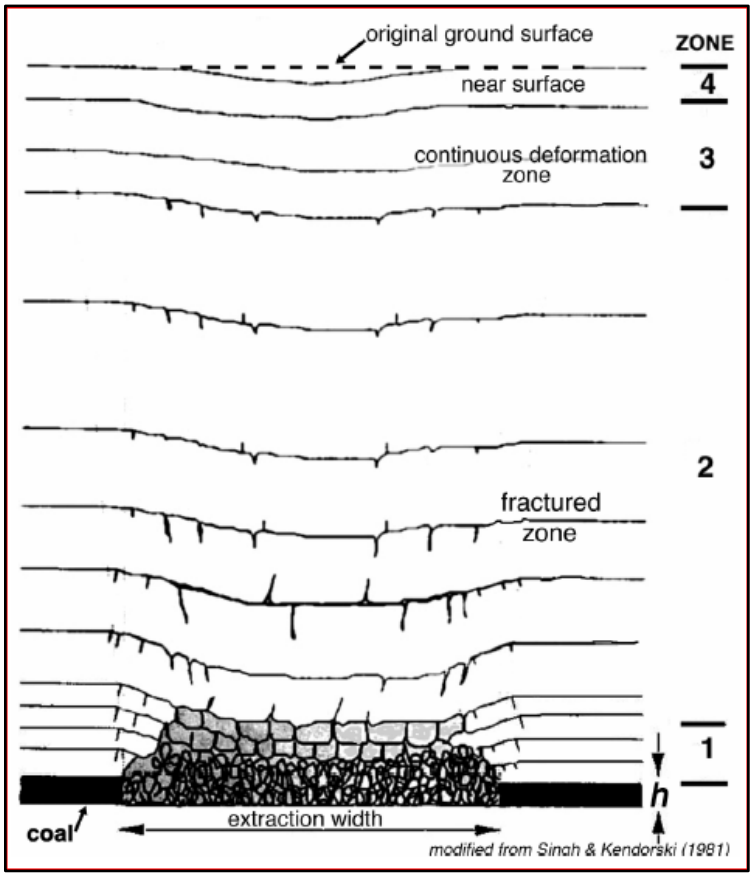
Longwall extraction creates a void which causes the overlaying strata behind the longwall supports to fall into the mine void after the supports have moved ahead. This is referred to as goaf. This can result in subsidence of the overlying strata. Depending on properties of the overlying rock, this can be expressed on the surface, where the ground subsides to a lower level. **Figure 3-2** shows a conceptualisation of the effect of the longwall cave in on the overlying geological strata and, ultimately, the ground surface.

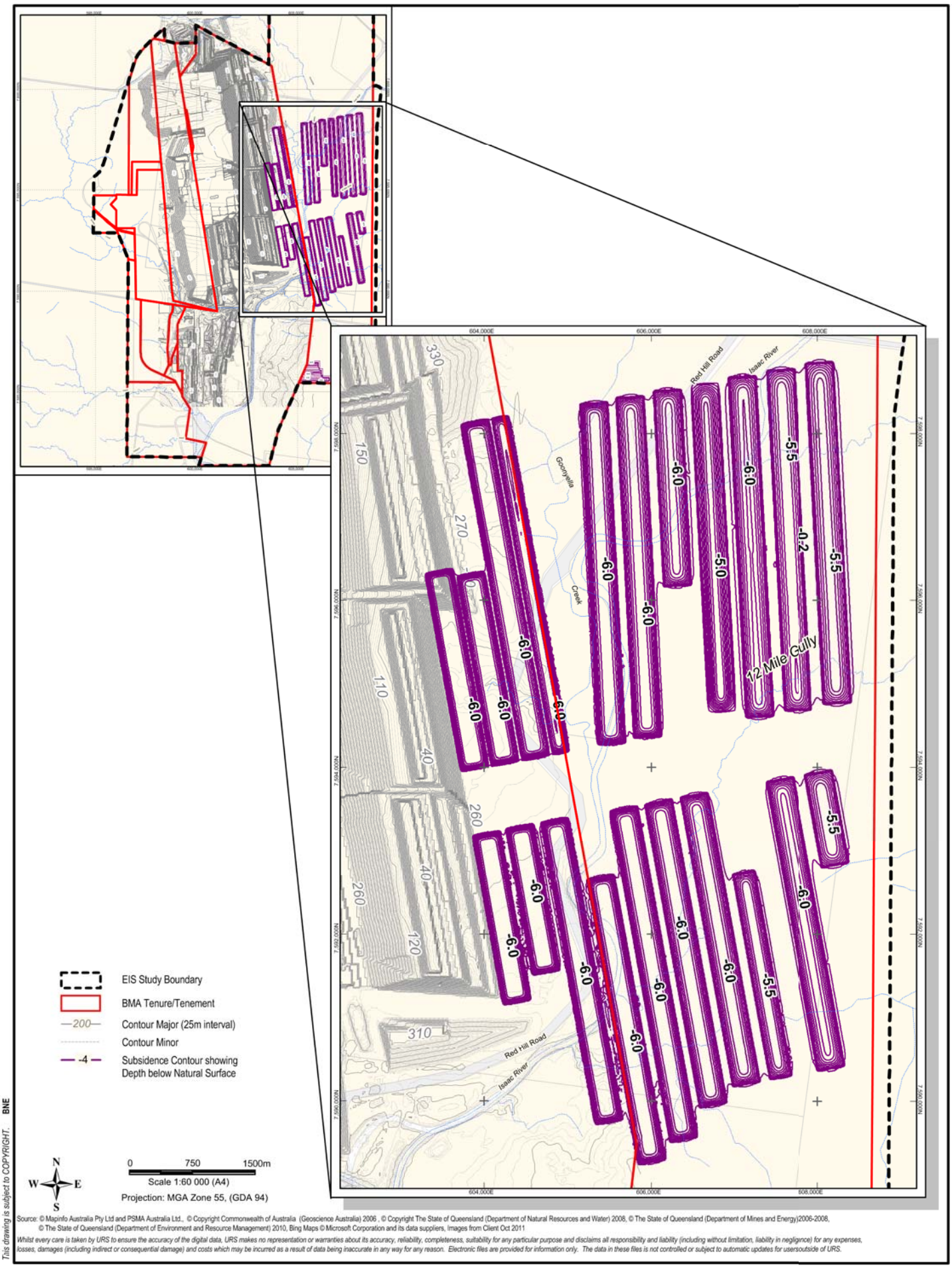
For longwall mining, maximum subsidence depths occur along the centre of the mined out panels, with the pillars and main heading remaining at or close to pre-mining ground levels. Subsidence generally starts to occur shortly after mining. Within one to two months, most of the subsidence has occurred.

Subsidence is generally complete within about 12 months of mining. The time frame and depth of subsidence can vary depending on the type of rock overlaying the mined area, as well as the depth to the mine.

Subsidence of a relatively flat surface typically results in a gently undulating landform. However, the final surface depends on pre-mining topography, geology, the seam thickness extracted, width of panels, and the depth of the longwall mining. **Figure 3-3** illustrates the modelled predicted subsidence that could occur as a result of the proposed underground operations. Modelling has been undertaken on a conservative basis and predicts average subsidence of three to five metres and maximum subsidence of up to six metres. The subsidence modelling report is provided in **Appendix I7** of the Red Hill Mining Lease EIS and further discussion of subsidence-related impacts is provided in **Sections 5.4** and **7.3** of the Red Hill Mining Lease EIS.

Figure 3-2 Typical Subsidence Profile (from Winters and Capo 2004)





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PREDICTED SUBSIDENCE

3.3 Surface Infrastructure and Facilities

3.3.1 Mine Industrial Area

A new MIA is proposed as part of GRM incremental expansion, located near the top of the drift. **Figure 3-4** illustrates the indicative footprint for the Red Hill MIA.

3.3.2 Internal Roads

Additional internal roads and a bridge crossing the Isaac River will be required to facilitate the future RHM.

The proposed CHPP is close to existing internal roads and minimal additional internal road construction is required to access this area.

The MIA and underground mine will be accessed via the construction of a short internal road from Red Hill Road.

A two lane, all weather bitumen road will be constructed from the Red Hill MIA to the proposed Red Hill accommodation village. This road will utilise a bridge across the Isaac River that is to be constructed separately as part of the existing operations and exploration activities at the site.

An all-weather access road will also be constructed along the main headings. Temporary and permanent access tracks to provide access to the IMG pre-drainage infrastructure will be constructed along the pillars (refer to **Section 3.4.3.2**).

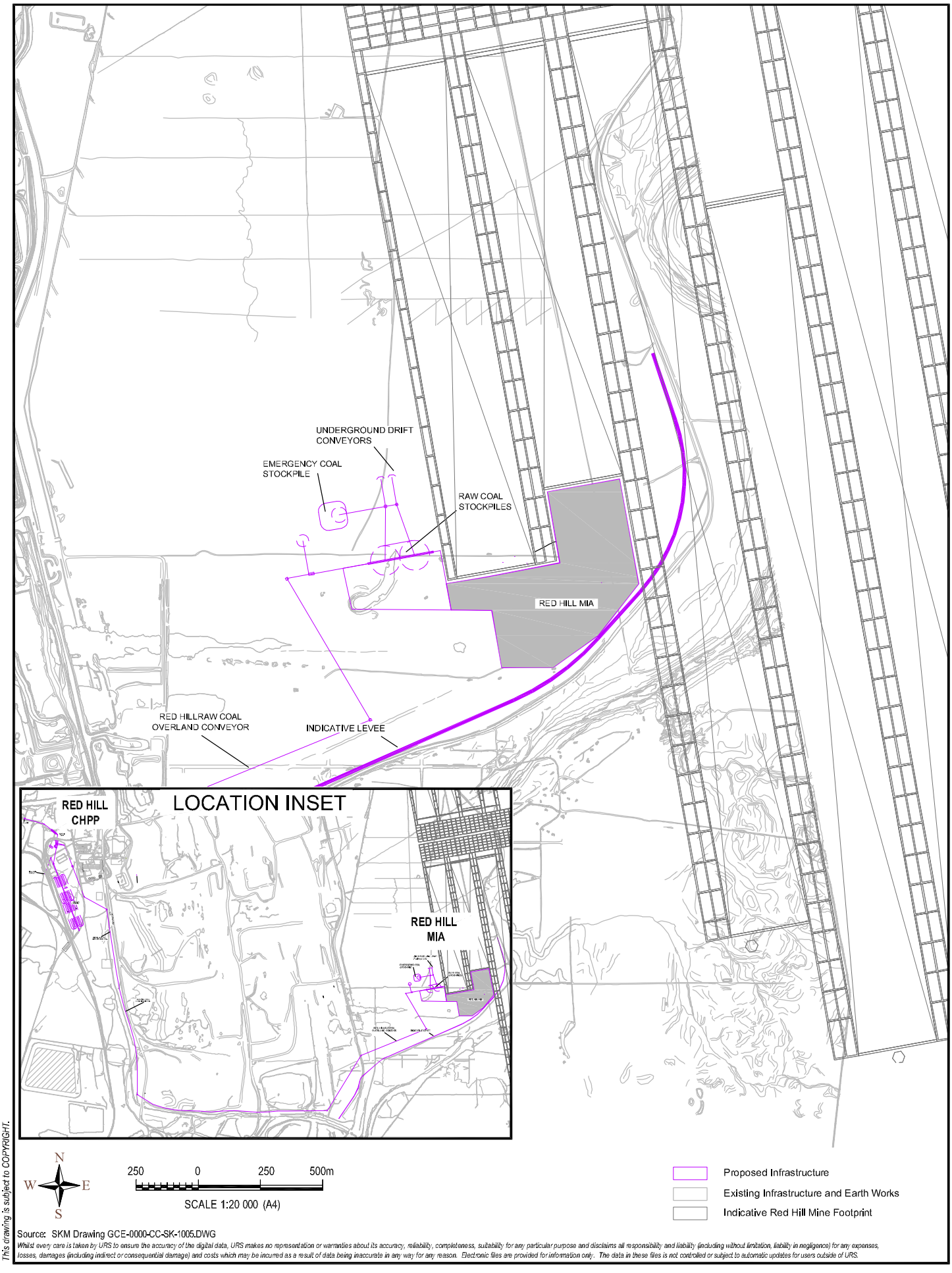
A maintenance access road will also be constructed along the conveyor corridors. This road will only be used to maintain the conveyors.

A new bridge will also be required across the Isaac River on the main headings to provide access to the eastern part of the mine footprint for IMG drainage and also to access environmental monitoring and management areas. The bridge will be designed to provide a suitable level of flood immunity and also to minimise impediment to flood flows within the river channel or floodplain. These requirements will be determined during detailed design.

This bridge may also be used to support gas and water pipelines from IMG management activities to the east of the Isaac River.

3.3.3 Raw Coal Stockpiles and Handling

Raw coal stockpiles will be located north-west of the MIA at the top of the drift proposed for the RHM underground expansion option (see **Figure 3-4**). These stockpiles will form part of the GRM incremental expansion.



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INDICATIVE RED HILL MIA

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3.3.4 Conveyors

The sized material will be sent by overland conveyor around the south of the Goonyella Mine to raw coal surge bins at the proposed Red Hill CHPP.

An overland conveyor will transfer coal from the raw coal stockpiles to the CHPP. The proposed route for this conveyor is shown on **Figure 3-5**. Dust controls will be installed on the conveyors, including enclosure of transfer chutes, partial enclosure of transfer points and partial enclosure of surge bins. Water sprays will also be fitted at transfer points.

3.3.5 Red Hill CHPP

A CHPP removes dirt, rock and other impurities from the coal before it is sold as product coal. This increases the value of the coal, and reduces transportation costs as impurities do not need to be transported.

The Red Hill CHPP, proposed as part of the GRM incremental expansion option, will be located within the GRB mine complex, adjacent to the Riverside MIA (see **Figure 3-5**). Water supply to the Red Hill CHPP will be managed and operated as part of the GRB mine water management system and existing raw water supply.

3.3.6 Product Stockpiles and Train Load-out

Product stockpiles will be located adjacent to the existing rail loop as shown on **Figure 3-5**. Stockpiles will include water sprays to manage dust emissions. A reclaim and conveyor system will then transfer the product coal to a new train load-out for export.

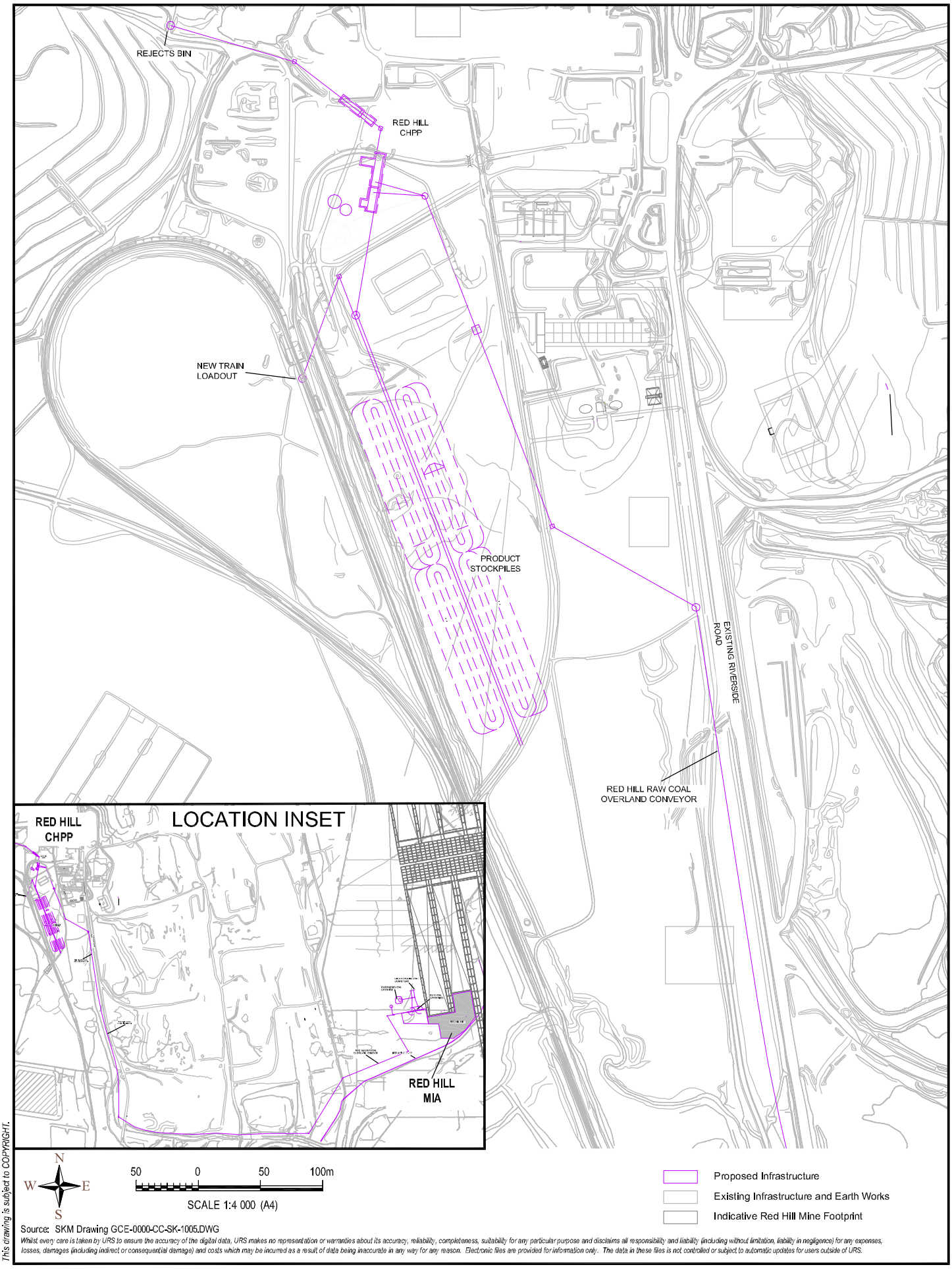
3.3.7 Power

The current GRB mine complex operations have a power requirement of 50 megawatts (MW). The RHM underground expansion option will require approximately 50 MW of additional power. New power lines are currently being constructed (which do not form part of the Red Hill Mining Lease EIS), which will allow a supply of 104 MW, thus covering both the existing operations and the proposed RHM underground expansion option.

New power reticulation for the project will involve:

- supply to the Red Hill CHPP and related infrastructure via a new 66 kilovolt (kV) overhead line from the existing GRM 132/66 kV substation to a new 66/11 kV substation to be located adjacent north of the existing Riverside rail loop; and
- supply to the Red Hill underground operations (RHM and MIA) will be via a connection to relocated 66 kV infrastructure on the eastern side, which will also require augmentation of the existing 66 kV infrastructure and construction of tie-lines around the northern lease area.

There may also be a need for temporary power lines for infrastructure associated with IMG management.



Source: SKM Drawing GCE-0000-CC-SK-1005.DWG

BHP Billiton Mitsubishi Alliance

RED HILL MINING LEASE
EPBC REPORT

INDICATIVE RED HILL CHPP AND CONVEYOR ROUTE

URS

EPBC REPORT

Figure: **3-5**

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Subject to the likelihood of subsidence based on final mining plans the Powerlink 132 kV switchyard located north of the RHM may require relocation at a future date. The Powerlink 132 kV overhead line traversing the Red Hill mining lease will require relocation at a future date. This is discussed further in Section 5.1 of the Red Hill Mining Lease EIS. All required power reticulation is within existing mining leases.

3.3.8 Eungella Pipeline

The Eungella pipeline runs across the proposed RHM footprint. Depending on the extent of subsidence, this pipeline may be affected by the project. If it is predicted to be affected, the pipeline will be replaced or relocated from its current location. This will be done in consultation with asset owners, currently Sunwater, through Eungella Water Pipeline Pty Ltd. This is discussed further in **Section 5.1** of the Red Hill Mining Lease EIS.

3.3.9 Accommodation Village

A dedicated accommodation village will be provided for the construction and operation workforce. The capacity of the Red Hill accommodation village will be 3,000 persons and will allow for construction and operation workforce requirements as provided in **Section 3.12** of the Red Hill Mining Lease EIS. The proposed location of the project accommodation village is shown on **Figure 2-2**.

Power and water will be supplied from the RHM power and water supply systems, with reticulated power and water to follow the access road alignment.

Sewage management is discussed in **Section 7.3.3** of the Red Hill Mining Lease EIS.

3.4 Incidental Mine Gas Management

3.4.1 Introduction

Assessments indicate that the target GMS and the overlying GUS and underlying Goonyella Lower Seam (GLS) all have high methane gas contents. As the methane is not the primary target of the mining activity, it is referred to as IMG. The methane is confined in the coal seam by overlying lower permeability rock formations and water pressure, but once the coal seam is disturbed or accessed during mining, methane gas can be released in quantities that have potential to impact safe and efficient underground mining operations.

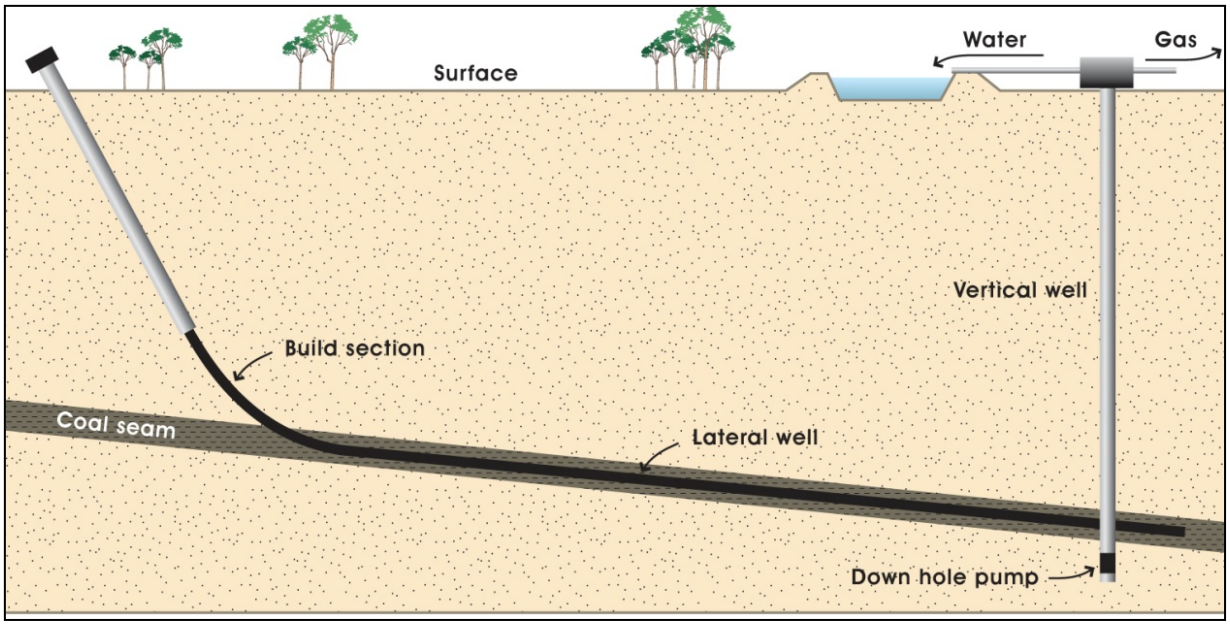
For RHM and the Broadmeadow extension, IMG levels are such that pre-drainage of the gas in the GUS, GMS and GLS will be required in most areas of the mine prior to extraction of the resource from the GMS. IMG will also need to be managed during mining through ventilation and after mining through goaf drainage techniques. Methane gas levels are generally lower on the western side of the proposed mine, increasing to the east and south.

3.4.2 Pre-drainage of IMG

3.4.2.1 Gas Extraction Wells

Pre-drainage of IMG will involve installation of a network of gas extraction wells from the surface to the seam connected to gathering lines and IMG process, monitoring and control facilities on the surface. The most likely method for pre-drainage IMG extraction is surface to in-seam (SIS) wells. These wells involve the use of directional drilling techniques to drill down from the surface and laterally along the seams requiring pre-drainage of IMG. The lateral wells are drilled to intersect vertical wells that are also drilled from the surface before the laterals wells. The vertical wells are used to collect and bring the IMG and associated water to the surface. **Figure 3-6** shows an indicative layout of surface to inseam drilling.

Figure 3-6 Indicative Layout of Surface to Inseam Drilling



The number and location of gas extraction wells cannot be determined at this stage of the project as further investigations are required to determine the optimal means to remove IMG from the coal seams. However, it is expected that the wells will be installed in rows across each panel, with well spacing likely to be in the order of 50 to 250 metres apart depending on the mine's IMG management requirements. The number and spacing of rows of wells required for each panel will vary depending on the gas content and also the lead time for gas removal prior to mining (a higher density of wells will allow faster drainage of gas). It is expected that the rows of wells will be spaced at intervals of several hundred metres along each panel consistent with the in-seam lateral portion of the SIS well. As gas content generally increases towards the east of the mine, the density of gas extraction wells will also likely increase.

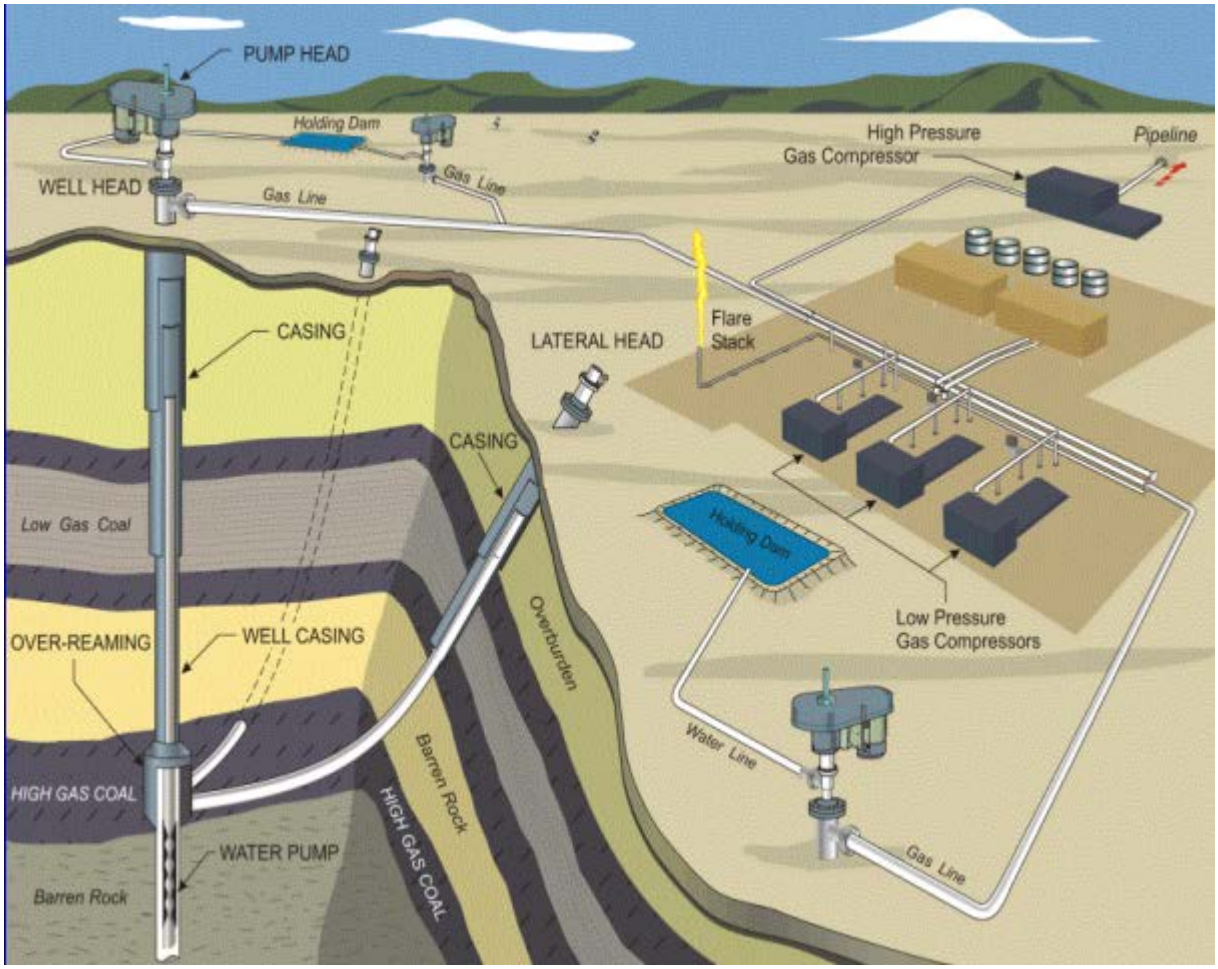
The gas extraction wells will be connected to water and gas pipelines to allow water and gas to be brought to central locations for further process management. Each well will also require power supply and vehicle access. This infrastructure will likely run along each of the pillars and each row of gas

extraction wells will then connect into the central water and gas collection pipelines. Further information on construction and management of surface facilities is provided in **Section 3.4.3**.

An example schematic layout for the IMG pre-drainage infrastructure is shown in **Figure 3-7**. This shows the possible surface and subsurface layout of a single ñChevronò SIS well. The actual design and density of wells and surface infrastructure will vary across the mine, with higher density in the east compared to the west.

Gas flares will also be required for the situation where IMG cannot be collected. This is discussed further in **Section 3.8.2.3**.

Figure 3-7 Indicative Layout for IMG Drainage



In order to allow gas to be effectively removed from the seam ahead of mining of each longwall panel, it is expected that gas extraction wells may need to be installed up to fifteen years ahead of mining.

Closer to mining of each panel, and depending on the amount of gas present and ease of extracting the gas, underground inseam drainage wells may also be installed. Underground inseam drainage requires horizontal drilling into the unmined seam from the adjacent underground roadway and connecting these horizontal bores to gas collection pipes. Gas is then conveyed to the surface for

management. Minimal water is produced by underground inseam drainage wells as a large amount of dewatering of the coal seam occurs on installation of the longwall development headings.

IMG pre-drainage wells will remain in place until immediately prior to mining, at which time they will be decommissioned and ventilation methods used to control gas during mining (refer to **Section 3.4.3**). Decommissioning of the pre-drainage gas extraction wells involves:

- removal of pumps, tubing and all surface equipment;
- filling of the well with fluid and concrete plugs;
- cutting of the steel conductor pipe as far below ground level as possible; and
- reinstatement of disturbed areas in line with the rehabilitation plan in place at the time of decommissioning.

3.4.2.2 Management of Water

As discussed in **Section 3.4.2.1**, water is present along with gas in the coal seams and will be removed as part of the IMG pre-drainage activities. The quantity of water can be highly variable at different locations, but indicative volumes of 400 to 800 kilolitres per well per day may be expected in the early stages. This will reduce to 10 to 100 kilolitres per day after a period of six months to two years.

Water quality is also highly variable with location and geological conditions; however water associated with coal seams is typically quite saline, with total dissolved solids levels of 400 to 7,500 milligrams per litre (mg/L) being experienced. Within Queensland, reported water quality from coal seam gas extraction operations are as follows:

- 1,500 to 10,000 mg/L average (QGC 2010);
- 100 to 10,000 mg/L (Santos 2012); and
- 2,400 to 6,600 mg/L (APLNG 2010).

Further assessment of groundwater quality is provided in **Section 8** of the Red Hill Mining Lease EIS.

All water produced from gas extraction wells for RHM will be collected in pipes and conveyed to the GRB mine water management network. **Section 7** of the Red Hill Mining Lease EIS provides further information on mine water management.

Further design and process risk studies will be undertaken in the detailed design phase of the project to determine the need for an IMG production water dam, when this might be required to be built and the optimum capacity. The capacity will be driven by the likely number of daysôstorage that might be required in the event of a disruption to the Red Hill MIA dam or GRB mine water management network. It is expected this be would be approximately 10 ML which is sufficient to store approximately five days of production water. As it is possible to shut down the gas production wells, long term storage in the event of a serious malfunction with the water transfer system is not required.

The gas will also contain small amounts of water vapour which will condense and collect at low points along the gas collection pipeline network. Water will need to be drained from these low points from time to time and each low point will be equipped with a valve that can be opened to allow water to drain to small stationary tanks or to tanks mounted on trucks. This water will then be discharged into the water collection network and conveyed to the GRB mine water management network. The size

and location of tanks for collection of water condensed at low points will be determined during detailed design, but these tanks are unlikely to exceed about one kilolitre (1,000 litres).

It is expected that gas pre-drainage will also be required from the proposed Broadmeadow extension.

3.4.2.3 Management of Incidental Mine Gas

BMA is investigating two options for beneficial use of the IMG:

- use of the gas on site, for example to generate electricity in an on-site power station for use within the mining operation; and
- transfer of the gas to a gas distribution and supply customer or the overlapping petroleum lease holder, as applicable.

If these options are not commercially or technically feasible, or cannot be undertaken within the existing legislative framework, the gas will be flared. Gas may also be flared under the following circumstances:

- during early gas pre-drainage phases, small mobile flares may be used before tie-in with a beneficial reuse scheme;
- when the quantity or quality of gas being produced is inadequate for any beneficial reuse, either on or off the mining lease; and/or
- for safety reasons at any time during mining operations.

The *Mineral Resources Act 1993* (MR Act) places restrictions on the use of IMG produced from a mining lease and BMA will ensure compliance with these requirements. Under a mining lease, IMG can either be:

- beneficially used for mining under the mining lease ī typical beneficial use is power generation; or
- transferred to the petroleum lease holder if it holds a valid overlapping petroleum lease and if an agreement can be reached.

3.4.3 Gas Extraction Infrastructure Development and Management

As discussed in **Section 3.4.2**, a range of surface infrastructure is required to install and operate IMG management systems.

3.4.3.1 Well Location and Construction

As discussed in **Section 3.4.2.1**, IMG pre-drainage extraction wells will likely be placed in rows across each panel, that is, perpendicular to the panels, with approximate spacing of 50 to 250 metres between each well. Rows of wells will be spaced several hundred metres apart along each panel. The work area for initial establishment of wells will be up to 100 by 100 metres, with opportunity to reduce this when wells are located close together. After wells are installed, a well pad of about 25 by 25 metres will be retained for operations.

The location of the wells will be largely influenced by underground conditions and mining schedule so that gas extraction can be maximised and the risks to safe and efficient mining minimised.

However, there is some flexibility in location and, wherever possible, the wells will be located to avoid the following features:

- drainage lines, riparian vegetation and flood prone areas;
- Threatened Ecological Communities (TECs): *Natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin* and *Brigalow (Acacia harpophylla dominant and co-dominant)* (refer to **Figure 5-3** for locations);
- habitat for conservation significant species such as the ornamental snake (to be identified in future surveys); and
- areas identified as containing significant cultural heritage material.

Survey of well site locations for these features will form part of the well site selection and field planning. This stage will also identify whether there is any need for any of the following prior to or during construction:

- translocation of certain plants;
- survey and/or salvage of cultural heritage items;
- weed control;
- fauna spotters during vegetation clearing; and
- overland flow diversion.

Placement of goaf drainage wells has limited flexibility as these must be placed along the edge of the panel; however, use of previously disturbed areas will be maximised wherever possible and wells will not be placed within stream channels.

Construction of wells for pre-drainage and goaf drainage will require the following steps:

- site clearance and authorisation, including cultural heritage and ecological checks;
- clearing of vegetation. Unless heavily weed infested, vegetation will be set aside for reuse in rehabilitation;
- removal of topsoil. Topsoil will be set aside for use in rehabilitation;
- earthworks as required to prepare the drill pad;
- establishment of drilling support requirements including worker amenities and a pond for containment of drilling mud. Some facilities will be shared between adjacent wells;
- drilling and construction of wells including installation of casing, pipes and downhole pumps;
- for pre-drainage wells, construction of surface facilities required to service the well, including connections to power, water and gas pipelines, metering equipment, a separation unit to separate gas and water, flares and valves;
- for goaf drainage wells, connection to a vacuum system; and
- water storage and removal amenities, temporary drilling mud ponds and partial rehabilitation of that part of the drilling pad not required for operation. Rehabilitation will utilise vegetation and topsoil set aside from site clearing and will follow any requirements of the current site rehabilitation plan. A well pad of about 25 by 25 metres will be retained after initial rehabilitation.

Surface gas and water gathering pipelines, power and access tracks will also be constructed along each row of pre-drainage bores. These will connect into the main gas system infrastructure likely located along each pillar to avoid subsidence impacts.

More details on environmental controls to be utilised during well construction are provided in subsequent sections of this EIS.

3.4.3.2 Linear IMG Infrastructure

Linear IMG infrastructure will be installed on the surface above each gate road to service the pre and post drainage gas extraction wells and will consist of:

- a gas pipeline ī this will typically be a buried pipeline, but may be above ground in some circumstances;
- a water pipeline ī this will typically be a buried pipeline but may be above ground in some circumstances;
- above or below ground power supply; and
- a vehicle access track ī the vehicle access track will initially be required for drill rig access, but can then be maintained as a light vehicle access track only.

This infrastructure will generally run in a straight line along each gate road, but there is some flexibility to optimise alignment to avoid environmental sensitivities. In particular, the linear infrastructure required to support gas drainage is likely to need to cross a number of minor streams and drainage lines. Gas and water pipelines and power supply are likely to cross the Isaac River at several locations to allow for efficient collection of gas and water from pre-drainage gas extraction wells and goaf wells. Detailed design of the gas collection network will seek to minimise the number of crossings.

Stream and river crossing locations will be determined in consultation with an ecologist, geomorphologist, and cultural heritage representative. In locating crossings of streams and drainage lines, the following will be considered wherever possible:

- crossing the channel at right angles;
- avoiding significant areas of riparian and in-stream vegetation (this includes areas identified in **Section 10** of the Red Hill Mining Lease EIS);
- avoiding areas of cultural heritage significance ī these will be confirmed as part of a Cultural Heritage Management Plan development (see also **Section 16** of the Red Hill Mining Lease EIS); and
- avoiding areas of potential erosion as identified in the geomorphological assessment (**Appendix I6** of the Red Hill Mining Lease EIS).

Stream crossings will generally comply with the *Guideline - activities in a watercourse, lake or spring associated with mining operations* (NRM 2012) or equivalent measures.

Road and vehicle access will not be provided across the Isaac River apart from at the main heading.

For the goaf drainage, surface infrastructure will consist of access tracks to goaf drainage wells, a large diameter gas pipeline connecting the wells and power supply. While goaf drainage wells will not

necessarily be co-located with decommissioned pre-drainage gas extraction wells, existing access tracks and power lines will be utilised wherever possible.

Construction of linear infrastructure to support gas drainage will require the following steps:

- site clearance and authorisation, including cultural heritage and ecological checks;
- clearing of vegetation ī unless heavily weed infested, vegetation will be set aside for reuse in rehabilitation;
- removal of topsoil ī topsoil stockpiled for use in rehabilitation;
- for gas and water pipelines that are to be buried:
  - ï excavation of trenches and preparation of bedding material to support the pipelines *in situ*;
  - ï placement of pipes in trenches and quality checks to ensure that pipes are properly joined and sealed;
  - ï backfilling and compaction of trenches with excavated material;
  - ï replacement of topsoil;
  - ï rehabilitation utilising vegetation set aside from site clearing in accordance with the requirements of the current site rehabilitation plan; and
  - ï placement of markers warning of presence of underground pipelines;
- for power lines, construction will involve installation of power poles and stringing of powerlines on these poles or, if below ground power is used, power cables will be co-located with either gas or water pipelines; and
- for access tracks, construction will involve:
  - ï grading of the road surface ī grading will be kept to a minimum required to allow access by drill rigs;
  - ï installation of roadside drains as required to prevent concentration of flows across the roadway; and
  - ï for stream and drainage line crossings, a pipe may be installed on the stream bed and a formed crossing created over the pipe.

Construction standards for gas pipelines will be based on the Australian Petroleum Industry Association (APIA) Code of Environmental Practice with adaptations as allowed following site specific risk assessment during detailed design.

A corridor of up to 50 metres wide may be required along each gate road (pillar) during construction due to safety requirements associated with gas and water pipeline installation. Once pipelines are in place the ground above the pipelines can be stabilised and rehabilitated with grass species.

For stream crossings, construction of linear infrastructure will be conducted in the shortest possible time, and wherever possible will be constructed outside the wet season when there is no flow in streams. For Isaac River buried pipeline crossings, construction will take place in no flow conditions wherever possible.

Pipeline trenches will be backfilled and stabilised to prevent bank erosion. Soft structures will be used to stabilise bed and banks of streams; concrete will not be used.

Road crossings will be stabilised to minimise wash outs and bank erosion. Stabilisation may include placement of matting along banks.

3.4.3.3 Maintenance and Management of Gas Infrastructure

Ongoing maintenance and management of the surface gas infrastructure will be required as the gas infrastructure will be put in place in advance of mining and may remain in place for the duration of the mine life. Maintenance and management will include:

- regular inspections, maintenance and monitoring of IMG surface infrastructure and works as required to maintain safe operations and the overall gas drainage system integrity, including carrying out work-overs of existing IMG pre-drainage wells;
- regular inspections of stream crossings, and proactive stabilisation works as required to maintain bed and bank stability ī this management requirement may be incorporated into the adaptive management program required to address subsidence impacts described in **Section 7.3.10** of the Red Hill Mining Lease EIS;
- regular inspections of roads and pipeline alignments to ensure that disturbed surfaces are stable and not subject to concentration of flows or erosion ī repair works will be undertaken proactively to prevent erosion from occurring or worsening; and
- weed management.

3.4.3.4 Decommissioning

Gas drainage infrastructure will be decommissioned progressively as mining advances and the installed wells and surface infrastructure becomes redundant. All surface infrastructure will be removed and disturbed surfaces rehabilitated in accordance with the site rehabilitation management plan as required.

As areas disturbed by gas drainage infrastructure will be subject to subsidence, streams and drainage lines will be monitored and managed in accordance with the adaptive management program required to address subsidence impacts described in **Section 7** of the Red Hill Mining Lease EIS.

3.5 Water Management

3.5.1 System Overview

Key aspects of the RHM mine water management system are described below:

- RHM raw water needs will be supplied from the BMA regional water allocation and transported to RHM via BMAôs raw water pipeline network.
- Groundwater intercepted at RHM will be transferred to existing water storage at the GRB mine complex.
- Mine water runoff from the RHM MIA will be contained in the MIA dam prior to being transferred to existing water storage within the GRB mine complex.
- The majority of water demands for the processing of RHM coal will be supplied from the GRB mine water inventory, with a small portion requiring a raw water source.

BMA does not envisage any controlled mine water release from the RHM mine water facilities. RHM mine waters will be contained to prescribed containment performance criteria at the RHM MIA and transferred to water storages at the GRB mine complex.

It is expected that for the majority of the RHM operational life, mine water demands associated with processing RHM coal will exceed the quantity of mine water generated at the RHM. As such, the GRB mine water management network will not require new licensed discharge points or changes to release conditions. This is discussed further in **Section 7.3.2** of the Red Hill Mining Lease EIS.

Detailed descriptions of the mine water management system and operations including figures showing locations of key features of the GRB mine water management network are presented in **Section 7** and **Appendix I2** of the Red Hill Mining Lease EIS where the existing GRB mine water management system (base case) is outlined and the additional RHM (project case) water management system is discussed.

3.6 Rehabilitation and Decommissioning

Current objectives in relation to post mining land use are that rehabilitation will return disturbed areas included in the EIS study area disturbed by the project to a stable landform capable of supporting cattle grazing as per the current land use.

Rehabilitation will be staged and occur progressively throughout the mining activity. Final rehabilitation and closure activities will commence once mining activity has ceased. **Section 5.5** of the Red Hill Mining Lease EIS sets out the overall objectives and strategy for rehabilitation and decommissioning as well as initial success criteria and anticipated rehabilitation and decommissioning methods and activities. While ultimately dependent on the actual rate of development and mining, the mine closure may not take place for an estimated 25 years. It is likely that accepted strategies and practices for rehabilitation and closure will have changed and, hence, rehabilitation and closure planning is a dynamic process.

BMA will prepare a rehabilitation management plan at the commencement of operations, covering the matters set out in **Section 5.5** of the Red Hill Mining Lease EIS, and will then prepare a closure plan five years prior to the anticipated closure. In addition, prior to the commencement of operations BMA will prepare a subsidence management plan as specified in **Section 7** of the Red Hill Mining Lease EIS, setting out the adaptive management approach for subsidence of the Isaac River.

It should be noted that rehabilitation of waste disposal areas for mineral wastes (rejects and dewatered tailings) will be in accordance with the existing Goonyella Riverside Broadmeadow Rehabilitation Management Plan.

3.7 Construction

The timeframe for construction of the GRM incremental expansion and the RHM underground expansion option has not been determined by the project owners. The scenario presented for the purposes of modelling the potential impacts of the project assumes that construction is expected to take two to three years. Construction activities may take place up to 24 hours a day, seven days a week. While the contracting strategy has not been finalised, it is expected that one or more contractor companies will be appointed to carry out construction works.

Section 3 of the Red Hill Mining Lease EIS describes construction activities for the following components of the project:

- Red Hill MIA;
- bridge across the Isaac River;
- CHPP including coal handling and conveyors and associated stockpiles;
- Red Hill accommodation village; and
- internal roads, pipes, powerlines and water management network.

3.8 Project Alternatives

An overview of project alternatives and the consequences of not proceeding with the project are provided below. Project alternatives are further detailed in **Section 2** of the Red Hill Mining Lease EIS.

3.8.1 No Project

In the event that the project was not to proceed:

- approximately 2,000 construction jobs and approximately 1,500 operational job opportunities will not be created;
- the significant flow-on (indirect) employment opportunities would not be created;
- growth and envisaged upgrades to services in the region would not materialise;
- significant export income would not be realised;
- injection of revenue into the state and regional economy would not occur;
- significant Queensland and Commonwealth Government taxes and royalties would not be generated;
- the economic opportunity of developing a coal resource which is viable and in demand would not be realised; and
- emerging overseas markets would be serviced by other mines (either in Australia or elsewhere).

3.8.2 Alternative Locations

While BMA has access to a number of existing and prospective coal resources in the Bowen Basin, the project has been identified as a potential site for incremental and strategic expansion and development on the basis that:

- The extent and nature of the resource is well understood due to extensive exploration and historic mining in the area. Hence, BMA can bring this project into production reasonably quickly compared to less well known resources.
- The resource is a high quality resource that will meet current and expected future market requirements and demands.
- Concurrent mining of different quality coals from adjacent mines provides a high level of flexibility in terms of product mixes, which is not readily achievable where mines are located further away.

- The resource is adjacent to an existing operation, the GRB mine complex. This provides a number of synergies in terms of water and wastewater management, power supply, ability to share rejects and mine waste disposal facilities, and ability to share rail infrastructure, particularly rail loops. The shared infrastructure reduces the amount of disturbed footprint required for the new project compared to a standalone project located away from the GRB mine complex.

Section 04 Methodology

4.1 EPBC Act Guidance

The EPBC Act Policy Statement 1.1 *Significant Impact Guidelines: Matters of National Environmental Significance* (DEWHA 2009) provides the framework for the assessment of potential impacts upon MNES from the project.

What is a significant impact?

> *A 'significant impact' is an impact which is important, notable, or of consequence, having regard to its context or intensity. Whether or not an action is likely to have a significant impact depends upon the sensitivity, value, and quality of the environment which is impacted, and upon the intensity, duration, magnitude and geographic extent of the impacts. You should consider all of these factors when determining whether an action is likely to have a significant impact on matters of national environmental significance*. (DEWHA 2009)

When is a significant impact likely?

> *To be 'likely', it is not necessary for a significant impact to have a greater than 50% chance of happening; it is sufficient if a significant impact on the environment is a real or not remote chance or possibility. If there is scientific uncertainty about the impacts of your action and potential impacts are serious or irreversible, the precautionary principle is applicable. Accordingly, a lack of scientific certainty about the potential impacts of an action will not itself justify a decision that the action is not likely to have a significant impact on the environment*. (DEWHA 2009)

The policy states that the following measures should be considered to determine whether an action is likely to have a significant impact on a MNES:

1. Whether there are any MNES located in the area of the proposed action (noting that the area of the proposed actionôis broader that the immediate location where the action is undertaken; consider also whether there are any matters of national environmental significance adjacent to or downstream from the immediate location that may potentially be impacted)?
2. Consider the proposed action at its broadest scope (that is, considering all stages and components of the action, and all related activities and infrastructure), whether there is potential for impacts, including indirect impacts, on MNES?
3. Whether there are any proposed measures to avoid or reduce impacts on MNES (and if so, is the effectiveness of these measures certain enough to reduce the level of impact below the ósignificant impactôthreshold)?
4. Whether any impacts of the proposed action on MNES are likely to be significant impacts (important, notable, or of consequence, having regard to their context or intensity)?

This report assesses whether an impact on MNES is likely to be significant or not for each of the potentially present MNES.

4.2 Desktop Analysis

A desktop analysis was completed to determine the known and likely suite of EPBC Act listed threatened species and TECs occurring across the EIS study area. The data sources used in this review included:

- Results of previous flora and fauna surveys undertaken in the vicinity of the EIS study area. These included:
  - WBM (1998 and 2000) dry and wet season fauna surveys of the GRM conducted in August 1998 and February 2000 respectively;
  - WBM (2002) a flora and fauna survey of the proposed ôRamp Fourô mining area at GRM, conducted in February 2002;
  - Ecoserve (2005a) *2005 Summer Season Flora and Fauna Surveys for Peak Downs Mine*. Prepared by Ecoserve Environmental Consultants;
  - Ecoserve (2005b) *An Investigation of Flora, Fauna and Biodiversity Values associated with Brigalow Remnants along the Proposed Heyford Back Access Road*. Prepared by Ecoserve Environmental Consultants;
  - Ecoserve and LAMR (2005) a review of habitat values for biodiversity and conservation significance for the GRM conducted in 2005. Prepared by Ecoserve Environmental Consultants and Landscape Assessment, Management and Rehabilitation Pty Ltd;
  - Ecoserve (2006a) Draft - *Flora & Fauna Baseline Surveys for the BMA Isaac River Project*. Prepared by Ecoserve Environmental Consultants and Landscape Assessment, Management and Rehabilitation Pty Ltd;
  - Ecoserve (2006b) *Draft- Preliminary Flora and Fauna Investigations – Land at Station Road, Moranbah.* Prepared for, BMA by Ecoserve Environmental Consultants and Landscape Assessment, Management and Rehabilitation Pty Ltd;
  - Ecoserve (2006c) *Targeted Vertebrate Fauna Surveys of Selected Remnant Regional Ecosystems on GRM*. Prepared by Ecoserve Environmental Consultants;
  - Ecoserve (2007) *A Review of Habitat Values for Biodiversity Species of Conservation Significance – Peak Downs Mine*. Prepared for BMA Peak Downs Mine by Ecoserve Environmental Consultants;
  - Emmerton and Elsol (2007) *Peak Downs Mine Rehabilitation Monitoring August September 2006*. Prepared by B.R. Emmerton Pty Ltd and J & J Elsol; and
  - URS (2007) *Goonyella Riverside Mine Expansion EIS - Terrestrial Flora Report*; Unpublished Draft,
- URS (2009) *Goonyella Riverside Mine Expansion EIS – Chapter 8 Terrestrial Ecology*, Unpublished draft relevant database searches, including:
  - The Department of the Environment (then DSEWPaC) online EPBC MNES database conducted on 12 June 2013, for the point -21.759 latitude and 147.969 longitude with a 10 kilometre buffer (**Appendix A**) (DSEWPaC 2013a);

- Department of Environment and Heritage Protection (EHP) Wildlife Online database (EHP 2013g);
- Queensland Museum fauna records (Queensland Museum 2011);
- Birds Australia database (Birds Australia 2011);
- Queensland EHP Essential Habitat mapping (EHP 2012c);
- Queensland EHP Ecomap ESA mapping (EHP 2009b); and
- species distribution maps from current field guides.

- Records published in scientific journals, reports and general flora and fauna distribution texts.

4.2.1 Reliability of Information

The reliability of Queensland Museum and Herbarium data is regarded as very high, since these represent actual specimens. The reliability of EHP Wildlife online records is regarded as moderately high, since these records have been vetted by recognised experts, even if some are observations only. The information used to produce the Wildlife online species lists is based on collated species lists and wildlife records (with a precision of 2,000 metres or less).

The relative reliability of the EPBC Protected Matters search tool for flora / fauna and ecological communities must be borne in mind as values highlighted by this search do not necessarily correlate to an actual observation. Species are highlighted by the database if their currently known distribution overlaps with the search area by one degree of latitude or longitude (approximately 100 km). This indication of potential presence does not take into account if suitable vegetation, geology, soil, climate or habitat types are actually present to support the occurrence of a significant species or ecological community.

4.3 Field Survey Methodology

4.3.1 Previous Terrestrial Flora Surveys

Several field surveys have been conducted on, or in the vicinity of the EIS study area over the past 14 years and the results are presented and discussed in this report. WBM conducted studies in 2002, Ecoserve conducted studies in 2005 and 2006 and Emmerton and Elsol conducted surveys in 2007. Results of these surveys provide background information on the flora present in the locality of the EIS study area.

4.3.2 URS Terrestrial Flora Surveys

Flora surveys were conducted by URS in 2005, 2006, 2009 and 2011, the results of these surveys are discussed in this report.

Surveys conducted by URS were targeted towards threatened species and communities identified during desktop analysis, including, but not limited to:

- *Dichanthium setosum* (bluegrass);
- *Dichanthium queenslandicum* (king bluegrass);

- *Digitaria porrecta* (finger panic grass);
- *Natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin* TEC; and
- *Brigalow (Acacia harpophylla dominant and co-dominant)* TEC.

The flora survey assessed floral taxa and vegetation communities in keeping with the methodology employed by the Queensland Herbarium for the survey of REs and vegetation communities (Neldner *et al.* 2005). Preliminary identification of the vegetation communities and target field sites was conducted prior to the commencement of fieldwork. Preliminary identification included vegetation community definition from stereo image 1:33,000, 1:35,000 and 1:36,000 colour aerial photography (AAM Hatch 2003, 2005 and 2008) and interpretation of 1:100,000 RE coverage Version 6.0b for the region (EHP 2012c).

Field surveys involved a botanical assessment at a number of representative sites within each remnant, non-remnant and regrowth vegetation community (**Figure 4-1**). The surveys employed a number of standard methods including: secondary survey sites; tertiary survey sites; quaternary survey sites; and random meander search areas. A number of vehicle traverses of the survey area were also undertaken throughout the survey periods to identify changes in landform and identify community boundaries. Community structural formation classes were assessed according to Neldner *et al.* (2005). RE classification of communities was determined as per Sattler and Williams (1999), and in accordance with the Regional Ecosystems Description Database (REDD) (EHP 2013d). Surveys were conducted under Queensland EHP Scientific Purposes Permit numbers WISP02056304 (2005 to 2006) and EISP06537209 (2009 and 2011). The flora surveys were conducted during the following months:

- Survey A: 2005 (October);
- Survey B: 2006 (January/February, May);
- Survey D and E: 2009 (March, May); and
- Survey F: 2011 (May).

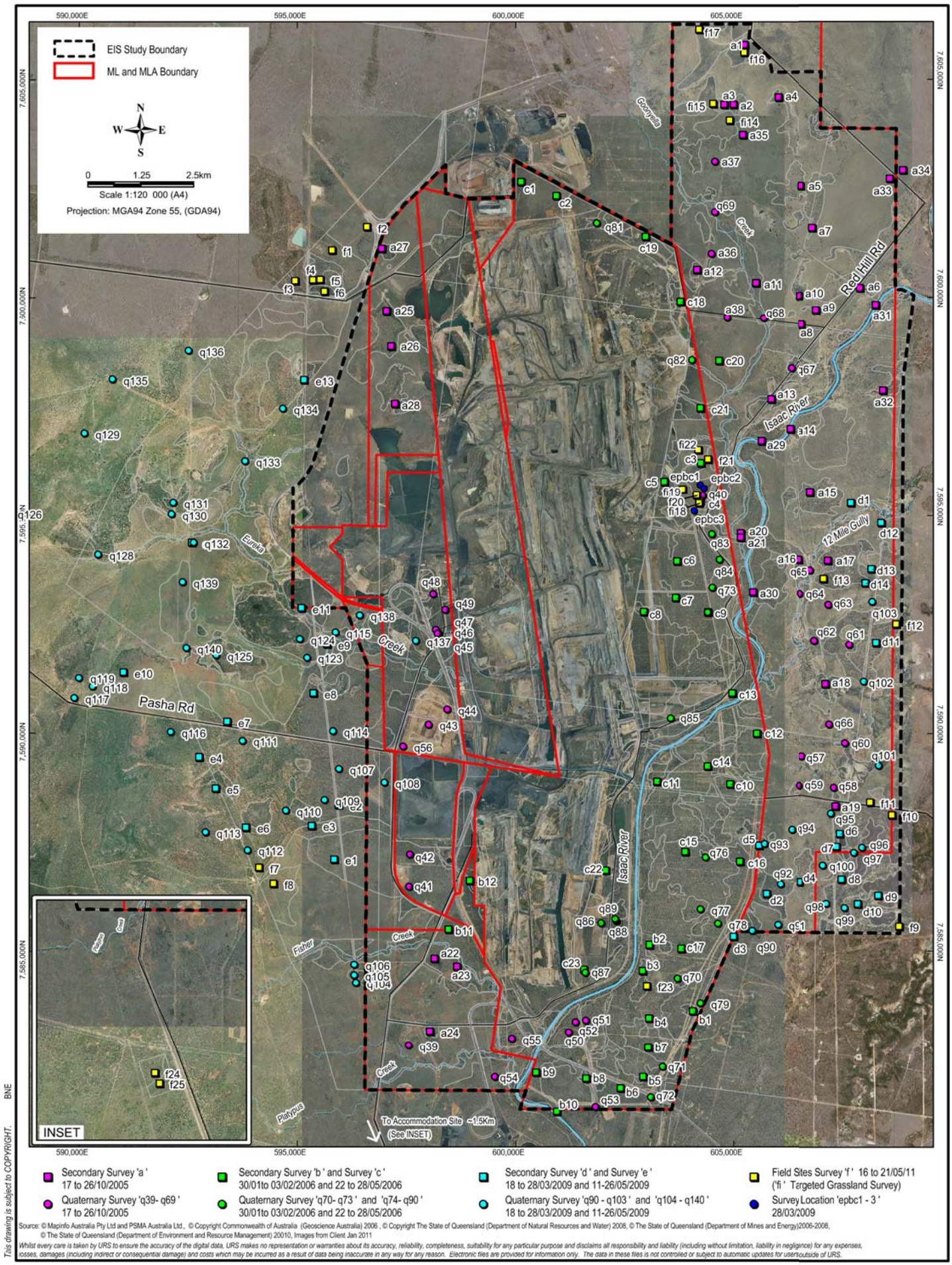
Targeted grassland surveys for the remnant grassland RE 11.8.11 (Survey F) were undertaken in the north-east of the EIS study area (**Figure 4-1**) to determine whether the grasslands mapped at this location met the criteria for the endangered *Natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin* TECs.

The survey methodology was based on the method set out in the EPBC listing advice for the *Natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin* (DSEWPaC 2008a), and consisted of assessment of key diagnostic characteristics and condition thresholds.

Detailed survey techniques and results are provided in **Appendix K1.1** of the Red Hill Mining Lease EIS.

4.3.3 Previous Terrestrial Fauna Surveys

Several fauna surveys have been undertaken by a number of consultants in the vicinity of the EIS study area. WBM conducted regular surveys between 1998 and 2002 and Ecoserve conducted two surveys in 2005 and 2006. Results from these surveys have been evaluated in describing the existing fauna values of the survey area.



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EPBC REPORT

FLORA SURVEY LOCATIONS

URS | **EPBC REPORT** | Figure: **4-1**

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4.3.4 URS Terrestrial Fauna Surveys

As part of the current assessment, fauna field surveys were conducted by URS in 2005, 2009 and 2011. The results of these surveys are discussed in this report. Surveys conducted by URS were targeted towards threatened species identified during desktop analysis as previously recorded or considered to have a high likelihood of occurring within the EIS study area.

Prior to each survey event, potential fauna survey transect sites were identified as part of the desktop studies and aerial photograph analysis, with the objective to target and characterise the key habitats of the site. Each survey period featured systematic fauna surveys which were undertaken in keeping with standard methodologies for the systematic survey of terrestrial fauna in eastern Australia (Eyre *et al.* 1997) as well as a number of non-standard observational methods.

Methods employed during each survey period included live capture and release trapping, bird census, spotlighting, active searches, call playback and microchiropteran bat call detection, as described in **Appendix K1.2** of the Red Hill Mining Lease EIS and summarised in **Section 4.4**, below. Incidental observations were also made during surveys and while outside of the main sampling sites. Survey locations are presented on **Figure 4-2**. The survey methodology and seasonal timing was designed to build on previous fauna surveys in the local environs (WBM 1998; WBM 2000; WBM 2002; Ecoserve and LAMR 2005; Ecoserve 2006a and 2006c).

4.4 EPBC Survey Guidelines Compliance

4.4.1 Threatened Ecological Communities

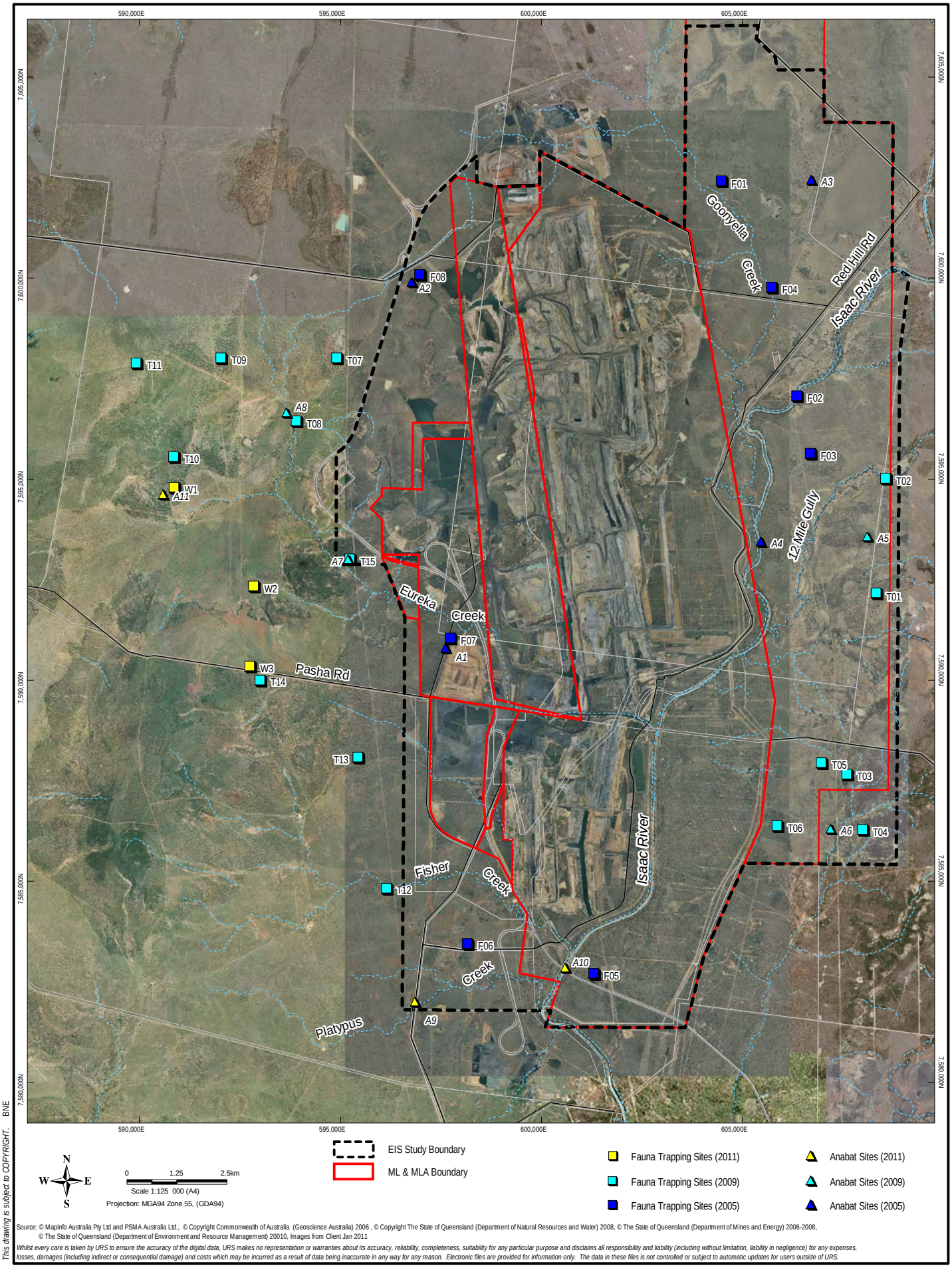
The flora survey employed methods suitable for confirming the presence of, and describing EPBC Act listed TECs. These are outlined below.

4.4.1.1 Brigalow (*Acacia harpophylla* dominant and co-dominant)

There are no EPBC survey guidelines available for this TEC.

The methods for the survey and mapping of REs in Queensland as identified in Neldner *et al*. (2005) are considered suitable for defining the EPBC Act listed brigalow TEC as a range of brigalow REs form part of the TEC in Queensland. The following REs were sampled within the EIS study area; the sampling effort (in brackets) highlights the level of detail expended to refine the REs:

- RE 11.3.1 (5 Secondary, 3 Quaternary);
- RE 11.4.8 (4 Secondary, 6 Quaternary);
- RE 11.4.9 (8 Secondary, 2 Quaternary);
- RE 11.5.16 (1 Quaternary); and
- RE 11.9.1 (2 Secondary).



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EPBC REPORT

FAUNA SURVEY LOCATIONS

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EPBC REPORT

Figure: **4-2**

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4.4.1.2 Natural Grasslands of the Central Queensland Highlands and Northern Fitzroy Basin

There are no EPBC survey guidelines in place for this TEC.

However, the Commonwealth Listing Advice on *Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin* (Threatened Species Scientific Committee, 2008) provides key diagnostic characteristics for recognising the TEC:

- distribution;
- tree canopy absent or sparse; and
- the ground layer is typically dominated by perennial native grasses and contains at least three of the native indicator species listed.

The methodology that is outlined within the Listing Advice was employed during a targeted assessment of natural grassland communities within the EIS study area.

The *Natural grasslands of the Central Queensland Highlands and Northern Fitzroy Basin* TEC was sampled in the optimal seasonal conditions with surveys completed in January/February and May 2006, March and May 2009 and May 2011. Methods utilised were consistent with those necessary to determine threshold condition according to the EPBC listing advice. Species were grouped into broad life-form categories with calculations of mean cover values and species richness utilised.

The REs that are analogous to the TEC sampled within the EIS study area are:

- RE 11.8.11 - 8 Secondary sites were sampled; and
- RE 11.8.11/non-remnant grassland ï three Secondary and one Quaternary site were sampled.

Other REs that form a component of the TEC (11.3.21, 11.4.4, 11.4.11 and 11.9.3) were not encountered.

4.4.2 EPBC Act Listed Flora Species

There are no EPBC survey guidelines for threatened flora species.

Secondary, tertiary and quaternary-level assessment sites were established as an outcome of the desktop site selection process in conjunction with on-ground analysis of values. Flora species were recorded as part of the vegetation community assessment methodology used in the secondary and quaternary-level sites.

Following the assessment at the secondary and quaternary sites, a further area of approximately one hectare surrounding each plot was also searched for 20 minutes utilising meander searches (Cropper 1993).

Wherever a vegetation community was considered to be potential critical habitat for EPBC Act listed flora species, the search area was broadened and a more extensive species list was established from an extended search area.

Flora species were also recorded on walking traverses, again with particular attention toward known and potential habitats of EPBC Act listed flora species. Botanical voucher specimens were collected throughout the field survey to verify site floristics and enable identification of those species that were problematic. Identifications were provided by The Queensland Herbarium. Vouchers of all EPBC Act listed flora species were sent to the Herbarium for incorporation into the collection.

Searches for *Dichanthium setosum* (bluegrass), *Dichanthium queenslandicum* (king bluegrass) and *Digitaria porrecta* (finger panic grass), were also undertaken during the targeted surveys of natural grasslands in suitable habitat for these species.

4.4.3 EPBC Act Listed Fauna Species

The Commonwealth Department of the Environment, Water, Heritage and the Arts (DEWHA) (now Department of the Environment) in 2010 and 2011 released a series of guidelines for surveys for threatened bats, birds, frogs, fish, mammals and reptiles. These guidelines provide a guide for stakeholders on the effort and methods considered appropriate when conducting a presence / absence survey for threatened species under the EPBC Act. The techniques and survey effort recommended are designed to detect a species if it is present, or to satisfy the argument that a species is not present or is present at very low abundance.

Targeted surveys for EPBC Act listed fauna species to the level outlined in the threatened fauna survey guidelines were not undertaken during the field survey as they are impractical at the EIS stage of the assessment process.

The field survey aimed to characterise potential fauna habitat and identify locations where faunal populations might exist as a guide to future targeted surveys. The survey methodology was successful in meeting these aims.

The fauna surveys utilised a range of standard fauna survey methods typically employed for terrestrial vertebrate surveys, in keeping with the conditions of the study teamôs survey approval under the Queensland animal ethics committee. The locations for all survey periods are presented on **Figure 4-2**.

Field survey methods employed included:

- live capture and release trapping;
- diurnal bird census;
- nocturnal spotlight surveys;
- owl call playback;
- microchiropteran bat call detection;
- active diurnal and nocturnal ground searches;
- incidental observations; and
- habitat assessments.

Section 05 Results

5.1 Desktop Analysis Results

5.1.1 Terrestrial Flora

5.1.1.1 Listed Species

The following four EPBC Act-listed species were cited in the desktop search results for the EIS study area:

- *Dichanthium setosum,*(bluegrass) identified as vulnerable under the EPBC Act;
- *Dichanthium queenslandicum* (king bluegrass), listed as endangered under the EPBC Act;
- *Digitaria porrecta* (finger panic grass), listed as endangered under the EPBC Act; and
- *Cycas ophiolitica,* listed as endangered under the EPBC Act.

5.1.1.2 Threatened Ecological Communities

The following two EPBC Act listed TECs were cited in the desktop search results for the EIS study area:

- *Natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin*, listed as an endangered TEC under the EPBC Act; and
- *Brigalow (Acacia harpophylla dominant and co-dominant)*, listed as an endangered TEC under the EPBC Act.

5.1.2 Terrestrial Fauna

5.1.2.1 Listed Species

The following 12 EPBC Act listed fauna species were cited in the desktop search results for the EIS study area. They include four bird species, three mammal species and five reptile species:

- red goshawk (*Erythrotriorchis radiatus*), identified as vulnerable under the EPBC Act;
- squatter pigeon (*Geophaps scripta scripta*), identified as vulnerable under the EPBC Act;
- star finch (eastern and southern) (*Neochmia ruficauda ruficauda*), identified as endangered under the EPBC Act;
- Australian painted snipe *(Rostratula australis*), identified as endangered under the EPBC Act;
- eastern long-eared bat (*Nyctophilus corbeni*), identified as vulnerable under the EPBC Act;
- northern quoll (*Dasyurus hallucatus*), identified as endangered under the EPBC Act;
- koala (*Phascolarctos cinereus*) (combined populations of Qld, NSW and the ACT) identified as vulnerable under the EPBC Act;
- ornamental snake (*Denisonia maculata*), identified as vulnerable under the EPBC Act;

- yakka skink (*Egernia rugosa*), identified as vulnerable under the EPBC Act;
- Fitzroy River Turtle (*Rheodytes leukops*), identified as vulnerable under the EPBC Act;
- Dunmallôs snake (*Furina dunmalli*), identified as vulnerable under the EPBC Act; and
- Allan's lerista (*Lerista allanae*), identified as endangered under the EPBC Act,

In addition to this, there are ten species listed as migratory or marine under the EPBC Act. As explained in **Section 6.5.1**, migratory species are not considered further in this report.

5.2 Field Survey Results

5.2.1 General Site Characteristics

The ecological values of the EIS study area were found to be to be relatively typical of the values generally found within Isaac River sub-catchment, where significant areas of the landscape have been historically cleared for grazing and cropping and continue to be utilised for this land use. Although some areas of remnant vegetation remain intact, a high degree of natural vegetation has been modified to some extent by historical and current land management practices. The most common modification is the removal of the shrub and ground layers of vegetation and the introduction of pasture grass species.

Contiguous tracts of vegetation within the EIS study area, representing local connectivity of habitat, are primarily linked by riparian corridors associated with the local creek and river systems. Connectivity in the east of the EIS study area is primarily provided by the Isaac River riparian corridor. The Isaac River corridor connects with a large significant tract of vegetation along the Burton Range, approximately 10 kilometres to the north-west of the project. The Burton Range represents a contiguous extent of woodland approximately 18 kilometres long, varying in width from between 1 and 5 kilometres. Lesser waterways within the EIS study area provide habitat connectivity at the local level.

The majority of the EIS study area is located on relatively flat or slightly undulating lands at elevations between 250 and 325 metres above sea level. Woodlands dominated by *Eucalyptus* or *Acacia* species cover part of the area with the remainder vegetated by non-remnant grasslands (as pasture) and shrubby regrowth. Areas of native grassland are present. In the drier areas *Eucalyptus populnea* (poplar box), *E. cambageana* (Dawson gum), *Corymbia tessellaris* (Moreton Bay ash) and *Acacia harpophylla* (brigalow) generally dominate the canopy, with a sparse mid layer and ground cover of tussocky introduced grasses. Black soil grassland areas with *Lysiphyllum* species occur, while other areas are dominated by sandy, clayey or stony soils. Isolated low laterite hills vegetated with *Acacia* species occur in the south-east and west of the EIS study area.

Natural waterways on the site include the Isaac River and its tributaries, including Goonyella, Eureka, Fisher, and Platypus creeks and 12 Mile Gully. All streams on the site are ephemeral with flow only evident following significant rain events. The Isaac River is a significant watercourse in the region, flowing south to enter the Fitzroy River system.

The primary existing land use within the EIS study area is cattle grazing. As a result, the general ecology of the area has been significantly modified. Modifications include the proliferation of the exotic *Pennisetum ciliare* (buffel grass) to the general exclusion of native groundcover species;

impacts from cattle (trampling of ground cover vegetation); loss of mid-story vegetation shrubby diversity; soil erosion; compaction; and disturbance and fouling of natural water bodies. The presence of artificial water supplies, such as dams, provide habitat and resources for fauna groups including waterbirds and frogs, and enhances the conditions for exotic fauna such as cane toads and feral pigs.

5.2.2 Terrestrial Flora

The field surveys identified the presence of 368 taxa representing 67 families and 202 genera. Families represented by three or more genera included Amaranthaceae (7 genera), Apocynaceae (4), Asteraceae (13), Caesalpiniaceae (6), Chenopodiaceae (7), Euphorbiaceae (8), Fabaceae (14), Malvaceae (7), Mimosaceae (3), Myrtaceae (3), Poaceae (42), Rubiaceae (7) and Rutaceae (3).

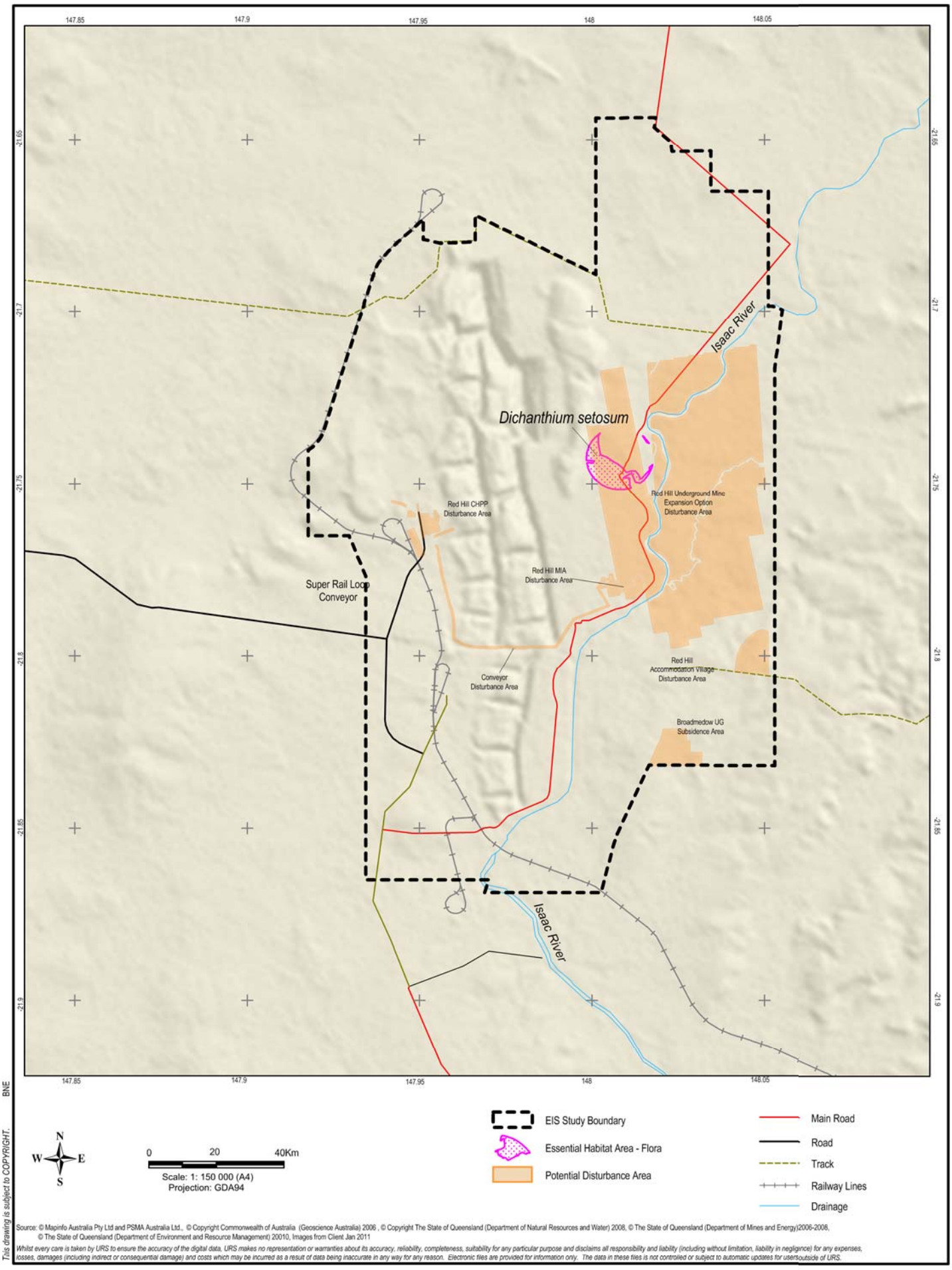
Genera represented by three or more species included *Acacia* (13 species), *Alectryon* (3), *Amyema* (4), *Aristida* (13), *Atriplex* (3), *Bothriochloa* (5), *Brachychiton* (3), *Chamaesyce* (3), *Chloris* (4), *Corymbia* (6), *Cyperus* (7), *Dichanthium* (4), *Digitaria* (4), *Enneapogon* (6), *Enteropogon* (3), *Eragrostis* (9), *Eremophila* (3), *Eucalyptus* (12), *Hibiscus* (4), *Indigofera* (4), *Jasminum* (4), *Leptochloa* (4), *Lysiphyllum* (3), *Melaleuca* (6), *Paspalidium* (5), *Phyllanthus* (3), *Sclerolaena* (4), *Sida* (9) and *Sporobolus* (7).

The surveys identified 46 exotic taxa representing 18 families. Families with three or more exotic weed taxa include Asteraceae (3), Cactaceae (3), Malvaceae (5) and Poaceae (15).

For a detailed account of flora survey results please refer to **Appendix K1.1** of the Red Hill Mining Lease EIS.

5.2.2.1 EPBC Act Listed Species

Field surveys located *Dichanthium setosum* (bluegrass) within the EIS study area (**Figure 5-1**). No other EPBC Act listed flora species were recorded during the field surveys.



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RECORDS OF NATIONALLY SIGNIFICANT FLORA SPECIES

URS

EPBC REPORT Figure: **5-1**

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5.2.2.2 Vegetation Communities

Field surveys identified 19 vegetation communities and their corresponding REs. **Table 5-1** lists the REs observed within the EIS study area, and the distribution of these REs is illustrated in **Figure 5-2a**, **5-2b** and **5-2c**.

Table 5-1 Observed Regional Ecosystems within the EIS Study Area

RE[1] Code	Community Description	Status		EIS Study Area Areas (ha)
		EPBC[2]	VM Act[3]	
RE 11.3.1	*Acacia harpophylla* open woodland on alluvial plains	E	OC	248
RE 11.3.2	*Eucalyptus populnea* woodland on alluvial plains	NL	OC	307
RE 11.3.3	*Eucalyptus coolabah* woodland on alluvial plains	NL	OC	60
RE 11.3.4	*Eucalyptus tereticornis* and/or Eucalyptus spp. woodland on alluvial plains	NL	OC	44
RE 11.3.4a	*Corymbia tessellaris* woodland on alluvial sand ridges to elevated levees and level terraces	NL	OC	158
RE 11.3.5	*Acacia cambageana* woodland on alluvial plains	NL	LC	8
RE 11.3.7	*Corymbia* spp. woodland on alluvial plains. Sandy soil	NL	LC	116
RE 11.3.25e	Eucalyptus tereticornis or E. camaldulensis woodland fringing drainage lines	NL	LC	293
RE 11.3.36	*Eucalyptus crebra* and\or *E. populena* and\or *E. melanophloia* on alluvial plains	NL	OC	13
RE 11.4.2	*Eucalyptus populnea/brownii* woodland on Cainozoic clay plains	NL	OC	864
RE 11.4.7	*Eucalyptus populnea* with *Acacia harpophylla* and/or *Casuarina cristata* open forest to woodland on Cainozoic clay plains	E	E	111
RE 11.4.8	*Eucalyptus cambageana* woodland to open forest with *Acacia harpophylla* or *A. argyrodendron* on Cainozoic clay plains	E	E	170
RE 11.4.9	*Acacia harpophylla* shrubby open forest to woodland with *Terminalia oblongata* on Cainozoic clay plains	E	E	439
RE 11.5.3	*Eucalyptus populnea* and/or *E. melanophloia* and/or *Corymbia clarksoniana* on Cainozoic sand plains/remnant surfaces	NL	LC	3008
RE 11.5.9	*Eucalyptus crebra* and other *Eucalyptus* spp. and *Corymbia* spp. woodland on Cainozoic sand plains/remnant surfaces. Plateaus and broad crests	NL	LC	580

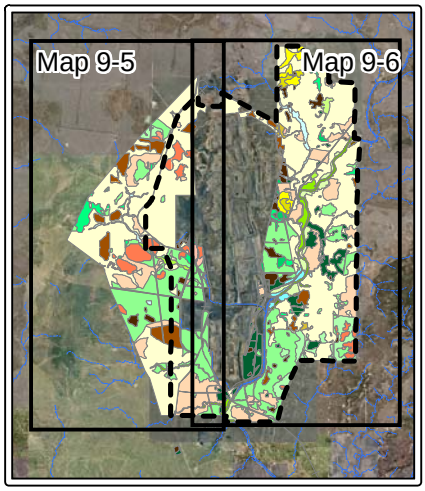
RE[1] Code	Community Description	Status		EIS Study Area Areas (ha)
		EPBC[2]	VM Act[3]	
RE 11.5.16	*Acacia harpophylla* and/or *Casuarina cristata* open forest in depressions on Cainozoic sand plains/remnant surfaces	E	E	74
RE 11.7.1	*Acacia harpophylla* and/or *Casuarina cristata* and *Eucalyptus thozetiana* or *E. macrocarpa* woodland on lower scarp slopes on Cainozoic lateritic duricrusts.	NL	LC	3
RE 11.7.2	*Acacia* spp. woodland on lateritic duricrust. Scarp retreat zone	NL	LC	406
RE 11.8.11	*Dichanthium sericeum* grassland on Cainozoic igneous rocks	E	OC	235
RE 11.8.11/ non remnant grassland	*Dichanthium sericeum* grassland on Cainozoic igneous rocks	NL	OC	113
RE 11.9.1	*Eucalyptus thozetiana* with *Acacia harpophylla* open woodland	E	E	52

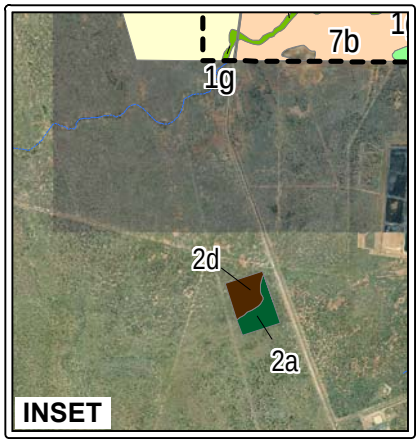
Note (1): Regional Ecosystem
Note (2): EPBC Act
Note (3): *Vegetation Management Act 1999*, NL ï Not listed, E ï Endangered, OC ï Of Concern, LC ï Least Concern.

5.2.3 Threatened Ecological Communities

Field surveys confirmed the presence of two EPBC Act listed TECs within the EIS study area. These communities and the REs analogous to each are listed below with their distribution illustrated in **Figure 5-3**.

- *Natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin* (Of Concern RE 11.8.11). Approximately 366 hectares of this community have been mapped within the EIS study area (**Figure 5-3**); and
- *Brigalow (Acacia harpophylla dominant and co-dominant)* (Endangered REs 11.3.1, 11.4.7, 11.4.8, 11.4.9, 11.5.16 and 11.9.1). Approximately 1,094 hectares of this community have been mapped within the EIS study area (**Figure 5-3**).





NOTE:
This Figure 5-2a must be viewed in conjunction with Figure 5-2c.

EIS Study Boundary
ML & MLA Boundary
Potential Disturbance Area

N
W E
S

0 1.25 2.5km
Scale 1:95 000 (A4)
Projection: GDA94, MGA Zone 55

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RE'S MAPPED WITHIN THE EIS STUDY AREA – WEST SECTOR

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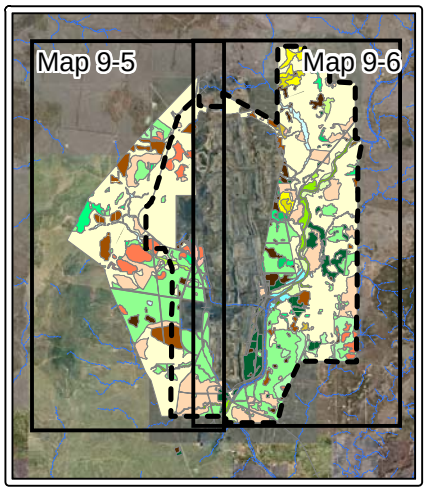

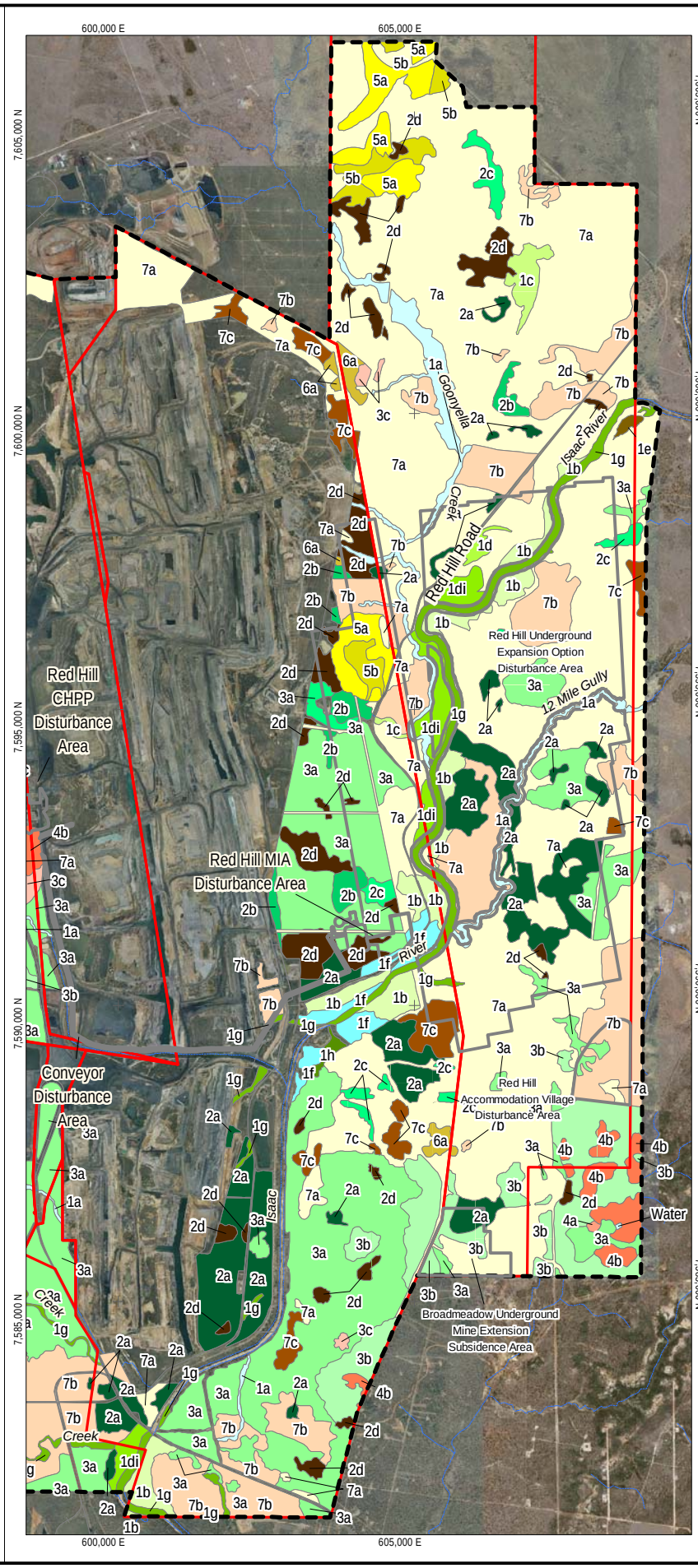

NOTE:
This Figure 5-2b must be viewed in conjunction with Figure 5-2c.

EIS Study Boundary
ML & MLA Boundary
Potential Disturbance Area

N
W E
S

0 1.25 2.5km
Scale 1:105 000 (A4)
Projection: GDA94, MGA Zone 55

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RE'S MAPPED WITHIN THE EIS STUDY AREA – EAST SECTOR

URS | **EPBC REPORT** | Figure: **5-2b**

File No: **42627136-g-2178.wor** | Drawn: **VH** | Approved: **CT** | Date: **20-11-2013** | Rev. **A** | A4

Vegetation Community Code	Community Description	Regional Ecosystem	VMA Status	EPBC Status
1a	*Acacia harpophylla* and/or *Casuarina cristata* open forest on alluvial plains.	RE 11.3.1	Endangered	Endangered
1b	*Eucalyptus populnea* woodland on alluvial plains.	RE 11.3.2	Of Concern	Not Listed
1c	*Eucalyptus coolabah* woodland on alluvial plains.	RE 11.3.3	Of Concern	Not Listed
1d	*Eucalyptus tereticornis* and/or Eucalyptus spp. woodland on alluvial plains.	RE 11.3.4	Of Concern	Not Listed
1di	*Corymbia tessellaris* woodland on alluvial sand ridges to elevated levees and level terraces.	RE 11.3.4a	Of Concern	Not Listed
1e	*Acacia cambagei* woodland on alluvial plains.	RE 11.3.5	Least Concern	Not Listed
1f	*Corymbia* spp. woodland on alluvial plains. Sandy soils	RE 11.3.7	Least Concern	Not Listed
1g	*Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines.	RE 11.3.25e	Least Concern	Not Listed
1h	*Eucalyptus crebra* and/or *E. populnea* and/or *E.melanophloia* on alluvial plains, higher terraces.	RE 11.3.36	Of Concern	Not Listed
2a	*Eucalyptus populnea/brownii* woodland on Cainozoic clay plains.	RE 11.4.2	Of Concern	Not Listed
2b	*Eucalyptus populnea* with *Acacia harpophylla* and/or *Casuarina cristata* Open forest to woodland on Cainozoic clay plains.	RE 11.4.7	Endangered	Endangered
2c	*Eucalyptus cambageana* woodland to open forest with *Acacia harpophylla* or *A. argyrodendron* on Cainozoic clay plains.	RE 11.4.8	Endangered	Endangered
2d	*Acacia harpophylla* shrubby open forest to woodland with *Terminalia oblongata* on Cainozoic clay plains.	RE 11.4.9	Endangered	Endangered
3a	*Eucalyptus populnea* and/or *E. melanophloia* and/or *Corymbia clarksoniana* on Cainozoic sand plains/remnant surfaces.	RE 11.5.3	Least Concern	Not Listed
3b	*Eucalyptus crebra* and other *Eucalyptus* spp. and *Corymbia* spp. woodland on Cainozoic sand plains/remnant surfaces. Plateaus and broad crests.	RE 11.5.9	Least Concern	Not Listed
3c	*Acacia harpophylla* and/or *Casuarina cristata* open forest in depressions on Cainozoic sand plains/remnant surfaces.	RE 11.5.16	Endangered	Endangered
4a	*Acacia harpophylla* and/or *Casuarina cristata* and *Eucalyptus thozetiana* or *E. macrocarpa* woodland on lower scarp slopes on Caino zoic lateritic duricrusts.	RE 11.7.1	Least Concern	Not Listed
4b	*Acacia* spp. woodland on lateritic duricrust. Scarp retreat zone.	RE 11.7.2	Least Concern	Not Listed
5a	*Dichanthium sericeum grassland on Cainozoic igneous rocks.*	RE 11.8.11	Of Concern	Endangered
5b	*Dichanthium sericeum grassland on Cainozoic igneous rocks/ non remnant modified grassland (50%/50%).*	RE11.8.11/ n/a	Of Concern/ Not Listed	Not Listed
6a	*Eucalyptus thozetiana with Acacia harpophylla open woodland.*	RE 11.9.1	Endangered	Endangered
7a	Non remnant modified open grassland.	n/a	Not Listed	Not Listed
7b	Non remnant mixed shrubby regrowth.	n/a	Not Listed	Not Listed
7c	Non remnant *Acacia harpophylla* regrowth.	n/a	Not Listed	Not Listed

NOTE: This Figure 3-5c must be viewed in conjunction with Figures 3-5a and 3-5b.

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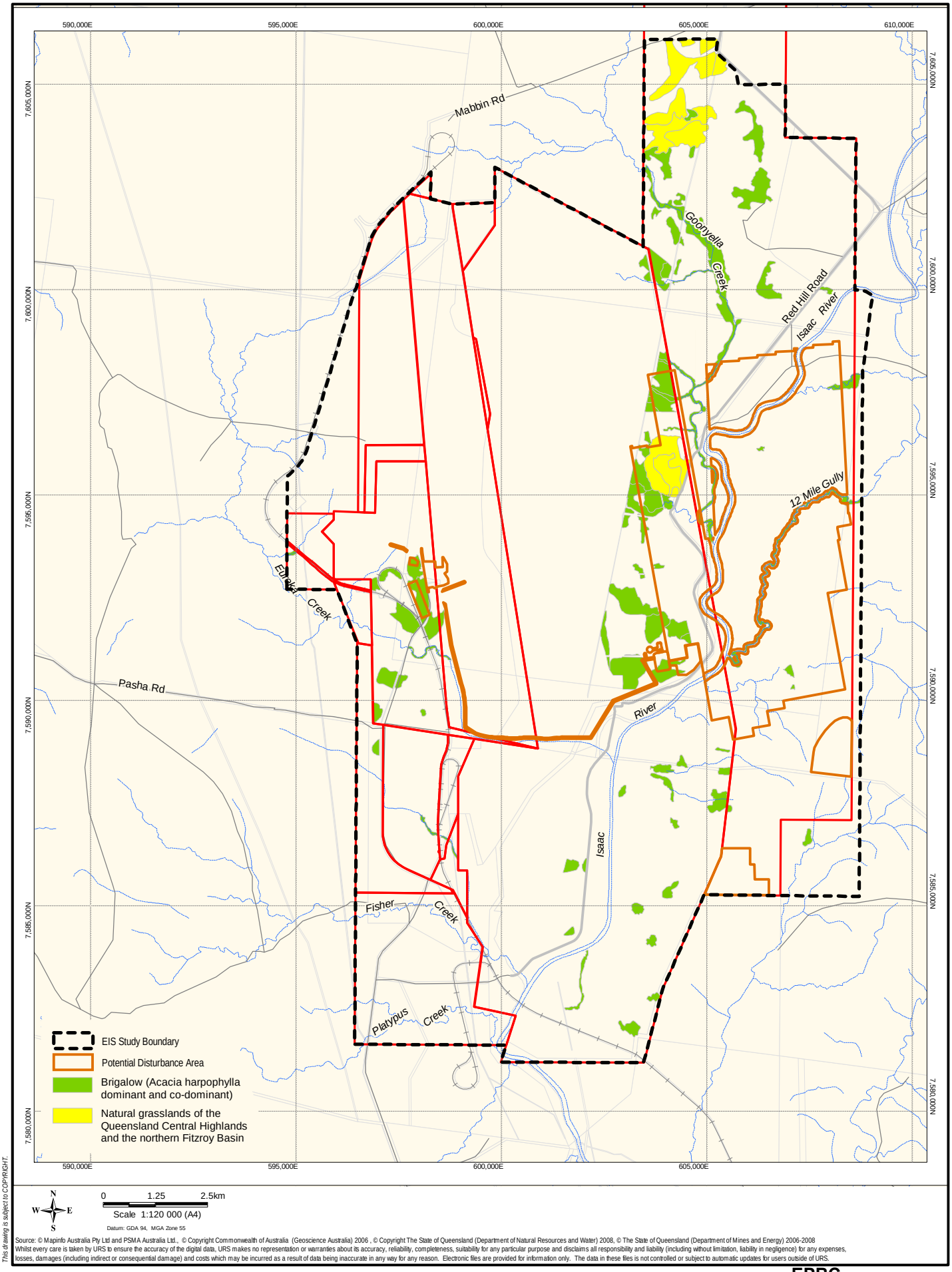
EPBC REPORT

RE'S MAPPED WITHIN THE EIS STUDY AREA - LEGEND



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EPBC REPORT

EPBC THREATENED ECOLOGICAL COMMUNITYS MAPPED WITHIN THE EIS STUDY AREA

URS

EPBC REPORT

Figure: **5-3**

File No: **42627136-g-2179.wor** Drawn: **VH** Approved: **CT** Date: **21-08-2013** Rev. **A** A4

5.2.4 Terrestrial Fauna

A total of 288 fauna species, (including exotic species) have been recorded within the locality of the EIS study area during field surveys between 1998 and 2011 (refer to **Appendix K1.2** of the EIS for detailed survey results). This includes 168 bird, 49 mammal, 17 amphibian and 54 reptile species.

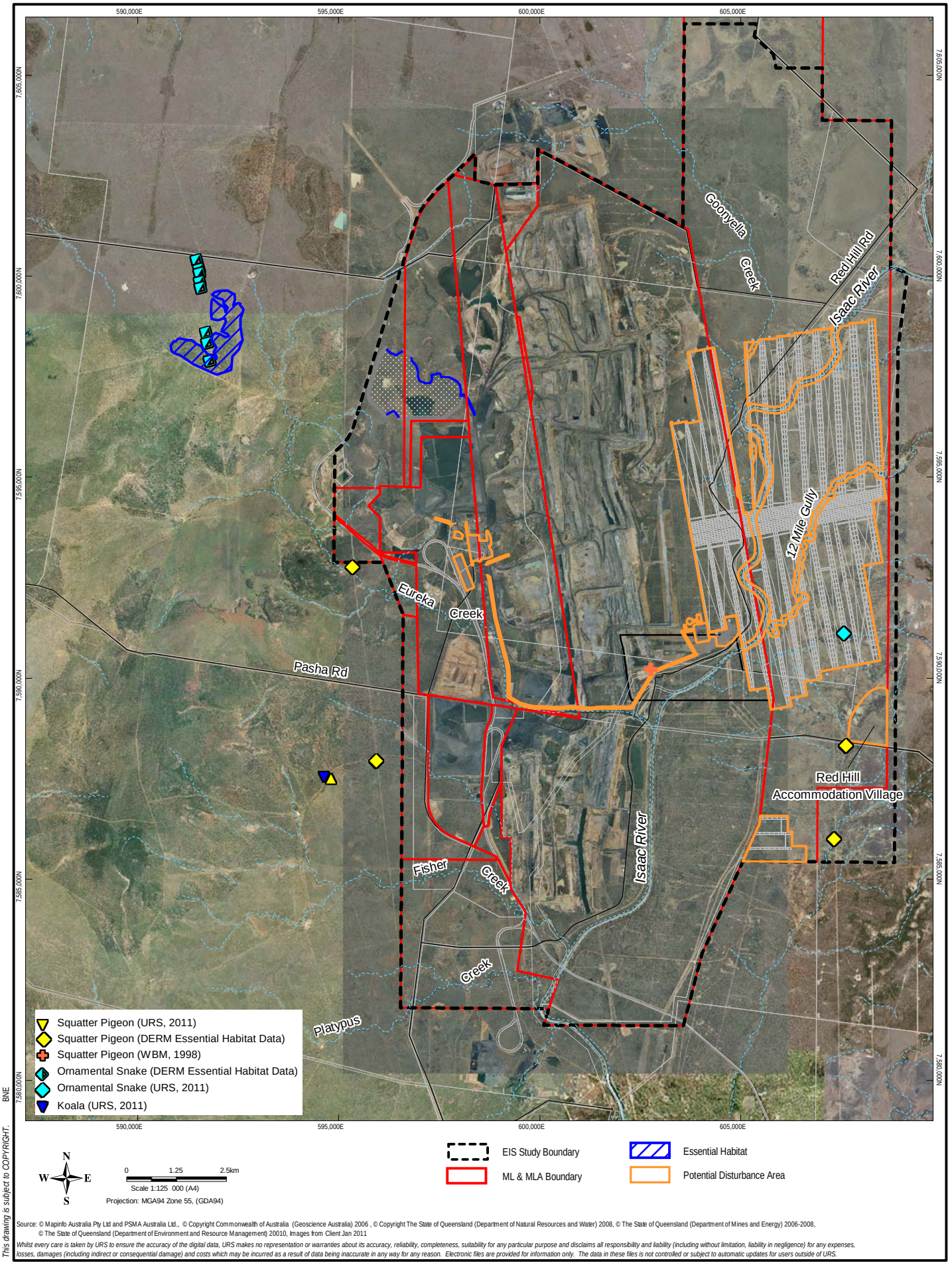
Three nationally threatened terrestrial fauna species were recorded within the vicinity of the EIS study area during the current URS surveys:

- squatter pigeon (*Geophaps scripta scripta*), identified as vulnerable under the EPBC Act;
- ornamental snake (*Denisonia maculata*), identified as vulnerable under the EPBC Act; and
- koala (*Phascolarctos cinereus*) (combined populations of Qld, NSW and the ACT) identified as vulnerable under the EPBC Act.

Squatter pigeon (*Geophaps scripta scripta*) has been recorded in the EIS study area on seven separate occasions, these include surveys undertaken by WBM in 1998, 2000 and 2002, and URS in 2005, 2009 and 2011. The observations are clustered in two areas and are likely to represent a viable population using the site (refer **Figure 5-4**). All individuals were observed in areas which have been grazed and have some level of habitat degradation, and their occurrence may reflect the nearby presence of water rather than food resources, or be simply a result of increased visibility improving the likelihood of detection.

The ornamental snake (*Denisonia maculata*) was recorded by URS during the May 2011 autumn survey. The specimen was identified in the east of the EIS study area, occupying spoil created from the excavation of an adjacent farm dam. The ornamental snake was also recorded adjacent to the west of the EIS study area during pipe trenching operations for the North Queensland Gas Pipeline in 2004. This data was used to map Essential Habitat for this species along the pipeline in the northwest of the EIS study area, external to the EIS study area (**Figure 5-4**) (EHP 2012c).

A solitary koala (*Phascolarctos cinereus*) was recorded by URS during the June 2009 survey. The individual was identified within *Eucalyptus populnea* (poplar box) woodland south-west of the EIS study area, approximately two kilometres from the EIS study area border (**Figure 5-4**). The paucity of observations of the species across all survey events suggests that it is sparsely distributed within the region.



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RED HILL MINING LEASE
EPBC REPORT

RECORDS OF NATIONALLY SIGNIFICANT FAUNA SPECIES

URS

EPBC REPORT

Figure: **5-4**

File No: **42627136-g-2180.wor** Drawn: **VH** Approved: **CT** Date: **21-08-2013** Rev. **A** A4

Section 06 Likelihood of Occurrence of MNES and Potential Habitat Mapping

6.1 Relevant Controlling Provisions

The potential impact of the project on MNES (as defined in the EPBC Act and regulations) is assessed by the Commonwealth Government under the Bilateral Agreement and in accordance with the Queensland EIS process.

The relevant controlling provisions as they relate to the project and its location are Threatened Ecological Communities and Listed Threatened Species.

6.2 Likelihood of MNES Occurrence

A likelihood of occurrence analysis has been undertaken to categorise the presence of MNES values into four likelihood probabilities based on known distribution, habitat preferences and field vegetation mapping. The likelihood of occurrence categories and corresponding definitions are:

- **Known** = the species has been observed within the EIS study area;
- **Likely** = a medium to high probability that a species occurs within the EIS study area or it has been recorded adjacent to the EIS study area;
- **Potentially occurring** = suitable habitat for a species occurs within the EIS study area, but there is insufficient information to categorise the species as likely to occur, or unlikely to occur; and
- **Unlikely to occur** = a very low to low probability that a species occurs within the EIS study area.

A review of the desktop analysis and field survey results was undertaken using recent data and knowledge on community and speciesô distributions and habitat requirements. As a result, two TECs, three flora species and three fauna species listed under the EPBC Act are known to be present, or are likely to be present, using the above likelihood of occurrence categories. The TECs and fauna and flora species are summarised in the sections below.

6.3 Threatened Ecological Communities

6.3.1 Brigalow (*Acacia harpophylla*) Dominant and Co-dominant TEC

The brigalow TEC was confirmed within the EIS study area. Six REs mapped within the EIS study area represent the brigalow TEC. These REs are:

- RE 11.3.1 ï *Acacia harpophylla* open woodland on alluvial plains;
- RE 11.4.7 ï *Eucalyptus populnea* with *Acacia harpophylla* and/or *Casuarina cristata* open forest to woodland on Cainozoic clay plains;
- RE 11.4.8 ï *Eucalyptus cambageana* woodland to open forest with *Acacia harpophylla* or *A. argyrodendron* on Cainozoic clay plains;
- RE 11.4.9 ï *Acacia harpophylla* shrubby open forest to woodland with *Terminalia oblongata* on Cainozoic clay plains;

- RE 11.5.16 ï *Acacia harpophylla* and/or *Casuarina cristata* open forest in depressions on Cainozoic sand plains/remnant surfaces; and
- RE 11.9.1 - *Eucalyptus thozetiana* with *Acacia harpophylla* open woodland.

The brigalow TEC occurs within the EIS study area in several locations (**Figure 5-3**). Stands of Brigalow within the EIS study area are generally in poor condition due to the long term impacts of grazing and invasion by *Pennisetum ciliare* (buffel grass). The tall shrub layer typical of this vegetation community is generally absent and the understorey is characterised by a low, open grass cover primarily dominated by buffel grass and a number of other introduced grass species. Recruitment of native species has generally been suppressed in the mid and ground strata by the high abundance of buffel grass and grazing pressure. Disturbance by pigs was also evident at a number of sites.

6.3.2 Natural Grasslands of the Queensland Central Highlands and the Northern Fitzroy Basin TEC

The natural grassland TEC, listed as endangered under the EPBC Act, is mapped within the EIS study area as RE 11.8.11 ï *Dichanthium sericeum* (bluegrass) grassland on Cainozoic igneous rocks. This community was located on black cracking clays north east of the Isaac River along natural drainage lines on the eastern edge of the GRB mine complex and in the north east portion of the EIS study area (**Figure 5-3**).

Survey methodology, consisting of key diagnostic characteristics and condition thresholds was used to determine the condition of RE 11.8.11 within the EIS study area. It is taken directly from the EPBC Listing Advice for the *Natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin* (DSEWPaC 2008a). This methodology confirmed some areas to be 100 per cent RE 11.8.11 and some areas to be RE 11.8.11 / non-remnant modified open grassland at the time of survey (50 per cent / 50 per cent respectively) (**Figure 5-2a-c**).

The areas mapped as RE 11.8.11 fit the criteria for the EPBC TEC: *Natural grassland of the Queensland Central Highlands and the Northern Fitzroy Basin*, listed as Endangered under the EPBC Act (**Figure 5–2 a-c** and **5-3**). The 0.1 hectare plots surveyed under the methodology outlined by DSEWPaC for determining this community met the condition threshold of ógood qualityôfor the EPBC listed community.

The areas surveyed and mapped as RE 11.8.11 / non remnant grassland (**Figure 5-2a-c**) do not currently meet the criteria. However, under suitable conditions, including absence of grazing, removal of weeds and optimal seasonal weather conditions, it is likely that the entire polygon mapped as RE 11.8.11 / non-remnant modified open grassland would be considered as the EPBC listed community. Guidelines for the determination of this community require consideration of the recovery potential of the community in the absence of direct impacts such as grazing. For this reason the entire area has been mapped as an EPBC TEC (**Figure 5-2a-c** and **Figure 5-3**).

6.4 Threatened Flora

The literature review and desktop searches indicates that four EPBC Act listed flora species potentially occur in the EIS study area. The assessment of likelihood of occurrence of each species is based on a comparison of the speciesôpreferred habitat against the habitat present within the EIS study area

and whether the species has been recorded in the area. The likelihood categories for which species were assessed are discussed in **Section 6.2**. The likelihood of occurrence of these species is discussed in **Table 6-1** below.

Table 6-1 Likelihood of Occurrence of EPBC Act listed Flora

Scientific Name (Common Name)	Status[1]	Distribution and Habitat	Likelihood of Occurrence
Dichanthium setosum (bluegrass)	V (A)	Associated with heavy basaltic black soils and found in moderately disturbed areas. In Queensland its distribution includes the Leichhardt, Moreton, North Kennedy and Port Curtis regions.	Known
Dichanthium queenslandicum (king bluegrass)	E (A) V (Q)	Endemic to Queensland where it occurs mostly on black clay soils around Emerald and more rarely on the Darling Downs.	Likely
Digitaria porrecta (finger panic grass)	E (A) NT (Q)	Occurs in four disjunct areas: in Queensland this includes the Nebo District, south-west of Mackay; the Central Highlands between Springsure and Rolleston; and from Jandowae south to Warwick. Found in grasslands on extensive basaltic plains and undulating woodlands / open forests with basaltic geology.	Likely
Cycas ophiolitica	E (A) E (Q)	Occurs from Marlborough to Rockhampton in woodland or open eucalypt woodlands.	Unlikely. Habitat for this species within the EIS study area is marginal. The lack of historical records and absence during the detailed field surveys indicates a low likelihood of occurrence within the EIS study area.

Note (1): (A) - Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*:
E = endangered, V = vulnerable,
(Q) - Queensland's *Nature Conservation Act 1992*: E = endangered, V = vulnerable, NT = near threatened.

6.4.1 Summary of Likelihood of Occurrence assessment for EPBC Act Listed Flora

Dichanthium setosum (bluegrass) was recorded within the eastern portion of the EIS study area within RE 11.8.11 (**Figure 5-1**). Only one specimen of *Dichanthium setosum* (bluegrass) was observed during the 2009 field survey. However, the area was heavily grazed at the time of survey and it is anticipated that additional specimens would be recorded with decreased grazing pressure and improved growing conditions.

Dichanthium queenslandicum (king bluegrass) and *Digitaria porrecta* (finger panic grass), were not identified during the field surveys. However, these species are known to inhabit similar areas to *Dichanthium setosum* (bluegrass) and therefore may be considered likely to occur within the EIS study area.

Cycas ophiolitica was also identified by the EPBC protected matters search database. However based on previous surveys, this species is considered unlikely to occur within the EIS study area. *Cycas ophiolitica* is endemic to Queensland, occurring from Marlborough to Rockhampton in woodland or open eucalypt woodlands (DSEWPaC 2012a). The EIS study area occurs within the known range of the species. However, extensive field surveys have been conducted across the survey area in which the species was not detected. Given the level of survey effort, it is considered unlikely that *Cycas ophiolitica* occurs within the EIS study area.

6.5 Threatened Fauna

Twelve EPBC-listed fauna species are cited in the EPBC Protected Matters Search Tool for the EIS study area. The assessment of likely occurrence of each species is based on an analysis of the species preferred habitat and the habitat present within the EIS study area and whether the species has been recorded in the EIS study area or surrounds. The likelihood categories in which a species was placed are described in **Section 6.2**. The likelihood of occurrence of these species is discussed in **Table 6-2** below.

Table 6-2 Likelihood of Occurrence of EPBC Act listed Fauna

Common name/Scientific Name	Status[1]	Habitat	Likelihood of Occurrence
Birds			
red goshawk (*Erythrotriorchis radiates*)	E (Q) V (A)	Red goshawks occupy a range of habitats, often at ecotones, including coastal and sub-coastal tall open forest, tropical savannahs crossed by wooded or forested watercourses, woodlands, the edges of rainforest and gallery forests along watercourses, and wetlands that include *Melaleuca* and *Casuarina* species (EHP 2013e).	Unlikely Habitat for this species within the EIS study area is marginal. The lack of records suggests it is not a regular inhabitant of the area and therefore it has a very low likelihood of occurrence within the EIS study area.
squatter pigeon (*Geophaps scripta scripta*) (southern subspecies)	V (Q) V (A)	The squatter pigeon occurs mainly in grassy woodlands and open forests that are dominated by *Eucalyptus* spp. It has also been recorded in sown grasslands with scattered remnant trees, disturbed habitats (Longmore 1976), in scrub (Baldwin 1975) and *Acacia* growth.	Known Recorded from the EIS study area (**Figure 5-4**).
star finch (*Neochmia ruficauda ruficauda*) (eastern and southern)	E (A)	The star finch inhabits tall grass and reed beds associated with swamps and watercourses. It may also be found in grassy woodlands, open forests and mangroves (EHP 2013f).	Unlikely Given the lack of recent records from central Queensland, it is considered to have a very low likelihood of occurrence within the EIS study area.

Common name/Scientific Name	Status[1]	Habitat	Likelihood of Occurrence
Australian painted snipe (*Rostratula australis*)	V, Mi, M (A)	The Australian painted snipe is usually found in shallow inland wetlands, either freshwater or brackish, that are either permanently or temporarily filled. It is a cryptic bird that is hard to see and often overlooked. Usually only single birds are seen, though larger groups of up to 30 have been recorded. It nests on the ground amongst tall reed-like vegetation near water, and feeds near the waterś edge and on mudflats, taking invertebrates, such as insects and worms, and seeds.	Potentially Occurring Unlikely to be present except as an occasional visitor as the requisite habitat type is not present.
Mammals			
South-eastern long-eared bat (*Nyctophilus corbeni*)	V (A)	The eastern long-eared bat forages in *Callitris*/ironbark/box open forest and buloke woodland in southern Queensland (DSEWPaC 2011a). Its extent is poorly understood, and although government databases list it for the area, it has not been recorded in earlier surveys on the site. It is known to roost in tree hollows and under bark (Churchill 1998), habitat features present in various communities at the EIS study area. Its potential presence on the site cannot be dismissed. An unidentified species of *Nyctophilus* has been recorded during surveys.	Unlikely Probably beyond the northerly limit of its range.
northern quoll (*Dasyurus hallucatus*)	E (A)	The northern quoll is found in the savannas of northern Australia. Populations of this quoll have declined across much of its former range, with cane toads thought to be a major factor. They utilise a range of habitats, with rocky areas and eucalypt forests preferred (DSEWPaC 2011b).	Unlikely Unlikely to be present due to lack of suitable habitat and high levels of disturbance.
koala (*Phascolarctos cinereus*) (combined populations of Qld, NSW and the ACT)	V (A)	Koala is widespread in dry sclerophyll forest and woodland on both sides of Great Dividing Range (GDR) from around Chillagoe in Qld to Mt Lofty Ranges in SA. West of the GDR, extends inland mainly along riparian corridors (Menkhorst and Knight 2004).	Likely One specimen was recorded within poplar box woodland adjacent to the EIS study area.

Common name/Scientific Name	Status[1]	Habitat	Likelihood of Occurrence
Reptiles			
Fitzroy River turtle *Rheodytes leukops*	V (A)	Cogger (2000) notes that the Fitzroy River turtle is known only from the Fitzroy River and its tributaries in Queensland. It is recorded as preferring fast-flowing water Although the EIS study area is within the Fitzroy River catchment, the waterways are ephemeral and the dams are still water containments. Therefore it is highly unlikely that this species would be present on the site.	Unlikely Unlikely as the requisite habitat type is not present.
ornamental snake *Denisonia maculata*	V (Q) V (A)	Occurs in *Acacia harpophylla* woodland growing on clay and sandy soils, riverine woodland, and open forest growing on natural levees. Shows a preference for moist areas. Known only from the Brigalow Belt (DSEWPaC 2011c).	Known Recorded from cracking clay habitat in the north-west of the site and amongst excavated dam spoil in the east.
yakka skink *Egernia rugosa*	V (Q) V (A)	Usually found in open dry sclerophyll forest or woodland, often taking refuge among dense ground vegetation, hollow logs, and cavities in soil-bound root systems of fallen trees and beneath rocks. Alternatively, skinks may also excavate burrow systems among low vegetation.	Unlikely Suitable habitat exists on site however no nearby known records suggest the species has a very low likelihood of occurrence within the EIS study area.
Dunmallôs snake *Furina dunmalli*	V (Q) V (A)	Usually found in open forest and woodland, particularly brigalow (*Acacia harpophylla*) forest and woodland growing on floodplains of deep cracking black clay and clay loam soils. The species is endemic to Queensland and occurs in the south-eastern interior of the state, especially the Darling Downs (EHP 2013a)	Unlikely The EIS study area is outside the speciesô known range and therefore it has a very low likelihood of occurrence within the EIS study area.
Allanôs lerista *Lerista allanae*	E (Q) E (A)	The few records of this species indicated that it is confined to undulating black soil downs of the central Brigalow Belt bioregion. The soils in which the species is found are fairly loose.	Unlikely Unlikely to be present due to distance from known range.

Note (1): (A)- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*:
E = endangered, V = vulnerable, Mi = migratory species, M = marine.
(Q)- Queenslandôs *Nature Conservation Act 1992*: E = endangered, V = vulnerable

6.5.1 Summary of Likelihood of Occurrence Assessment for EPBC Act Listed Fauna

From **Table 6-2**, three fauna species are known to be present, or are likely to be present:

- squatter pigeon (southern subspecies) (*Geophaps scripta scripta*);
- ornamental snake (*Denisonia maculata*); and
- koala (*Phascolarctos cinereus*) (combined populations of Qld, NSW and the ACT).

Squatter pigeons (*Geophaps scripta scripta*) have been recorded in the EIS study area on seven separate occasions, these include surveys undertaken by WBM in 1998, 2000 and 2002, and URS in 2005, 2009 and 2011. The observations are clustered in two areas and are likely to represent a viable population using the site (refer **Figure 5-4**). All individuals were observed in areas which have been grazed and have some level of habitat degradation, and their occurrence may reflect the nearby presence of water rather than food resources, or be simply a result of increased visibility improving the likelihood of detection.

The ornamental snake (*Denisonia maculata*) was recorded by URS during the May 2011 autumn survey. The specimen was identified in the east of the EIS study area, occupying spoil created from the excavation of an adjacent farm dam. The ornamental snake was also recorded adjacent to the west of the EIS study area during pipe trenching operations for the North Queensland Gas Pipeline in 2004. This data was used to map Essential Habitat for this species along the pipeline in the northwest of the EIS study area, external to the EIS study area (**Figure 5-4**) (EHP 2012c).

A solitary koala (*Phascolarctos cinereus*) was observed to the south-west of the EIS study area within poplar box (*Eucalyptus populnea*) woodland (**Figure 5-4**). The paucity of observations of the species across all survey events suggests that it is sparsely distributed within the region, yet may still utilise habitat within the EIS study area.

6.6 Migratory Species

The EPBC Act Protected Matters Search results notes that eight migratory bird species may potentially be found in the vicinity of the EIS study area (refer to **Appendix A**). Additional migratory species were recorded during fieldwork within the survey area (refer to **Appendix K1.2** for full details).

As part of the project's EPBC Act referral process, DSEWPaC requested additional supporting information from BMA to help inform their assessment of the EPBC referral made by BMA on 14th May 2013. Specifically, the information was required to determine whether the action is likely to have a significant impact on listed migratory species.

As an outcome of the provision of the additional information, DSEWPaC has confirmed that the relevant controlling actions for the project are: listed threatened species and communities. Migratory species are not a controlling action for the project. As a result, migratory species are not considered within this report.

6.7 Potential Habitat Mapping

MNES potential habitat mapping of the EIS study area was undertaken to:

- estimate potential habitat present within the EIS study area;
- determine the potential impact to MNES values; and

- aid the development of specific mitigation measures.

Prior to the mapping of MNES values, a likelihood of occurrence assessment was undertaken for MNES identified during desktop and field studies (**Section 6.2**, **Section 6.4** and **Section 6.5**).

Using the results from this likelihood of occurrence assessment, habitat mapping using the field validated RE mapping was undertaken for MNES values which are **known to occur** or **likely to occur** within the EIS study area. MNES regarded as potentially occurring were not mapped due to limited information being available to accurately depict habitat potential and usage within the EIS study area.

Where MNES values were known or likely, the following methodology for habitat mapping was used:

- Potential habitat mapping criteria for MNES were developed by analysing distribution and habitat preferences using desktop and field data. Field verified REs were used as the primary base criteria, with additional features such as waterways, landzones and regrowth communities also used (more detail is presented in **Section 6.7.2**).
- Upon the determination of habitat criteria, potential habitat types were further categorised into known location, high potential habitat or low potential habitat (where applicable) based on further examination of speciesô habitat preferences (explained further below).
- Using the criteria for High Potential Habitat or Low Potential Habitat, mapping was undertaken and potential habitat areas for each MNES were calculated.
- Potential impacts of the project were then analysed by overlying the proposed project footprint with MNES potential habitat mapping.

MNES habitat types were categorised into one of the following:

- known location ï field validated location of MNES value;
- high potential habitat ï buffer area around known locations; MNES occurrences are commonly recorded in these area; habitat provides superior habitat values and foraging potential to low potential habitat areas. Habitat which is preferential and has been identified during desktop investigations;
- low potential habitat ï habitat in which the MNES has been known to occur however, offers inferior habitat values or foraging potential to high potential habitat areas; and
- unlikely habitat ï habitat which is not suitable to the MNES value.

The potential habitat mapping criteria developed for each of the MNES known to occur or likely to occur (as outlined in **Section 6.7.2**) have been utilised to refine known occurrence or likelihood of presence within the EIS study area as detailed within the profiles for each of the MNES as detailed in **Section 7.2**.

6.7.1 Threatened Ecological Communities

TECs are mapped on the basis of their component REs. These REs have been confirmed during field surveys within the EIS study area.

6.7.2 Development of Potential Habitat Mapping Criteria for EPBC Act Listed Flora

The identification of potential habitat mapping criteria was conducted for each of the three flora species known or likely to be present within the EIS study area. The process used is described below.

6.7.2.1 Dichanthium setosum

Dichanthium setosum is associated with heavy basaltic black soils and stony red-brown hard-setting loam with clay subsoil (Ayers *et al*. 1996; DEH 2012a; TSSC 2008a). The detailed field assessment identified the most suitable habitat within the EIS study area as RE 11.8.11 and this RE has been mapped as High Potential Habitat for the species. Based upon the field assessment areas with lower potential habitat but still containing habitat features suitable for the species was RE 11.3.25 ï this RE has been mapped as Low Potential Habitat for the species.

6.7.2.2 Dichanthium queenslandicum

Dichanthium queenslandicum is associated with heavy clay soils, typically vertic in nature, derived from a range of sources including alluvium and basalt. The detailed field assessment identified the most suitable habitat within the EIS study area as RE 11.8.11 and this RE has been mapped as High Potential Habitat for the species. Based upon the field assessment areas with lower potential habitat but still containing habitat features suitable for the species were REs 11.3.2 and 11.3.3; these REs have been mapped as Low Potential Habitat for the species.

6.7.2.3 Digitaria porrecta

Digitaria porrecta is associated with grasslands, woodlands and open forests associated with basaltic plains (TSSC 2008e). The detailed field assessment identified the most suitable habitat within the EIS study area as RE 11.8.11 and this RE has been mapped as High Potential Habitat. Based upon the field assessment areas with lower potential habitat but still containing habitat features suitable for the species was RE 11.3.2 ï this RE has been mapped as Low Potential Habitat for the species.

6.7.3 Development of Potential Habitat Mapping Criteria for EPBC Act Listed Fauna

The identification of potential habitat mapping criteria was conducted for each of the three fauna species. The process used is described below.

6.7.3.1 Squatter Pigeon

The squatter pigeon is known to utilise a variety of remnant and non-remnant habitats, with no particular preference for either. Therefore it is not possible to differentiate between potential habitat and non-habitat. For this reason, potential habitat mapping for the squatter pigeon has not been developed.

6.7.3.2 Ornamental Snake

The ornamental snake favours vegetation communities on Landzones 4 and 3, particularly where the presence of water supports populations of its favoured prey of frogs. It shows a strong association with

brigalow (*Acacia harpophylla*). Initially, Essential Habitat factor REs for the ornamental snake were reviewed for presence within the EIS study area. Habitat Factor REs on site include 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.25, 11.4.2, 11.4.7, 11.4.8 and 11.4.9. These REs have been used as criteria for the High Potential habitat category, along with the area within a 500 metre buffer around known locations.

Low Potential Habitat includes the Essential Habitat factor REs 11.5.16, 11.8.11 and 11.9.1 that are less likely to support the ornamental snake but all feature brigalow. In addition, Low Potential Habitat includes:

- a 50 metre buffer around watercourses (Landzone 3) with non-remnant vegetation; and
- non-remnant *Acacia harpophylla* shrubland on Landzone 4.

These ecosystems have been included as the ornamental snake may show some preference for these areas over non-remnant communities on other landzones.

6.7.3.3 Koala

The koala is known to have a preference for different food trees. This has been used as the basis for the Potential Habitat category for this species. The Australian Koala Foundation has produced a guideline to recommended tree species for protection and planting of koala habitat (AKF 2012) for the various local government areas in which the koala is found. Vegetation communities mapped within the EIS study area that feature preferred koala trees as dominant or sub-dominant canopy species have been selected for use as the mapping criteria: REs 11.3.2 11.3.3, 11.3.4, 1.3.25, 11.3.6, 11.4.2, 11.4.7, 11.4.8, 11.5.3 and 11.5.9. All other communities mapped on site are either non-remnant communities, grassland communities or feature less favoured tree species such as brigalow. Therefore, a Low Potential Habitat category has not been formulated for this species.

Section 07 MNES Profiles

7.1 Introduction

This section provides profiles of the MNES known to occur or likely to occur in the EIS study area. Profiles for each MNES include the following:

- a discussion of the current distribution of the species or TEC;
- relevant information about the ecology of the species (e.g. habitat, feeding and breeding behaviour);
- information about any populations of the species or habitat for the species in the area affected by the project;
- a discussion of current pressures on the species, especially those in the area to be affected by the project; and
- a discussion of relevant controls or planning regimes already in place.

7.2 Listed Species and Threatened Ecological Communities Profiles for the EIS Study Area

7.2.1 *Dichanthium setosum* (bluegrass)

7.2.1.1 Current Distribution

Dichanthium setosum (bluegrass) occurs predominantly on the northern tablelands in the Sumarez area, west of Armidale and 18 to 30 kilometres east of Guyra. In Queensland it has been reported from the Leichardt, Morton, North Kennedy and Port Curtis regions (DSEWPaC 2008b).

7.2.1.2 Ecology

Dichanthium setosum (bluegrass) is an upright perennial grass less than one metre tall. It has mostly hairless leaves about two to three millimetres wide. The flowers are densely hairy and clustered together along a stalk in a cylinder shape and appear mostly during summer. The species can form pure swards or occur as scattered clumps (DEH 2012a).

The species is associated with heavy basaltic black soils and stony red-brown hard-setting loam with clay subsoil (Ayers *et al.* 1996; DEH 2012a; TSSC 2008a) and is located in moderately disturbed areas, including cleared woodland, grassy roadside remnants, grazed land and highly disturbed pasture (DEH 2012a). The species profile and threats (SPRAT) database does not identify any specific geographical areas as supporting important populations for the species.

7.2.1.3 Populations within the EIS Study Area

Dichanthium setosum (bluegrass) has been recorded in the east of the EIS study area (refer **Figure 5-1**) where it was observed within RE 11.8.11 (*Dichanthium sericeum* (Queensland bluegrass) grassland on Cainozoic igneous rocks) which forms part of the *Natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin* TEC. Only one specimen of *Dichanthium setosum*

was observed during the 2009 URS field survey. However, the area was heavily grazed at the time of survey and it is anticipated that additional specimens would be recorded with decreased grazing pressure and improved growing conditions. The potential habitat mapping developed for this report (**Section 6.7**) identifies that 366 ha of high potential habitat and 292 ha of low potential habitat for the species may occur within the EIS study area (**Figure 7-1**).

7.2.1.4 Potential Habitat Mapping Criteria

The following criteria (**Table 7-1**) have been used to map potential habitat within the EIS study area.

Table 7-1 Potential Habitat Mapping Criteria

Habitat Category	Criteria
High Potential Habitat	• RE 11.8.11
• Low Potential Habitat	• RE 11.3.25

7.2.1.5 Current Pressures

Key threats identified to the species (DSEWPaC 2008b) include heavy grazing by domestic stock, loss of habitat through clearing for pasture improvement and cropping, frequent fires (particularly regular burning for agricultural purposes), invasion by introduced grasses (including Coolatai grass, lippia and African lovegrass) and road widening.

7.2.1.6 Management and Recovery Plans

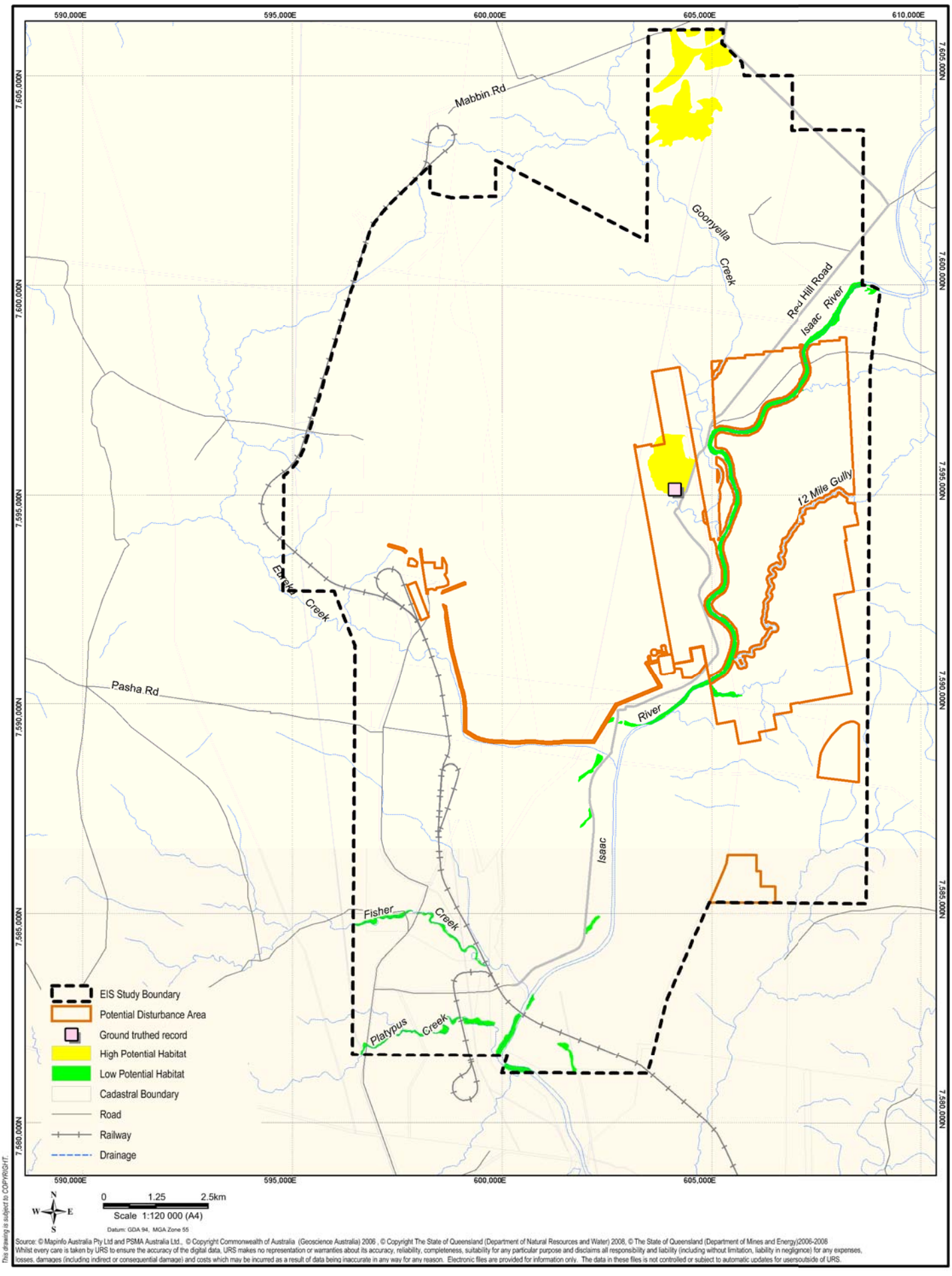
Clearing of *Dichanthium setosum* is regulated under federal legislation (EPBC Act).

There is no Recovery Plan or Threat Abatement Plan for the species. Conservation Advice has been prepared for the species.

7.2.2 *Dichanthium queenslandicum* (king bluegrass)

7.2.2.1 Current Distribution

Dichanthium queenslandicum (king bluegrass) is endemic to Queensland, and is known from the Brigalow Belt North and South Bioregions with records from the northern Darling Downs, Burnett, Leichhardt, South Kennedy and Mitchell Pastoral Districts. Fensham *et al.* (1999) consider the taxon restricted to the Central Highlands following its extinction from southern Queensland. Hill (2000 in Silcock and Scattini2007) also considers it extinct on the Darling Downs. More recently, the species has been found near Jondaryan (R.G. Silcock, unpublished data) and near Roma (W.J. Scattini, unpublished data in Silcock and Scattini 2007).



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POTENTIAL HABITAT FOR *Dichanthium setosum*

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Figure: **7-1**

File No: **42627136-g-2224.wor** Drawn: **VH/RG** Approved: **CT** Date: **21-08-2013** Rev.**A** A4

7.2.2.2 Ecology

Dichanthium queenslandicum is a perennial tussock-forming grass that can vegetatively reproduce. The species occurs in subtropical, subhumid climatic zone on flat ground or gently undulating rises. It is found on fine textured cracking clays, often deep and dark in colour (DSEWPaC 2012b). The species is associated with native grasslands and grassy woodlands although it may occur in disturbed or non-remnant habitats.

The SPRAT database (DSEWPaC 2012b) does not identify any specific geographical areas as supporting important populations for the species.

7.2.2.3 Populations within the EIS Study Area

This species was not recorded within the EIS study area however potential habitat is present, and therefore it cannot be discounted. The potential habitat mapping developed for this report (**Section 6.7**) identifies that 366 ha of high potential habitat and 367 ha of low potential habitat for the species may occur within the EIS study area (**Figure 7-2**).

7.2.2.4 Potential Habitat Mapping Criteria

The following criteria (**Table 7-2**) have been used to map potential habitat within the EIS study area.

Table 7-2 Potential Habitat Mapping Criteria

Habitat Category	Criteria
High Potential Habitat	• RE 11.8.11
• Low Potential Habitat	• RE 11.3.2, 11.3.3

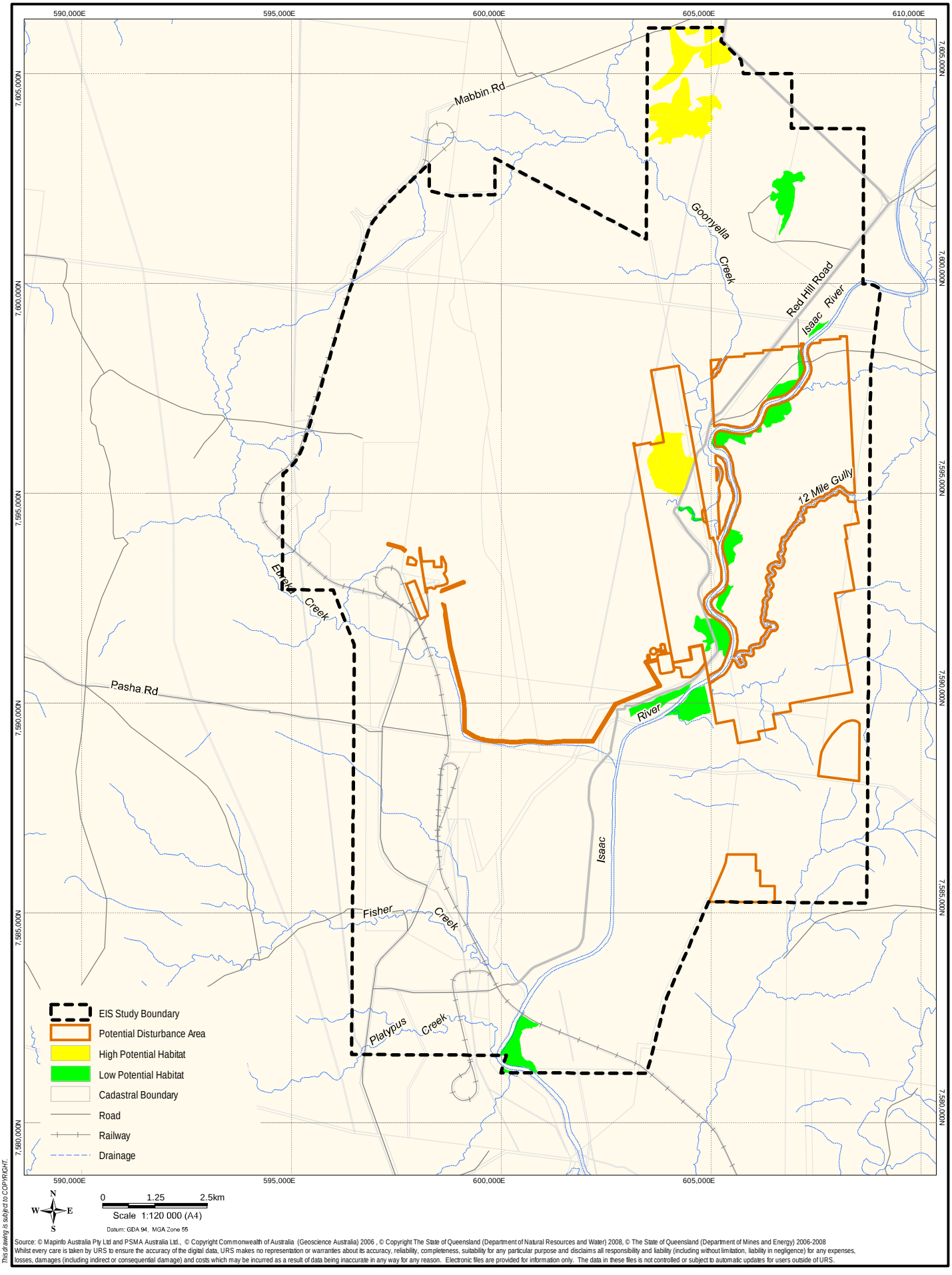
7.2.2.5 Current Pressures

DSEWPaC (2012b) do not identify any key threats to the species. General threats to the species include clearing for agriculture or conversion to improved pastures which has heavily fragmented the speciesô native grassland habitat. Remaining habitat is threatened by degradation from mechanical disturbance, invasive weeds and unsustainable grazing regimes. The species is considered highly palatable to stock and its habitat may be subject to over-grazing.

7.2.2.6 Management and Recovery Plans

Clearing of *Dichanthium queenslandicum* is regulated under federal and state legislation (EPBC Act and *Nature Conservation Act 1992* (NC Act)).

There is no Recovery Plan or Threat Abatement Plan for the species. Conservation Advice has been prepared for the species.



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POTENTIAL HABITAT FOR
Dichanthium queenslandicum

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Figure: **7-2**

File No: **42627136-g-2222.wor** Drawn: **VH/RG** Approved: **CT** Date: **21-08-2013** Rev.**A** A4

7.2.3 *Digitaria porrecta* (finger panic grass)

7.2.3.1 Current Distribution

The SPRAT database (DSEWPaC 2012c) does not identify any specific geographical areas as supporting important populations for the species. The species is known from four disjunct areas extending over a 1,000 kilometre range. Its Queensland distribution includes the scattered records in the Nebo district; the Central Highlands between Springsure and Rolleston; and from Jandowae south to Warwick. It is also known from NSW, from near Inverell, south to the Liverpool Plains near Coonabarabran and Werris Creek (TSSC 2008b). A single roadside herbarium record likely represents northern limit of the species distribution in Queensland. The largest population in Queensland occurs near Dalby and is estimated to host 2,900 individuals out of an estimated national population of 200,000 individual plants (TSSC 2008b).

7.2.3.2 Ecology

Digitaria porrecta is a perennial tussock-forming grass that can vegetatively reproduce; flowering is in summer or late summer (DEH 2012b). It usually occurs in grasslands on extensive basaltic plains, and in undulating woodlands and open forests with an underlying basaltic geology. It persists in disturbed habitats, such as fallow paddocks, but its capability to maintain a viable population is unknown (DSEWPaC 2012c).

In Queensland, it occurs in communities dominated by *Eucalyptus orgadophila* on hills and slopes and *E. tereticornis* and *E. populnea* in drainage lines.

7.2.3.3 Populations within the EIS Study Area

This species was not recorded within the EIS study area, however potential habitat is present and therefore it cannot be discounted.

The potential habitat mapping developed for this report (**Section 6.7**) identifies that 366 ha of high potential habitat and 306 ha of low potential habitat for the species may occur within the EIS study area (**Figure 7-3**).

7.2.3.4 Potential Habitat Mapping Criteria

The following criteria (**Table 7-3**) have been used to map potential habitat within the EIS study area.

Table 7-3 Potential Habitat Mapping Criteria

Habitat Category	Criteria
High Potential Habitat	RE 11.8.11
Low Potential Habitat	RE 11.3.2

7.2.3.5 Current Pressures

The primary threats identified for this species are habitat fragmentation, urban expansion, clearing of native habitat for cropping and pasture, over-grazing, frequent fires and destruction of habitat for road maintenance (DEH 2012b). Competition from introduced grasses such as Rhodes grass (*Chloris gayana*) and liverseed Grass (*Urochloa panicoides*) is also recognised as a potential threat.

7.2.3.6 Management and Recovery Plans

Clearing of *Digitaria porrecta* is regulated under federal and state legislation (EPBC Act, NC Act).

There is no Recovery Plan or Threat Abatement Plan for the species. Conservation Advice has been prepared for the species.

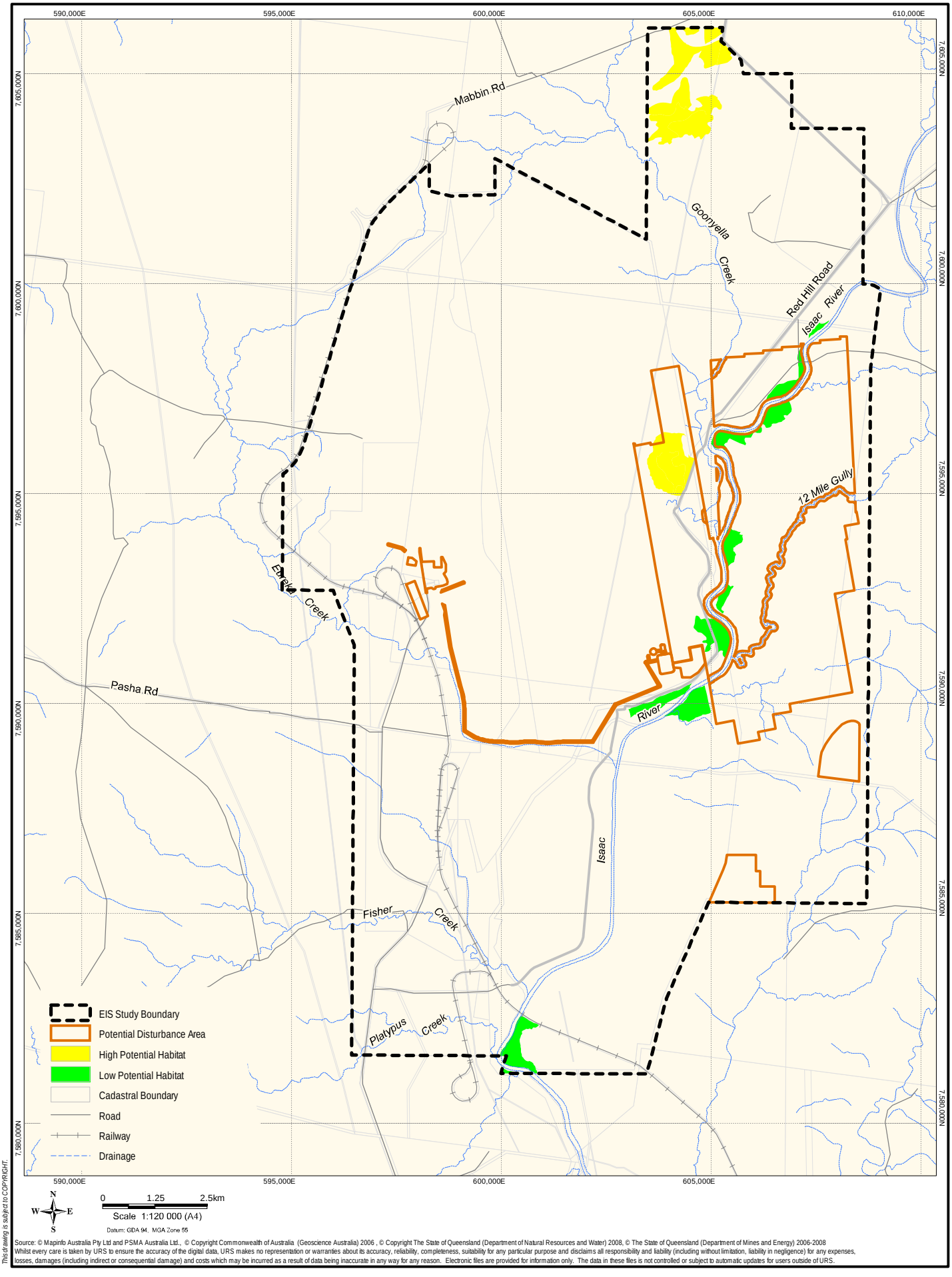
7.2.4 Natural Grasslands of the Queensland Central Highlands and the Northern Fitzroy Basin

7.2.4.1 Current Distribution

The natural grasslands TEC are native grasslands typically composed of perennial native grasses. They are found on soils that are fine textured (often cracking clays) derived from either basalt or fine-grained sedimentary rocks, on flat or gently undulating rises. These grasslands occur in areas with relatively high summer rainfall and a tree canopy usually absent, but when present projective crown cover is no more than 10 per cent (TSSC 2008c).

The natural grasslands TEC may be recognised by the following diagnostic features (as defined by TSSC 2008c):

- Distribution: It occurs within the Brigalow Belt North and South subregions, which are largely within the Central Highlands and northern Fitzroy River Basin regions of Queensland.
- Tree canopy absent or sparse (less than 10 per cent projective crown cover). If it can be demonstrated, beyond reasonable doubt, that the grassland was derived from cleared woodland then it is not part of the national ecological community.
- The ground layer is typically dominated by perennial native grasses and contains at least three of the indicator native species listed below:
  - feather-top wiregrass (*Aristida latifolia*);
  - white speargrass (*Aristida leptopoda*);
  - hoop Mitchell grass (*Astrebla elymoides*);
  - curly Mitchell grass (*Astrebla lappacea*);
  - bull Mitchell grass (*Astrebla squarrosa*);
  - satin-top grass (*Bothriochloa erianthoides*);
  - king bluegrass (*Dichanthium queenslandicum*);
  - Queensland bluegrass (*Dichanthium sericeum*);
  - cup grass (*Eriochloa crebra*);
  - native millet (*Panicum decompositum*);
  - yabila grass (*Panicum queenslandicum*);
  - shot grass (*Paspalidium globoideum*); and
  - coolibah grass (*Thellungia advena*).



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POTENTIAL HABITAT FOR
Digitaria porrecta

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Figure: **7-3**

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In Queensland, the natural grasslands TEC that has been listed under the EPBC Act is defined by reference to the following REs: REs 11.3.21, 11.4.4, 11.4.11, 11.8.11, 11.9.3, 11.9.12, and 11.11.17. Under the provisions of the VM Act two of these REs (i.e. 11.3.21 and 11.9.12) are listed as endangered, two (i.e. 11.8.11 and 11.11.17) are listed as of concern.

7.2.4.2 Ecology

The floristic composition of the natural grasslands TEC has been relatively well documented (Fensham *et al.* 1999) and typically includes a number of native and exotic grass and forb species. A number of perennial native grasses are used as typical indicator species including *Dichanthium* spp., *Aristida* spp., *Astrebla* spp. *Panicum* spp., *Eriochloa* spp. Canopy trees may be present including *Eucalyptus orgadophila*, *E. melanophloia*, and *Corymbia erythrophloia*. However, if present, these species are sporadically distributed as scattered individuals (Beeton 2007).

The natural grasslands TEC may be found growing on a variety of landforms, including quaternary alluvial systems, clay plains not currently associated with current alluvium, plains and hills on Cainozoic flood basalts, and undulating landscapes on more or less horizontally bedded fine grained sedimentary rocks (Sattler and Williams 1999).

7.2.4.3 Populations within the EIS Study Area

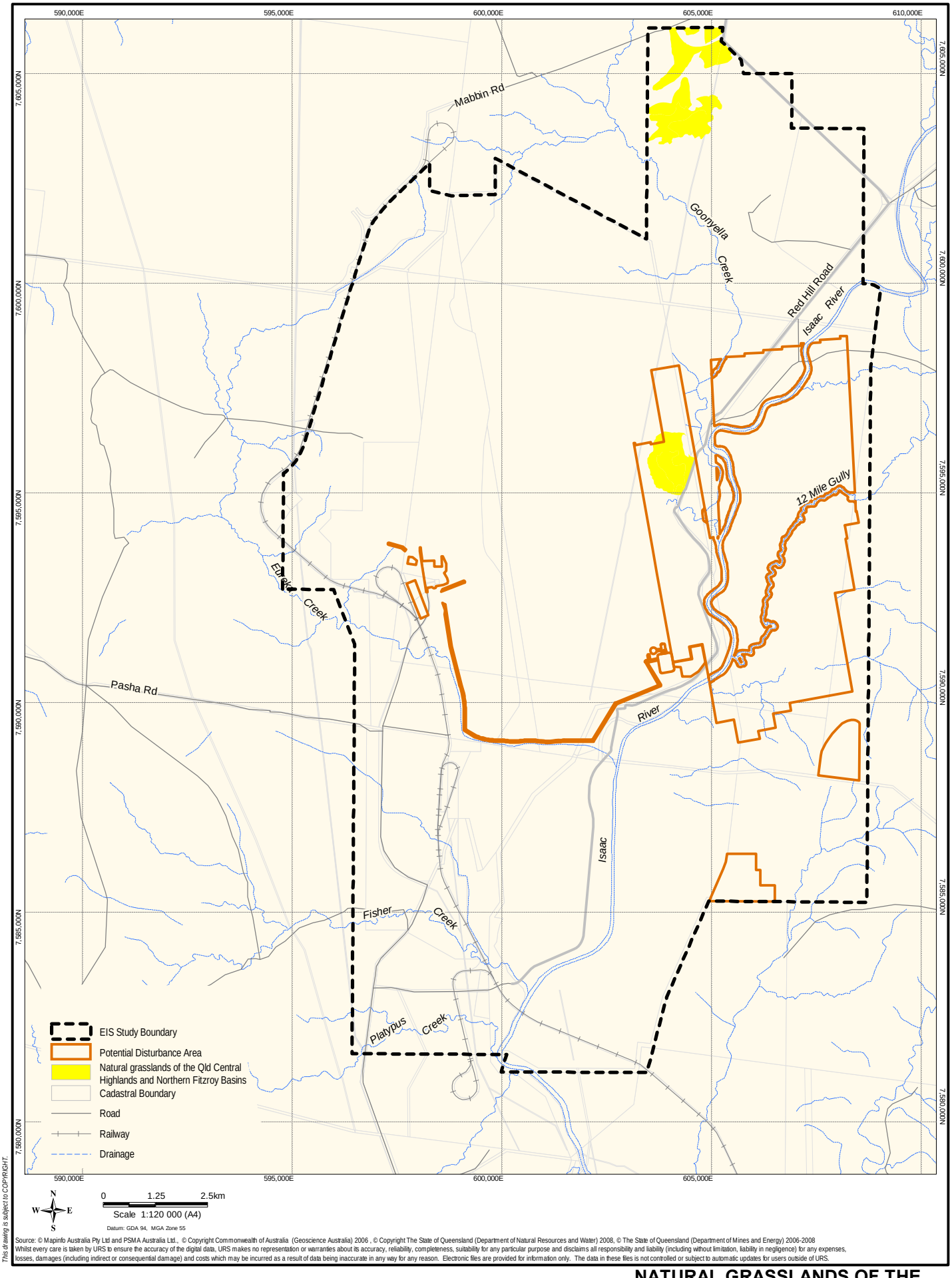
The natural grasslands TEC occurs at two locations within the eastern section of the EIS study area (refer **Figure 7-4**). These areas are comprised primarily of native species including *Dichanthium sericeum, Aristidia leptopoda* and *Panicum decompositum,* and scattered shrubs including *Owenia acidula* and *Acacia salicina,* although intrusion of parthenium weed grass is apparent. Approximately 366 hectares of the natural grasslands TEC is present within the EIS study area.

7.2.4.4 Current Pressures

The primary threats identified for the *Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin* include: Grazing, cropping, pasture improvement; weed invasion pest animals; mining activities; construction of roads and other infrastructure (Beeton 2007).

Of the major threats ongoing conversion from native pastures to cropping systems is identified as a primary concern (DEWHA 2007). In addition, when overgrazed, this TEC is susceptible to invasion by exotic flora species such as parthenium, which subsequently lowers its value for grazing purposes.

Grazing is considered the predominant land use to which remaining patches of the grasslands are subject. Persistent heavy grazing can degrade grasslands and increases the risk of weed invasion. It leads to the elimination of palatable species reducing habitat quality (Tremont 1994; Fensham *et al*.1999; Dorrough *et al.* 2004).



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NATURAL GRASSLANDS OF THE QUEENSLAND CENTRAL HIGHLANDS AND THE NORTHERN FITZROY BASIN THREATENED ECOLOGICAL COMMUNITY

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Figure: 7-4

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7.2.4.5 Management and Recovery Plans

Clearing of the natural grassland TEC is regulated under federal legislation (EPBC Act). Within Queensland four of the seven REs which constitute this TEC (i.e. REs 11.3.21, 11.8.11, 11.9.12 and 11.11.17) are listed as significant under the provisions of the VM Act.

A draft recovery plan for the natural grasslands TEC was prepared in 2007 (Butler 2007). Specific objectives proposed for the recovery plan are to:

- Maintain the remnant areas of the bluegrass grassland TEC in subregions in which its extent is 30 percent or less of its pre-clearing extent and, in other subregions, maintain the remnant areas of the bluegrass grassland TEC that are either known habitat for threatened species, are infrequently grazed, or are larger than 50 ha in area.
- Improve the condition of bluegrass grasslands across the Brigalow Belt.
- Maintain or enhance populations and knowledge of threatened flora and fauna from bluegrass grasslands, such as grazing sensitive plants.
- Improve knowledge of key ecosystem components, such as perennial grasses and legumes, and identify appropriate management practices that will contribute to item two above.

7.2.5 Brigalow (*Acacia harpophylla* Dominant and Co-dominant)

7.2.5.1 Current Distribution

The brigalow TEC is characterised by the presence of brigalow (*Acacia harpophylla*) as one of the three most abundant tree species. Brigalow is usually either dominant in the tree layer or co-dominant with other species such as belah (*Casuarina cristata*). The structure of the vegetation ranges from open forest to open woodland. The height of the tree layer varies from approximately nine metres in low rainfall areas to approximately 25 metres in higher rainfall areas (DSEWPaC 2012d).

Within Queensland, the brigalow TEC comprises the following 16 REs:

- RE 6.4.2 - *Casuarina cristata* +/- *Acacia harpophylla* open forest on clay plains;
- RE 11.3.1 - *Acacia harpophylla* and/or *Casuarina cristata* open forest on alluvial plains;
- RE 11.4.3 - *Acacia harpophylla* and/or *Casuarina cristata* shrubby open forest on Cainozoic clay plains;
- RE 11.4.7 - Open forest of *Eucalyptus populnea* with *Acacia harpophylla* and/or *Casuarina cristata* on Cainozoic clay plains;
- RE 11.4.8 - *Eucalyptus cambageana* open forest with *Acacia harpophylla* or *A. argyrodendron* on Cainozoic clay plains;
- RE 11.4.9 - *Acacia harpophylla* shrubby open forest with *Terminalia oblongata* on Cainozoic clay plains;
- RE 11.4.10 - *Eucalyptus populnea* or *E. pilligaensis, Acacia harpophylla*, *Casuarina cristata* open forest on margins of Cainozoic clay plains;
- RE 11.5.16 - *Acacia harpophylla* and/or *Casuarina cristata* open forest in depressions on Cainozoic sand plains/remnant surfaces;

- RE 11.9.1 - *Acacia harpophylla-Eucalyptus cambageana* open forest on Cainozoic fine-grained sedimentary rocks;
- RE 11.9.5 - *Acacia harpophylla* and/or *Casuarina cristata* open forest on Cainozoic fine-grained sedimentary rocks;
- RE 11.9.6 - *Acacia melvillei* Ñ *A. harpophylla* open forest on Cainozoic fine-grained sedimentary rocks;
- RE 11.11.14 - *Acacia harpophylla* open forest on deformed and metamorphosed sediments and interbedded volcanics;
- RE 11.12.21 - *Acacia harpophylla* open forest on igneous rocks; colluvial lower slopes;
- RE 12.8.23 - *Acacia harpophylla* open forest on Cainozoic igneous rocks;
- RE 12.9-10.6 - *Acacia harpophylla* open forest on sedimentary rocks; and
- RE 12.12.26 - *Acacia harpophylla* open forest on Mesozoic to Proterozoic igneous rocks.

In Queensland, about 85 per cent of the brigalow TEC remnants occur on flat to gently undulating Cainozoic clay plains that are not associated with current alluvium, and on gently undulating landscapes on more or less horizontally bedded fine grained sedimentary rocks. About 10 per cent of remnants are associated with river and creek flats, and the remainder with old loamy and sandy plains, basalt plains and hills, or hills and lowlands on metamorphic or granitic rocks (DSEWPaC 2012d).

The brigalow TEC extends from south of Charters Towers in Queensland, in a broad swathe east of Blackall, Charleville and Cunnamulla, south to northern New South Wales near Narrabri and Bourke (DSEWPaC 2012d).

In Queensland, the TEC occurs predominantly within the Brigalow Belt North, Brigalow Belt South, Darling Riverine Plains and Southeast Queensland bioregions, with smaller amounts in the Mitchell Grass Downs, Mulga Lands and Einasleigh Uplands bioregions (DSEWPaC 2012d).

7.2.5.2 Ecology

The floristic composition of the brigalow TEC is relatively well documented. In the southern Brigalow Belt, brigalow is commonly found with belah, however, sometimes monotypic stands are present (Johnson 1964). Common understorey species include *Geijera parviflora* (wilga), *Eremophila mitchelli* (sandalwood), *Heterodendrum diversifolium* (boonaree), *Eremocitrus glauca* (lime bush), *Myoporum deserti* (Ellangowan poison bush) and *Melaleuca bracteata* (black tea tree) (Johnson 1964).

In mature stands, the grass/herbaceous layer is sparse and ephemeral. Where present, the ground layer is characterised by genera such as *Atriplex*, *Bassia*, *Chloris*, *Leptochloa*, *Paspalidium* and *Sporobolus*, which tend to be more prominent in years where rainfall exceeds the mean (Isbell 1962). Brigalow tend to have short, dense tree and shrub layers, with understorey dominated by edge species. In contrast, wider stands display more open tree and shrub layers, as well as spatial variation in species and structure (West *et al.* 1999). Five broad soil groups support Brigalow dominated vegetation (Isbell 1962):

- deep gilgaied clay soils;
- sedentary clay soils;

- alluvial clay soils;
- miscellaneous deep clay soils; and
- light-textured red soils.

The two main clay groups (deep gilgaied clays and sedentary clays) cover approximately 86 per cent of the Brigalow Belt (Bradley 2006). The phrase ógilgaied soilôis used to refer to soils with alternating mounds and depressions, which result in an irregular, undulating land surface.

Brigalow vegetation has a recognised tendency to develop extensive horizontal root systems, typical of trees in environments where there is no access to the groundwater table (West *et al.* 1999, van Noordwijk *et al.* 1996). Johnson (1964) observed lateral roots in the upper 90 centimetres of the soil profile being well developed in the top 30 centimetres. Tunstall and Connor (1981) completed a hydrological study of a mature Brigalow community and found that most of the soil water fluctuations underneath Brigalow trees occurred in the top one metre section of the soil.

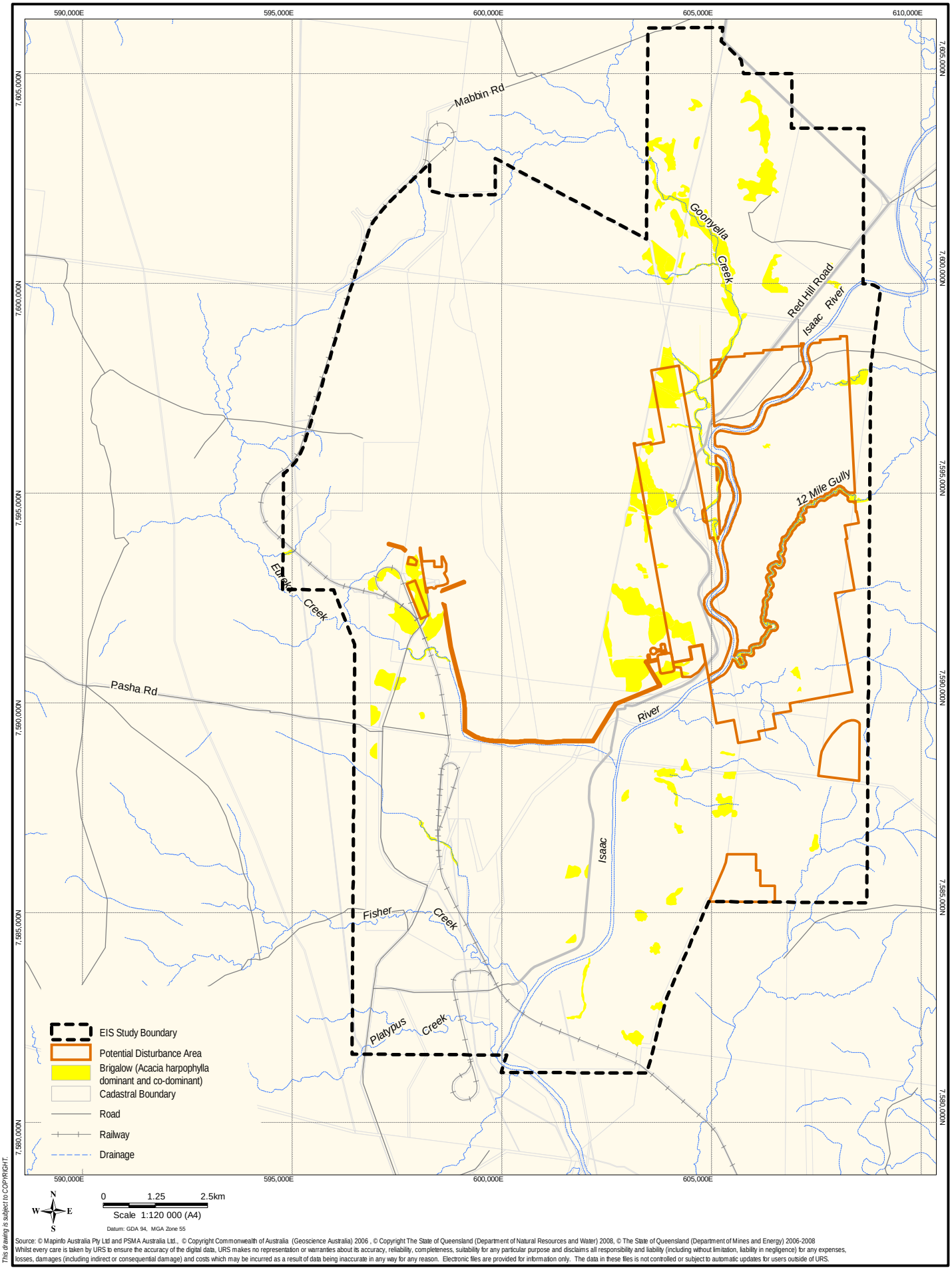
A distinctive feature of Brigalow vegetation is its capacity to sucker freely from an extensive system of shallow, lateral roots. Suckering is initiated when there is damage to aerial parts of the vegetation or to lateral roots (Nix 1994). Brigalow communities are particularly susceptible to fire, with hot fires being able to burn mature vegetation (Butler and Fairfax 2003). Under most circumstances the practice of burning tends to induce suckering from lateral Brigalow roots (Johnson 1964). If no further management is applied to a burnt Brigalow community, it is likely to revert to its original condition. If an area has been cultivated for a number of consecutive years Brigalow suckering is likely to be negligible. In terms of regrowth development, the average growth rate of Brigalow suckers has been measured at approximately 30 centimetres in height each year over the first 5 to 10 years, with growth being particularly rapid in the early stages (Johnson 1964). The growth rate of Brigalow tends to slow down after 10 to 15 years, being extremely slow from 20 years onwards.

7.2.5.3 Populations within the EIS Study Area

The brigalow TEC occurs within the EIS study area in several locations (refer **Figure 5-3**). All Brigalow stands are generally in poor condition with evidence of dieback and a high level of buffel grass invasion within the understorey. Native flora species are sparsely distributed within the mid and low strata of the stands present on site. Approximately 1,094 hectares of the brigalow TEC is present within the EIS study area (**Figure 7-5**).

7.2.5.4 Current Pressures

The brigalow TEC once occupied approximately seven million hectares in Queensland. This area has been reduced to approximately 660,000 hectares, primarily as a result of land clearing for agricultural development (Bradley 2006). The southern Brigalow Belt has been extensively cleared over the last 200 years. As a result, vegetation communities, flora and fauna, including several species of reptiles, have become threatened. Many of these reptiles are endemic.



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BRIGALOW (ACACIA HARPOPHYLLA DOMINANT AND CO-DOMINANT) THREATENED ECOLOGICAL COMMUNITY

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Figure: 7-5

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7.2.5.5 Management and Recovery Plans

Clearing of the brigalow TEC is regulated, with all 16 of the REs which characterise the community in Queensland being listed as endangered under the VM Act.

The national recovery plan for the brigalow TEC was prepared in 2007 (Butler 2007). Specific objectives proposed for the recovery plan are to:

- increase the area of the Brigalow ecological community and its representation in conservation reserves;
- improve knowledge of the Brigalow ecological community and its condition as habitat for native species; and
- mitigate key threats to the Brigalow ecological community by controlling fire, weeds and animal pests.

7.2.6 Squatter Pigeon (*Geophaps scripta scripta*)

7.2.6.1 Current Distribution

The range of the squatter pigeon extends from Cape York Peninsula south through central Queensland to northern inland NSW. The southern subspecies is found south of Proserpine and the Burdekin River (Higgins and Davies 1996; Schodde and Tideman 1997). Over 100 records of this species have been made in the Brigalow Belt South Bioregion. Queensland remains an important stronghold for this species as it has declined markedly in many parts of its range since 1905 (Storr 1973; Garnett 1992a; Ayers 1996).

7.2.6.2 Ecology

The squatter pigeon forages on the ground in pairs or small flocks on a wide range of seeds, including grasses, legumes, trees and shrubs, also occasionally takes insects (Crome 1976; Frith 1982). It feeds during the day on the ground and at night roosts on low branches. It constructs a shallow scrape lined with grass in sheltered locations on the ground, such as beneath grass tussocks, bushes or fallen logs (Crome 1976; Higgins and Davies 1996). The movements of this pigeon are poorly understood, with some evidence that it is locally nomadic (Blakers *et al*. 1984; Higgins and Davies 1996).

7.2.6.3 Populations within the Study Area

Squatter pigeons have been recorded in the EIS study area during six separate events. These include surveys undertaken by:

- WBM in 1998, 2000 and 2002; and
- URS in 2005, 2009 and 2011.

The observations are clustered in two areas and are likely to represent a viable population using the site (refer **Figure 5-4**). All individuals were observed in areas which have been grazed and have some level of habitat degradation, and their occurrence may reflect the nearby presence of water rather than food resources, or be simply a result of increased visibility improving the likelihood of detection. Although known to occur within the EIS study area and surrounds, potential habitat mapping

was not undertaken for the squatter pigeon because the speciesô habitat preferences were not able to be accurately represented by the key data sources used in the mapping process. Whilst there is potential for habitat within the entire area to be used by the squatter pigeon, only a very small proportion will be used at any one time and that usage cannot be predicted.

7.2.6.4 Current Pressures

Known pressures on the squatter pigeon include the following:

- Habitat loss: destruction and fragmentation of habitat due to the clearing of woodland for cropping lands and improved pastureland, which removes foraging and breeding habitat (Garnett 1992a).
- Habitat degradation: degradation of remaining habitat due to over-grazing by livestock and rabbits (Garnett 1992a; Higgins and Davies 1996). For example, cattle grazing combined with drought in 1902 apparently caused a population decline in the Dawson River valley (Campbell and Barnard 1917; Barnard 1925).
- Grazing: reduces or eliminates vegetative cover used by the species for cover and breeding purposes; reduces the availability of perennial grasses and herbaceous plants (important dietary sources); and nests are vulnerable to trampling (Blakers *et al.* 1984; Garnett 1992a; Ayers 1996).

Suspected pressures on the squatter pigeon include the following:

- feral animals: predation by foxes and cats (Blakers *et al.* 1984);
- fire: inappropriate fire regimes, particularly during the breeding season;
- weeds: proliferation of exotic grasses (e.g. buffel grass) may reduce the dietary diversity, particularly the availability of perennial grasses and herbaceous plants; and
- other factors: the species may still be vulnerable to illegal hunting in certain localities (Crome 1976), as well as trapping for the bird trade (Garnett 1992b). Mortality may also occur due to ingestion of poisoned grain in aerially broadcast strychnine baits for house mice (Brown and Lundie-Jenkins 1999).

7.2.6.5 Management and Recovery Plans

Currently no Recovery Plan or Threat Abatement Plan has been prepared for this species. Conservation Advice has been prepared for the squatter pigeon. The squatter pigeon is listed as Vulnerable under the NC Act and is subject to regulations under this Act.

7.2.7 Ornamental Snake (*Denisonia maculata*)

7.2.7.1 Current Distribution

The ornamental snake is found in the Dawson and Fitzroy River drainages of central coastal Queensland (Ehmann 1992).

7.2.7.2 Ecology

The ornamental snake occurs in low-lying areas with deep-cracking clay soils that are subject to seasonal flooding, and in adjacent areas of clay and sandy loams. The species is found in woodlands

and shrublands, such as Brigalow, and in riverine habitats, and lives in soil cracks and under fallen timber. It is a secretive and nocturnal species and feeds almost entirely on frogs, though lizards may very occasionally be eaten (Ehmann 1992; Wilson 2005; Wilson and Swan 2008).

7.2.7.3 Populations within the EIS Study Area

The ornamental snake was recorded during surveys in 2006 by Ecoserve and 2011 by URS (**Figure 5-4**). These records tend to indicate a continued presence of the species within the EIS survey area. The ornamental snake was also recorded adjacent to the west of the EIS study area during pipe trenching operations for the North Queensland Gas Pipeline in 2004. This data was used to map Essential Habitat for this species along the pipeline in the northwest of the survey area, external to the EIS study area (**Figure 5-4**) (EHP 2012c).

The potential habitat mapping developed for this report (**Section 6.7**) identifies that 2,571 ha of high potential habitat and 1,049 ha of low potential habitat for the species may occur within the EIS study area (refer to **Figure 7-6**).

7.2.7.4 Potential Habitat Mapping Criteria

Table 7-4 presents the criteria that have been used to map potential habitat within the EIS study area.

Table 7-4 Potential Habitat Mapping Criteria

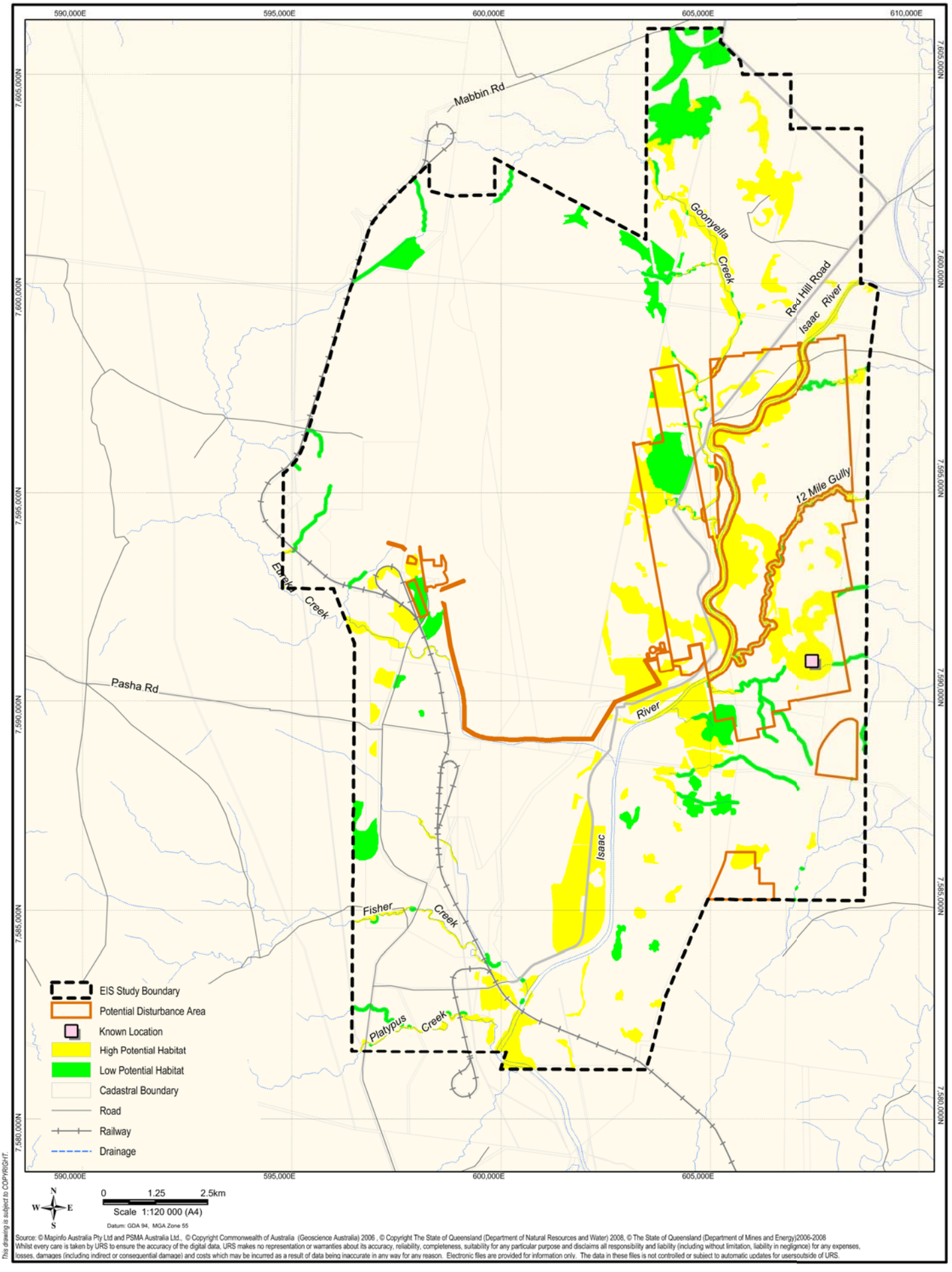
Habitat Category	Criteria
Known location	GPS locations from field surveys
High Potential Habitat	500 m buffer around known locations REs: 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.25, 11.4.2, 11.4.7, 11.4.8, 11.4.9
Low Potential Habitat	50 m buffer around watercourses with non-remnant vegetation REs: 11.5.16, 11.8.11, 11.9.1 Non-remnant *Acacia harpophylla* shrubland on Land Zone 4

7.2.7.5 Current Pressures

Threats to this species are uncertain. It is likely to be susceptible to habitat destruction, habitat degradation through overgrazing and inappropriate fire regimes, poisoning by attempted predation on cane toads, predation by feral predators, and a decline in prey abundance (McFarland *et al.* 1999).

7.2.7.6 Existing Controls and Planning Regimes

There is a draft national Recovery Plan in preparation for the ornamental snake and other reptiles of the Brigalow Belt Bioregion (Richardson 2006). While there is no Recovery Plan or Threat Abatement Plan for the species, Conservation Advice has been prepared for the ornamental snake. The ornamental snake is listed as Vulnerable under the Queensland NC Act and is subject to regulations under this Act.



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POTENTIAL HABITAT FOR ORNAMENTAL SNAKE *(Denisonia maculata)*

URS

EPBC REPORT

Figure: 7-6

File No: 42627136-g-2228.wor Drawn: VH/RG Approved: CT Date: 21-08-2013 Rev.A A4

7.2.8 Koala (*Phascolarctos cinereus*) (combined populations of Qld, NSW and the ACT)

7.2.8.1 Current Distribution

Koalas inhabit a range of temperate, sub-tropical and tropical forest, woodland and semi-arid communities dominated by species from the genus *Eucalyptus* (Martin and Handasyde 1999 in DSEWPaC 2013b). The distribution of koalas is also affected by altitude (limited to <800 metres ASL), temperature and, at the western and northern ends of the range, leaf moisture (Munks *et al*. 1996 in DSEWPaC 2013b).

Within central Queensland, koalas have been studied at Tambo (Mitchell Grass Downs bioregion), Springsure and Blair Athol (both in Brigalow Belt North bioregion). Koalas in this region typically occur in low densities and have large home ranges (Ellis *et al*. 2002 in DSEWPaC 2013b).

7.2.8.2 Ecology

The koala is heavily reliant on eucalypt leaves, a diet that is extremely energy constraining. As a result, the koala is very inactive and spends around 19 hours per day sleeping (Curtis *et al*. 2012). Koalas can live to 15 years of age in the wild (Curtis *et al*. 2012) and females can potentially produce one offspring per year (McLean 2003 in DSEWPaC 2013b). Young are born between October and May and occupy the pouch for 6 to 8 months (Curtis *et al*. 2012).

7.2.8.3 Populations within the Survey Area

A solitary koala was observed to the south-west of the EIS study area within poplar box (*Eucalyptus populnea*) woodland. The paucity of observations of the species across all survey events suggests that it is sparsely distributed within the region.

The potential habitat mapping developed for this report (**Section 6.7**) identifies that 5,250 hectares of potential habitat for the species may occur within the EIS study area (**Figure 7-7**). Data are not available for specific habitat preferences within this identified potential habitat so the area figure above is a conservative estimate.

7.2.8.4 Potential Habitat Mapping Criteria

The following criteria (**Table 7-5**) have been used to map potential habitat within the EIS study area.

Table 7-5 Potential Habitat Mapping Criteria

Habitat Category	Criteria
Potential Habitat	REs 11.3.2, 11.3.3, 11.3.4, 1.3.25, 11.3.6, 11.4.2, 11.4.7, 11.4.8, 11.5.3, 11.5.9

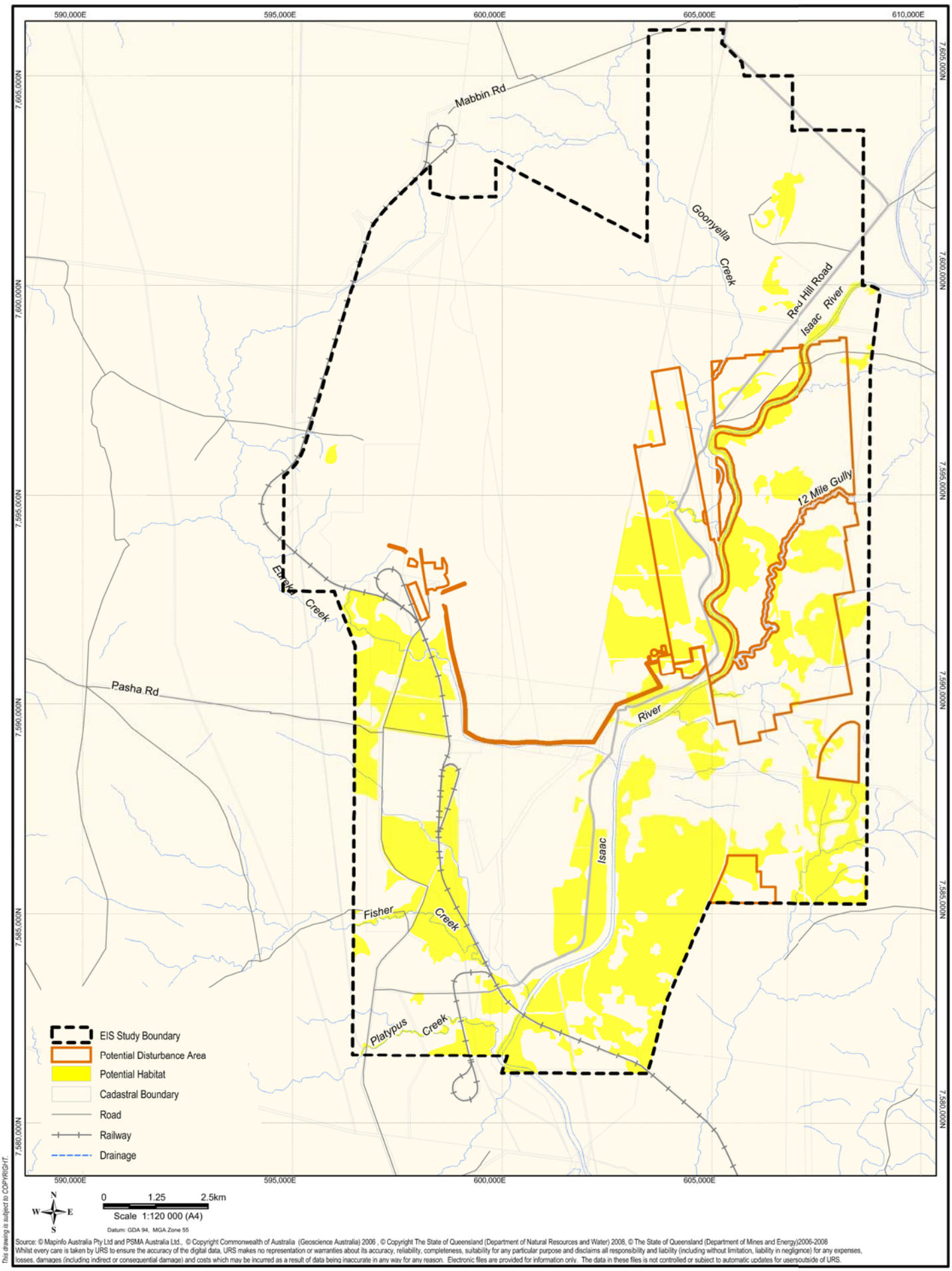
7.2.8.5 Current Pressures

Curtis *et al*. (2012) note that in south-east Queensland, the koala is at threat from habitat clearing and urbanisation and associated issues such as dogs, road kills, habitat fragmentation, inappropriate fire management and disease.

In central Queensland, threats include habitat clearing for agriculture and grazing, unmanaged fires and predation from feral animals such as dogs and foxes.

7.2.8.6 Management and Recovery Plans

There are no recovery or management plans for the koala in central Queensland. The *Nature Conservation (Koala) Conservation Plan 2006* and *Management Program 2006-2016* relate to koalas in the south-east Queensland bioregion. In the remainder of Queensland, the koala is 'of least concern' (common), but is still protected under the Queensland NC Act.



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POTENTIAL HABITAT FOR KOALA *(Phascolarctos cinereus)*

URS | EPBC REPORT | Figure: 7-7

File No: 42627136-g-2227.wor | Drawn: VH/RG | Approved: CT | Date: 21-08-2013 | Rev.A | A4

Section 08 Significant Impact Criteria Assessments and Proposed Mitigation Measures

8.1 Introduction

This section describes the potential impacts of the project on MNES assessed against the Significant Impact Criteria in the EPBC Act (Environment Australia 2000), and the mitigation measures available for each impact. When effective mitigation measures are not available, compensatory measures to offset unavoidable impacts have been proposed and are discussed further in **Section 8.3**.

The potential impacts on MNES and potential habitat are described below. The potential impact on each MNES has been assessed following review of all project components, including:

- clearing for incidental mine gas infrastructure and subsidence associated with the RHM and Broadmeadow extension; and
- direct clearing for surface facilities (Red Hill MIA, Red Hill accommodation village, conveyor, and Red Hill CHPP).

The areas impacted by development of the RHM underground footprint and Broadmeadow extension are considered as a maximum worst case. In reality, the actual disturbance will be significantly less as the clearing works required for IMG drainage are anticipated to only disturb a maximum of 50 per cent of the mapped areas. A worst case 100 per cent has been shown for each MNES.

Impacts on vegetation and habitat will occur throughout the life of the project. On commencement of construction, areas required for the accommodation village, Red Hill MIA, Red Hill CHPP, and conveyor will be cleared. As the footprints of these facilities will be fully developed, 100 per cent of vegetation will be cleared from these areas.

IMG drainage infrastructure will be installed as early as possible to allow adequate time to drain gas prior to mining. This is discussed further in **Section 3.8** of the Red Hill Mining Lease EIS. In terms of surface disturbance, installation of the IMG drainage infrastructure will result in a mosaic of clearing throughout the life of the project.

As mining progresses, the mined out panels will subside resulting in a change in topography. Modelling has been undertaken on a conservative basis and predicts average subsidence of three to five metres and maximum subsidence of up to six metres across portions of the RHM footprint, as discussed in **Section 3.6.5** of the Red Hill Mining Lease EIS. While there is no direct removal of surface vegetation required over the subsided areas, changes in topography and surface drainage could alter conditions in many of the subsided areas.

Each of these impacts pertaining to specific MNES values are discussed below.

8.2 Assessment of Impacts

Two TECs and six nationally threatened species were recorded either within the vicinity of the EIS study area or have the potential to occur within the vicinity of the EIS study area. This includes:

- three flora species:
  - *Dichanthium queenslandicum* (king bluegrass);

- *Dichanthium setosum* (bluegrass); and
- *Digitaria porrecta* (finger panic grass);

- two ecological communities:
  - *Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin*; and
  - *Brigalow (Acacia harpophylla dominant and co-dominant)*;
- seven fauna species:
  - squatter pigeon;
  - ornamental snake; and
  - koala.

8.2.1 *Dichanthium setosum* (bluegrass)

This species is listed as vulnerable under the EPBC Act. An assessment of the significance of impacts on this species under the assessment guidelines of the EPBC Act (Environment Australia 2000) is provided in **Table 8-1**.

Table 8-1 Assessment of Significance of Impact on Listed Threatened Species – *Dichanthium setosum*

EPBC Act Criteria	Assessment of Significance
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	*Dichanthium setosum* is an upright perennial grass less than 1 m tall. It has mostly hairless leaves about 2-3 mm wide. The flowers are densely hairy and clustered together along a stalk in a cylinder shape and appear mostly during summer. The species can form pure swards or occur as scattered clumps. The species is often found in moderately disturbed areas such as cleared woodlands, grassy roadside remnants and highly disturbed pasture. It is uncertain if this species tolerates or is promoted by a certain level of disturbance. Associated species include *Eucalyptus albens, Leptorhynchos squamatus* and *Calotis hispidula*. A fire frequency of five years is considered to be appropriate for the species. *Dichanthium setosum* has been recorded in the east of the EIS study area (refer **Figure 5-1**) where it was observed within RE 11.8.11 (*Dichanthium sericeum* (Queensland bluegrass) grassland on Cainozoic igneous rocks) which forms part of the *Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin* TEC. Only one specimen of *Dichanthium setosum* was observed during the 2009 URS field survey. However, the area was heavily grazed at the time of survey and it is anticipated that additional specimens would be recorded with decreased grazing pressure and improved growing conditions.
Lead to a long-term decrease in the size of an important population of a species.	Based upon habitat mapping (**Figure 7-1**) 114 ha of high potential habitat and 13 ha of low potential habitat for this species could potentially be impacted as a result of the proposed action. With mitigation through measures proposed in **Section 8.3** and offsetting of residual impact, the result of the proposed action would not significantly reduce the extent of these habitats. It is expected that any possible decrease in any local population would be minor and temporary. See **Section 6.6** for detail on offsetting.
Reduce the area of occupancy of an important population.	It is expected that any reduction in the extent of this possible local population of the species would be minor.

EPBC Act Criteria	Assessment of Significance
Fragment an existing important population into two or more populations.	No important population of this species would be fragmented due to the proposed action.
Adversely affect habitat critical to the survival of a species.	There is no habitat present in the area of impact that is critical to the survival of the species. All potential habitat within the EIS study area is currently substantially compromised due to heavy grazing.
Disrupt the breeding cycle of an important population.	It is expected that any disruption to any possible local population of the species would be minor and temporary.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	The project has the potential to facilitate the spread of weed species which could potentially reduce the quality of habitat available to the species. A detailed pest management plan will be developed for the project to mitigate and manage the potential spread of pest flora and fauna species. The proposed action is considered unlikely to decrease habitat availability to the extent that the species is likely to decline given the impact area forms only a small portion of the known distribution of the species and that impact will be managed through the proposed mitigation commitments.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable speciesô habitat.	Invasive flora has been identified as a key threat to the species (DSEWPaC 2013a) with species known to impact *Dichanthium setosum* including invasive grasses such as such as *Hyparrhenia hirta* (coolatai grass), *Phyla canescens* (lippia) and *Eragrostis curvula* (African lovegrass). A detailed pest management plan will be developed to mitigate and manage the potential spread of pest flora and fauna species. Species-specific management will be undertaken for identified key weed species at risk of spread through project activities. Weed control efforts will be increased in areas particularly sensitive to invasion.
Introduce disease that may cause the species to decline.	Disease has not been identified as a key threat to *Dichanthium setosum*. The implementation of a pest management plan will help control and prevent the establishment of invasive species (and associated diseases) as a result of the project.
Interfere with the recovery of the species.	Habitat rehabilitation and restoration activities using seed or seedlings of local provenance are likely to assist, rather than interfere, with the recovery of the species in the local area.

The assessment indicates that due to the limited disturbance to suitable habitat from the proposed action, mitigation of impacts through measures proposed in **Section 8.3** and offsetting of residual impact, the impacts of the project on *Dichanthium setosum* are unlikely to be significant.

8.2.2 *Dichanthium queenslandicum* (king bluegrass)

This species is listed as endangered under the EPBC Act. An assessment of the significance of impacts on this species under the assessment guidelines of the EPBC Act (Environment Australia 2000) is provided in **Table 8-2**.

Table 8-2 Assessment of Significance of Impact on Listed Threatened Species ï *Dichanthium queenslandicum*

EPBC Act Criteria	Assessment of Significance
An action is likely to have a significant impact on an endangered species if there is a real chance or possibility that it will:	King bluegrass is known from the Brigalow Belt bioregion. *Dichanthium queenslandicum* is a perennial tussock-forming grass that can vegetatively reproduce. The species occurs in subtropical, subhumid climatic zone on flat ground or gently undulating rises. It is found on fine textured cracking clays, often deep and dark in colour. This species was not recorded within the EIS study area, however potential habitat is present and therefore it cannot be discounted.
Lead to a long-term decrease in the size of a population.	Based upon habitat mapping (**Figure 7-2**) 114 ha of high potential habitat and 161 ha of low potential habitat for this species could potentially be impacted as a result of the proposed action. With mitigation through measures proposed in Section 8.3 and offsetting of residual impact, the result of the proposed action would not significantly reduce the local extent of these habitats. It is expected that any possible decrease in any possible local population of the species would be minor.
Reduce the area of occupancy of the species.	It is expected that any reduction in the area of occupancy of any possible local population of the species would be minor.
Fragment an existing important population into two or more populations.	If this species is present, any population is unlikely to be of a sufficient size for fragmentation to occur.
Adversely affect habitat critical to the survival of a species.	A lack of historical records and study records indicates that there is no habitat present that is critical to the survival of the species.
Disrupt the breeding cycle of a population.	It is expected that any disruption to any possible local population of the species would be minor and short-term.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	The project has the potential to facilitate the spread of weed species which could potentially reduce the quality of habitat available to the species. A detailed pest management plan will be developed for the project to mitigate and manage the potential spread of pest flora and fauna species. The proposed action is considered unlikely to decrease habitat availability to the extent that the species is likely to decline given the impact area forms only a small portion of the potential habitat within the known distribution of the species and that impact will be managed through the proposed mitigation commitments.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the critically endangered or endangered speciesô habitat.	A detailed pest management plan will be developed to mitigate and manage the potential spread of pest flora and fauna species. Species-specific management will be undertaken for identified key weed species at risk of spread through project activities. Weed control efforts will be increased in areas particularly sensitive to invasion.
Introduce disease that may cause the species to decline.	Disease has not been identified as a key threat to *Dichanthium queenslandicum*. The implementation of a pest management plan will help control and prevent the establishment of invasive species (and associated diseases) as a result of the project.
Interfere with the recovery of the species.	The species is not known to occur in the EIS study area, however, habitat rehabilitation and restoration activities using seed or seedlings of local provenance are likely to assist, rather than interfere, with the recovery of the species in the local area.

The assessment indicates that the limited disturbance to suitable habitat from proposed action, mitigation of impacts through measures proposed in **Section 8.3** and offsetting of residual impact, the impacts of the project on *Dichanthium queenslandicum* are unlikely to be significant.

8.2.3 *Digitaria porrecta* (finger panic grass)

This species is listed as endangered under the EPBC Act. An assessment of the significance of impacts on this species under the assessment guidelines of the EPBC Act (Environment Australia 2000) is provided in **Table 8-3**.

Table 8-3 Assessment of Significance of Impact on Listed Threatened Species ï *Digitaria porrecta*

EPBC Act Criteria	Assessment of Significance
An action is likely to have a significant impact on an endangered species if there is a real chance or possibility that it will:	Finger panic grass occurs in four disjunct areas extending over 1,000 km. In Queensland, it occurs in the Nebo district, south-west of Mackay; the Central Highlands between Springsure and Rolleston; and from Jandowae south to Warwick. In NSW it occurs from near Inverell, south to the Liverpool Plains. Its population is estimated to be 200,000 individuals with 75% occurring in NSW. The species is a perennial tussock-forming grass that can vegetatively reproduce; flowering is in summer or late summer. It usually occurs in grasslands on extensive basaltic plains, and in undulating woodlands and open forests with an underlying basaltic geology. It persists in disturbed habitats, such as fallow paddocks, but its capability to maintain a viable population is unknown. In Queensland, it occurs in communities dominated by *Eucalyptus orgadophila* on hills and slopes and *E. tereticornis* and *E. populnea* in drainage lines. This species was not recorded within the EIS study area, however potential habitat is present therefore it cannot be discounted.
Lead to a long-term decrease in the size of a population.	Based upon habitat mapping (**Figure 7-3**), 114 ha of high potential habitat and 154 ha of low potential habitat for this species could potentially be impacted as a result of the proposed action. With mitigation through measures proposed in **Section 8.3** and offsetting of residual impact, the result of the proposed action would not significantly reduce the local extent of these habitats. It is expected that any possible decrease in any possible local population of the species would be minor.
Reduce the area of occupancy of the species.	It is expected that any reduction in the area of occupancy of any possible local population of the species would be minor.
Fragment an existing population into two or more populations.	If this species is present, any population is unlikely to be of a sufficient size for fragmentation to occur.
Adversely affect habitat critical to the survival of a species.	A lack of historical records and study records indicates that there is no habitat present that is critical to the survival of the species.
Disrupt the breeding cycle of a population.	It is expected that any disruption to any possible local population of the species would be minor and short-term.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	The project has the potential to facilitate the spread of weed species which could potentially reduce the quality of habitat available to the species. A detailed pest management plan will be developed for the project to mitigate and manage the potential spread of pest flora and fauna species. The proposed action is considered unlikely to decrease habitat availability to the extent that the species is likely to decline given the impact area forms only a small portion of the potential habitat within the known distribution of the species and that impact will be managed through the proposed mitigation commitments.

EPBC Act Criteria	Assessment of Significance
Result in invasive species that are harmful to an endangered species becoming established in the endangered speciesô habitat.	Invasive flora has been identified as a key threat to the species with species known to impact finger panic grass including *Chloris gayana* (rhodes grass) and *Urochloa panicoides* (liverseed grass). A detailed pest management plan will be developed to mitigate and manage the potential spread of pest flora and fauna species. Species-specific management will be undertaken for identified key weed species at risk of spread through project activities. Weed control efforts will be increased in areas particularly sensitive to invasion.
Introduce disease that may cause the species to decline.	Disease has not been identified as a key threat to *Digitaria porrecta.* The implementation of a pest management plan will help control and prevent the establishment of invasive species (and associated diseases) as a result of the project.
Interfere with the recovery of the species.	The species is not known to occur in the EIS study area, however, habitat rehabilitation and restoration activities using seed or seedlings of local provenance are likely to assist, rather than interfere, with the recovery of the species in the local area.

The assessment indicates that due to the limited disturbance to suitable habitat from the proposed action, mitigation of impacts through measures proposed in **Section 8.3** and offsetting of residual impact, the impacts of the project on *Digitaria porrecta* are unlikely to be significant.

8.2.4 Natural Grasslands of the Queensland Central Highlands and the Northern Fitzroy Basin

An assessment of the potential significance of impacts on the natural grassland TEC under the assessment guidelines of the EPBC Act (Environment Australia 2000) is provided in **Table 8-4**.

Table 8-4 Assessment of Significance of Impact on Listed TEC ï *Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin*.

EPBC Act Criteria	Assessment of Significance
An action is likely to have a significant impact on an TEC if there is a real chance or possibility that it will:	The *Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin* TEC is analogous to areas mapped as REs 11.3.21, 11.4.4, 11.4.11, 11.8.11, 11.9.9, 11.9.12 and 11.11.17. Within the EIS study area this TEC is analogous to RE 11.8.11 (refer **Figure 5-2a-c**).
Reduce the extent of an ecological community.	Approximately of 114 ha of this TEC will be potentially impacted as a result of the proposed action. Using analogous Regional Ecosystems to determine the local impact within the northern Bowen Basin Provence approximately 0.5% of the current extent of RE 11.8.11 would be affected by the proposed action. As this represents minimal portions of the existing extent of the analogous RE within the local region, and combined with mitigation measures proposed in **Section 8.3** and offsetting of residual impact, the result of the proposed action is not considered to significantly reduce the extent of this TEC.

EPBC Act Criteria	Assessment of Significance
Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines.	Relatively small areas of the analogous RE within the EIS study area will potentially be impacted as a result of the proposed action. With mitigation through offsetting and the control of buffel grass and parthenium within offset areas, the result of the proposed action would not significantly contribute to the local fragmentation of this TEC.
Adversely affect habitat critical to the survival of an ecological community.	As the extent of impact represents minimal portions of the existing extent of the analogous RE within the region, with mitigation through offsetting and the control of buffel grass and parthenium on site and within offset areas the result of the proposed action is not considered to significantly adversely affect habitat critical to the survival of this TEC.
Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological communityôs survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns.	The TEC occurs on Cainozoic igneous rocks, particularly fresh basalt, and is generally associated with undulating to gently undulating rises. It usually occurs on the crests and middle and upper slopes (slopes 2ï 6%), although in places is occasionally present on lower slopes and flat areas (slopes 0ï 2%). Associated soils are moderately shallow to deep cracking clay soils with gravel, stone or linear gilgai sometimes present. The occurrence of this TEC in association with specific landforms, soil types and inferred drainage requirements indicates that a narrow range of conditions are required for its establishment. The proposed action will remove a small area containing these features thus reducing potential areas for the distribution of the TEC. The presence of buffel grass and parthenium has contributed to the endangered status of this TEC as both species outcompete and suppress native grasslands in the region. Control of these species on site and as part of the management program for offsets will minimise further impacts on the remaining TEC within the EIS study area. Modification or destruction of abiotic factors to the extent that the TECôs survival is compromised outside of the area of impact is highly unlikely.
Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting.	While the proposed action would remove a portion of the natural grasslands TEC on site, those areas that remain would be managed to reduce buffel grass and parthenium, thereby possibly affecting an increase in the number of functionally important species within the TEC.
Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to: • assisting invasive species, that are harmful to the listed ecological community, to become established; or • causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community.	While the proposed action would remove a portion of the natural grasslands TEC on site, which have been assessed as being in ógoodô ecological condition, those areas that remain would be managed to reduce buffel grass and parthenium, thereby possibly affecting an increase in the quality of the TEC.

EPBC Act Criteria	Assessment of Significance
Interfere with the recovery of an ecological community.	It is proposed that areas of the community retained on site will be managed to control exotic species in accordance with the pest and weed management plan as required under state legislation. With mitigation through offsetting and the control of buffel grass and parthenium on site and within offset areas, the loss of natural grasslands through the proposed action would not interfere with the recovery of this TEC.

The assessment indicates that due to the limited disturbance to the TEC from the proposed action, mitigation of impacts through measures proposed in **Section 8.3** and offsetting of residual impact, the impacts of the project on the TEC are unlikely to be significant

8.2.5 Brigalow (*Acacia harpophylla* dominant and co-dominant)

An assessment of the potential significance of impacts on the brigalow TEC under the assessment guidelines of the EPBC Act (Environment Australia 2000) is provided in **Table 8-5**.

Table 8-5 Assessment of Significance of Impact on Listed Threatened Species ï *Brigalow (Acacia harpophylla dominant and co-dominant)*

EPBC Act Criteria	Assessment of Significance
An action is likely to have a significant impact on an endangered TEC if there is a real chance or possibility that it will:	In Queensland, the brigalow TEC that has been listed under the EPBC Act is defined by reference to 16 REs, (i.e. 6.4.2, 11.3.1, 11.4.3, 11.4.7, 11.4.8, 11.4.9, 11.4.10, 11.5.16, 11.9.1, 11.9.5, 11.9.6, 11.11.14, 11.12.21, 12.8.23, 12.9-10.6 and 12.12.26), all of which are listed as endangered under the VM Act. Six REs mapped within the EIS study area represent the brigalow TEC. These are RE 11.3.1, RE 11.4.7, RE 11.4.8, RE 11.4.9, RE 11.5.16 and RE 11.9.1 (refer **Figure 5-2a-c**).
Reduce the extent of an ecological community.	Approximately of 188 ha of this TEC will be potentially impacted as a result of the proposed action. Using analogous Regional Ecosystems to determine the local impact within the northern Bowen Basin Provence this extent represents the following impacts to analogous REs: approximately 0.81% of the current extent of RE 11.3.1, 0% of the remaining current of RE 11.4.7, 1.79% of the current extent of RE 11.4.8, 0.89% of the current extent of RE11.4.9, 3.41% of the current extent of RE 11.5.16 and 0.01% of the current extent of RE 11.9.1. As this represents minimal portions of the existing extent of the analogous REs within the local region and combined with mitigation measures proposed in **Section 8.3** and offsetting of residual impact, the result of the proposed action is not considered to significantly reduce the extent of this TEC.
Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines.	Relatively small areas of analogous REs within the EIS study area will potentially be impacted as a result of the proposed action. With mitigation through measures proposed in **Section 8.3** and offsetting of residual impacts, the result of the proposed action would not significantly contribute to the local fragmentation of this TEC.
Adversely affect habitat critical to the survival of an ecological community.	As the extent of impact represents minimal portions of the existing extent of the analogous REs within region and with mitigation through measures proposed in **Section 8.3** and offsetting of residual impacts, the result of the proposed action is not considered to significantly adversely affect habitat critical to the survival of this TEC.

EPBC Act Criteria	Assessment of Significance
Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns.	The proliferation of buffel grass has contributed to the endangered status of brigalow as this species invades the understorey, outcompetes and suppresses brigalow species recruitment, and increases fire frequency and intensity in brigalow communities. Management of this species on site through strategic land management strategies and as part of the management program for offsets may improve the condition of this TEC. The vegetation species and regional soil/geology types suggest that the level of groundwater dependence is likely to be low within this TEC and vegetation is likely to be able to satisfy plant water requirements using retained soil moisture. Modification or destruction of abiotic factors to the extent that the TECs survival is compromised outside of the area of impact is highly unlikely.
Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting.	While the proposed action will potentially impact a portion of the brigalow TEC on site, the remaining area would be managed to reduce buffel grass and other weed species. With the application of fire management aimed at reducing the frequency and intensity of fires in these areas, it is likely that there will be an increase in the number of functionally important species within the brigalow TECs.
Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to: • assisting invasive species, that are harmful to the listed ecological community, to become established; or • causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community.	While the proposed action will potentially impact a portion of the brigalow TECs on site, which have been assessed as being in poor ecological condition, those areas that remain would be managed to reduce buffel grass and too frequent fire, thereby possibly affecting an increase in the quality of the TEC.
Interfere with the recovery of an ecological community.	It is proposed that areas of the brigalow TEC that are retained on site will be managed to control exotic species in accordance with the proposed pest and weed management plan. With mitigation through measures proposed in **Section 8.3** and offsetting of residual impacts, the loss of areas of brigalow through the proposed action would not interfere with the recovery of this TEC.

The assessment indicates that due to the limited disturbance to the TEC from the proposed action, mitigation of impacts through measures proposed in **Section 8.3**and offsetting of residual impact, the impacts of the project on the TEC are unlikely to be significant.

8.2.6 Squatter pigeon (*Geophaps scripta scripta*)

This species is listed as vulnerable under the EPBC Act. An assessment of the significance of impacts on this species under the assessment guidelines of the EPBC Act (Environment Australia 2000) is provided in **Table 8-6**.

Table 8-6 Assessment of Significance of Impact on Listed Threatened Species ï squatter pigeon

EPBC Act Criteria	Assessment of Significance
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	The squatter pigeon occurs in open dry sclerophyll woodland with grassy understorey, nearly always near permanent water. Birds may occasionally feed in sown grasslands and pastures. Squatter pigeons mainly eat seeds, including those of exotic pasture plants, and some insects (Crome and Shields 1992; Higgins and Davies 1996). Squatter pigeons have been recorded in the survey area on six separate occasions, including surveys undertaken by WBM in 1998, 2000 and 2002 and URS in 2005, 2009 and 2011. These observations are clustered in two areas and are likely to represent a viable population using the site. All individuals were observed in areas which have been grazed and have some level of habitat degradation and their occurrence may reflect the nearby presence of water rather than food sources, or may simply be a result of increased visibility improving the likelihood of detection. The squatter pigeon, despite substantial declines and even local extinctions in the southernmost parts of its range, remains common locally even in areas degraded by cattle.
Lead to a long-term decrease in the size of an important population of a species.	Habitat present is typical of squatter pigeon habitat found throughout central Queensland, and small groups of the species have been observed in many locations outside the EIS study area. It is unlikely that the proposed works will lead to a long-term decrease in the size of an important population of a species. Potential habitat mapping has not been conducted for this species as available mapping criteria are not detailed enough to provide a suitable estimation of usage. Similarly, an estimation of the area of habitat potentially impacted has not been undertaken due to the lack of knowledge on habitat preferences.
Reduce the area of occupancy of an important population.	Habitat present is typical of squatter pigeon habitat found throughout central Queensland, and small groups of the species have been observed in many locations outside the EIS study area. It is unlikely that the proposed works will reduce the area of occupancy of an important population.
Fragment an existing important population into two or more populations.	Habitat present is typical of squatter pigeon habitat found throughout central Queensland, and small groups of the species have been observed in many locations outside the EIS study area. It is unlikely that the proposed works will fragment an existing important population into two or more populations.
Adversely affect habitat critical to the survival of a species.	No habitat considered critical to the survival of the species is present in the EIS study area.
Disrupt the breeding cycle of an important population.	Habitat present is typical of squatter pigeon habitat found throughout central Queensland, and small groups of the species have been observed in many locations outside the EIS study area. It is unlikely that the proposed works will disrupt the breeding cycle of an important population.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	No habitat to be modified, destroyed, removed, isolated or decreased by the project would result in species decline. Potential habitat within the EIS study area is already significantly degraded due to grazing and current mining activities, therefore it is considered to be of moderate value to the species.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable speciesô habitat.	Any impacts on any local populations or individuals would be minor, particularly following the implementation of a pest and weed management plan, as is required under State legislation to control and prevent the establishment of invasive species as a result of the project.

EPBC Act Criteria	Assessment of Significance
Introduce disease that may cause the species to decline.	The implementation of a pest and weed management plan, as required under State legislation, will help control and prevent the establishment of invasive species (and associated diseases) as a result of the project.
Interfere with the recovery of the species.	Population scale movement would be unaffected in the long-term and significant disruptions to breeding cycles and interference to species recovery as a result of the proposed actions are therefore unlikely.

The assessment indicates that due to the restriction of the mine footprint to existing cleared, modified and degraded lands, and the limited disturbance to suitable habitat from development of infrastructure, the impacts of the project on the squatter pigeon will not be significant.

8.2.7 Ornamental snake (*Denisonia maculata*)

The ornamental snake is listed as Vulnerable under the EPBC Act. An assessment of the significance of impacts on this species under the assessment guidelines of the EPBC Act (Environment Australia 2000) is provided in **Table 8-7**.

Table 8-7 Assessment of Significance of Impact on Listed Threatened Species ï Ornamental Snake

EPBC Act Criteria	Assessment of Significance
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	The ornamental snake was recorded during surveys in 2006 by Ecoserve and 2011 by URS. These records indicate a continued presence of the species at the site. The ornamental snake was also recorded adjacent to the west of the EIS study area during pipe trenching operations for the North Queensland Gas Pipeline in 2004. This data was used to map Essential Habitat for this species along the pipeline in the northwest of the study site, external to the EIS study area. Further targeted surveys for this species within the EIS study area are proposed. The ornamental snake occurs in low-lying areas with deep-cracking clay soils that are subject to seasonal flooding, and in adjacent areas of clay and sandy loams. The species is found in woodlands and shrublands, such as brigalow, and in riverine habitats, and lives in soil cracks and under fallen timber (Ehmann 1992; Wilson 2005; Wilson and Swan 2008).
Lead to a long-term decrease in the size of an important population of a species.	The habitat within the EIS study area is typical of that found throughout the speciesôrange, and it is expected that the ornamental snake is widespread throughout the region. It is therefore unlikely that the proposed project will impact habitat to such an extent that it will lead to a long-term decrease in the size of an important population of a species. Based upon habitat mapping (**Figure 7-3**), 759 ha of high potential habitat and 203 ha of low potential habitat for this species could potentially be impacted as a result of the proposed action. With mitigation through measures proposed in **Section 8.3** and offsetting of residual impact, the result of the proposed action will not significantly reduce the regional extent of these habitats. It is expected that any possible decrease in any possible local population of the species would be minor.
Reduce the area of occupancy of an important population.	The habitat within the EIS study area is typical of that found throughout the speciesôrange, and it is expected that the ornamental snake is widespread throughout the region. It is therefore unlikely that the proposed project will reduce the area of occupancy of an important population.

EPBC Act Criteria	Assessment of Significance
Fragment an existing important population into two or more populations.	The habitat within the EIS study area is typical of that found throughout the speciesôrange, and it is expected that the ornamental snake is widespread throughout the region. It is therefore unlikely that the proposed project will fragment an existing important population into two or more populations.
Adversely affect habitat critical to the survival of a species.	There is no habitat present in the EIS study area that is critical to the survival of the species.
Disrupt the breeding cycle of an important population.	The habitat within the EIS study area is typical of that found throughout the speciesôrange, and it is expected that the ornamental snake is widespread throughout the region. It is therefore unlikely that the proposed project will disrupt the breeding cycle of an important population.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	The potential impact area is not considered to contain habitat important enough for the species such that its modification, destruction, removal or isolation, or a decrease in its availability or quality would result in overall species decline.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable speciesô habitat.	The implementation of a pest and weed management plan as required under state legislation will help control and prevent the establishment of invasive species (and associated diseases) as a result of the project.
Introduce disease that may cause the species to decline.	The implementation of a pest and weed management plan as required under state legislation will help control and prevent the establishment of invasive species (and associated diseases) as a result of the project.
Interfere with the recovery of the species.	Habitat rehabilitation and restoration activities using seed or seedlings of local provenance and replacement of habitat such as logs are likely to assist, rather than interfere, with the recovery of the species in the local area.

This species, while Vulnerable, is widespread in occurrence across the regional landscape, and the project is not considered to have a significant impact on the ornamental snake, its habitat or breeding/feeding resources. An additional survey will be conducted to further determine the extent in which the ornamental snake occurs within the east.

8.2.8 Koala (*Phascolarctos cinereus*) (combined populations of Qld, NSW and the ACT)

This species is listed as Vulnerable under the EPBC Act. An assessment of the significance of impacts on this species under the assessment guidelines of the EPBC Act (Environment Australia 2000) is provided in **Table 8-8**.

Table 8-8 Assessment of Significance of Impact on Listed Threatened Species ï Koala

EPBC Act Criteria	Assessment of Significance
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	Koalas inhabit a range of temperate, sub-tropical and tropical forest, woodland and semi-arid communities dominated by species from the genus Eucalyptus (Martin and Handasyde 1999 in DSEWPaC 2013b). The distribution of koalas is also affected by altitude (limited to <800 m ASL), temperature and, at the western and northern ends of the range, leaf moisture (Munks *et al*. 1996 in DSEWPaC 2013b). Within central Queensland, koalas have been studied at Tambo (Mitchell Grass Downs bioregion), Springsure and Blair Athol (both in Brigalow Belt North bioregion). Koalas in this region typically occur in low densities and have large home ranges (Ellis *et al*. 2002 in DSEWPaC 2013b). The koala is heavily reliant on eucalypt leaves, a diet that is extremely energy constraining. As a result, the koala is very inactive and spends around 19 hours per day sleeping (Curtis *et al*. 2012). Koalas can live to 15 years of age in the wild (Curtis *et al*. 2012) and females can potentially produce one offspring per year (McLean 2003 in DSEWPaC 2013b). Young are born between October and May and occupy the pouch for six to eight months (Curtis *et al*. 2012). A solitary koala was observed to the south-west of the EIS study area within poplar box (*Eucalyptus populnea*) woodland, the only record for the species within the survey area. The paucity of observations of the species across all survey events suggests that it is sparsely distributed within the region.
Lead to a long-term decrease in the size of an important population of a species.	Based upon habitat mapping (**Figure 7-3**), 946 ha of potential habitat for this species could potentially be impacted as a result of the proposed action. With mitigation through measures proposed in **Section 8.3** and offsetting of residual impact, the result of the proposed action would not significantly reduce the local extent of these habitats. It is expected that any possible decrease in any possible local population of the species would be minor.
Reduce the area of occupancy of an important population.	The habitat within the EIS study area does not support an important population of the species as documented through the lack of observations. Therefore, the proposed works will not reduce the area of occupancy of an important population.
Fragment an existing important population into two or more populations.	The habitat within the EIS study area does not support an important population of the species as documented through the lack of observations. Therefore, the proposed works will not fragment an existing important population into two or more populations.
Adversely affect habitat critical to the survival of a species.	There is no habitat present in the area of potential impact that is critical to the survival of the species.
Disrupt the breeding cycle of an important population.	The habitat within the EIS study area does not support an important population of the species as documented through the lack of observations. Therefore, the proposed works will not disrupt the breeding cycle of an important population.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	The potential impact area is not considered to contain habitat important enough for the species such that its modification, destruction, removal or isolation, or a decrease in its availability or quality would result in overall species decline.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable speciesô habitat.	It is unlikely that the introduction of invasive species not already present will impact the koala. The implementation of a pest and weed management plan as required under state legislation will help control and prevent the establishment of invasive species (and associated diseases) as a result of the project.

EPBC Act Criteria	Assessment of Significance
Introduce disease that may cause the species to decline.	It is unlikely that the introduction of disease will impact the koala. The implementation of a pest and weed management plan as required under state legislation will help control and prevent the establishment of invasive species (and associated diseases) as a result of the project.
Interfere with the recovery of the species.	The project will have little bearing on the recovery of the species as a whole.

The low population density of the koala in the region means that overall impacts on the species will be minor.

8.3 Proposed Mitigation Measures

The application of mitigation measures will minimise impacts from the project on EPBC Act listed flora, fauna and TECs. Where impacts are unable to be avoided or mitigated (e.g. clearing of vegetation) offsets may be required.

8.3.1 Mitigation Measures Specific to Surface Facilities

EPBC listed Flora and TECs

When clearing vegetation for any of the surface facilities, the following mitigation measures will be utilised:

- areas for clearing will be clearly delineated to avoid inadvertent clearing;
- if habitat trees can be retained without compromising safety, these will be identified and clearly marked;
- habitat features such as felled trees and logs will be considered for relocation to other areas where practical to provide microhabitat;
- vehicles and equipment will be cleaned to remove weed seeds before being brought to the site; and
- workers will be made aware of management requirements in induction training and through work instructions.

Throughout construction, the following mitigation measures will be utilised to manage impacts from construction activities:

- vehicles and equipment will be cleaned to remove weed seeds before being brought to the site;
- topsoil will be removed and used to rehabilitate existing disturbed areas;
- erosion and sediment control measures will be installed and maintained as set out in **Section 7** of the Red Hill Mining Lease EIS; and
- dust suppression measures will be utilised to minimise deposition of dust on adjacent vegetation.

Following construction in each area, disturbed areas not required will be stabilised and rehabilitated consistent with the rehabilitation plan. For the bridge across the Isaac River, this will include rehabilitation of riparian vegetation. Otherwise, revegetation around surface infrastructure will

generally involve establishing of pasture grass as it will not generally be appropriate to establish native woodland or shrubland very close to surface facilities.

Weed monitoring and management will be ongoing throughout construction and operation, as will dust suppression measures.

As it will not be possible to avoid all impacts to TECs and EPBC Act listed flora habitats, offsets will be required to mitigate residual impacts.

Fauna

Measures set out above to minimise impacts on TECs and EPBC Act listed flora species will also assist to some extent in minimising impacts on fauna. Offsets will also assist in providing habitat for species present on the site. Other measures which will be undertaken include:

- Spotter/catchers will be required when remnant vegetation likely to contain nesting fauna.
- Spotter/catchers will hold appropriate permits under the NC Act.
- When working in other areas, workers will be provided with contact details in the event that fauna is present and needs to be removed, or fauna are accidentally injured. This will be covered in induction training and work instructions. Vehicles will not be allowed to traverse vegetated areas but will be required to remain on existing tracks.
- During detailed design, lighting will be designed such that light spill into adjacent habitat areas is minimised. This will be particularly important for the proposed accommodation village.
- If fauna are injured by vehicles during operations, the RSPCA or local wildlife carers will be contacted for assistance. Fauna killed on roads will be dragged to the side immediately, and then removed and disposed of on a regular basis to prevent carrion eaters from also being exposed to vehicle strike.

8.3.2 Mitigation Measures Specific to the Gas Drainage Network

EPBC Listed Flora and TECs

While the extent of infrastructure required for incidental mine gas drainage will mean that impacts will occur to TECs and potential habitat for EPBC listed flora species, there are a range of measures that will be taken to potentially reduce the level of impact of clearing and manage associated impacts. These include:

- Avoid placing incidental mine gas extraction wells and infrastructure within *Natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin* TEC where practical. Where unavoidable, offsets will be required.
- Avoid placing incidental mine gas extraction wells and infrastructure within *Brigalow (Acacia harpophylla dominant and co-dominant)* TEC where practical. Where unavoidable, offsets will be required.
- If clearing within potential habitat for EPBC listed flora species (Figures 7-1, 7-2 and 7-3) is required, pre-clearing surveys will be conducted for *Dichanthium setosum, Dichanthium queenslandicum* and *Digitaria porrecta*.

- If these grasses are identified, clearing should be avoided in these areas wherever possible, with slashing preferred to gain access.
- If clearing is required, individual plants may be collected and relocated and topsoil will be carefully removed and set aside to protect seed banks. Topsoil will be replaced over pipelines as quickly as possible.

- Designing and constructing incidental mine gas management infrastructure to minimise disturbance to riparian zones along Isaac River and 12 Mile Gully and avoiding placement of wells within 50 metres of these waterways wherever possible.
- Wherever practical, locating infrastructure alignments and gas drainage wells to avoid remnant vegetation.
- Selecting river and creek crossings where natural breaks in vegetation occur wherever possible, recognising that crossing locations must align with the pillars between each longwall panel.
- Clearly delineating clearing areas so that inadvertent clearing of additional areas does not occur. This will be covered in induction training and work instructions to crews undertaken vegetation clearing.
- Cleaning of vehicles and equipment to remove weed seeds before equipment and vehicles are brought to the site. Weed washdowns on vehicles and equipment will also be undertaken when leaving a known weed infested area.
- Monitoring weed levels and actively managing weeds around the edges of vegetation fragments.
- Dust suppression measures will be undertaken to minimise dust deposition on vegetation adjacent to tracks and construction areas. Frequently trafficked surfaces will be gravelled to reduce dust generation, otherwise water trucks will be used to suppress dust.
- Utilising erosion and sediment control measures as set out in **Section 7** of the Red Hill Mining Lease EIS for all ground disturbance activities and stream crossings.
- Rehabilitating buried pipeline alignments consistent with the Rehabilitation Plan (**Section 5.5** of the Red Hill Mining Lease EIS).
- Rehabilitating drill pads once wells are installed consistent with the Rehabilitation Plan (**Section 5.5** of the Red Hill Mining Lease EIS).

Even with these mitigation measures, the ecological function of most vegetation communities within the proposed underground mine footprint will be lost due to the extent of fragmentation, and offsets will be required to mitigate this residual impact. This is discussed further in **Section 9** of the Red Hill Mining Lease EIS.

Fauna

The primary impacts on fauna during construction of the gas drainage network are the loss of habitat and potential risk of mortality associated with the works.

Measures to reduce habitat impacts will include:

- Restricting crossings of the Isaac River to a bridge crossing on the main headings, and one to two pipeline crossings, unless detailed design indicates that additional crossings cannot be avoided for safety reasons.

- Selecting already disturbed areas for crossings of creeks and drainage lines wherever possible.
- Minimising the width of clearing required for crossing, and particularly retaining tall trees on either side of crossing locations wherever this is safe to do so.
- Minimising placement of gas wells in riparian and woodland areas wherever possible.

Mitigation measures proposed for flora and vegetation communities will address loss and degradation of habitat to some extent; however, as noted above, offsets will also be required.

Spotter/catchers will be required when clearing woodland vegetation likely to contain nesting fauna that may be trapped when trees are felled. Spotter/catchers will hold appropriate permits under the *Nature Conservation Act 1992*.

When working in other areas, workers will be provided with contact details in the event that fauna is present and needs to be removed, or are accidentally injured. This will be covered in the induction training and work instructions. Vehicles will not be allowed to traverse vegetated areas but will be required to remain on existing tracks.

If lighting is required, lighting will be directed away from vegetated areas.

8.3.3 Mitigation Measures Specific to the RHM and BRM

Adaptive management will be incorporated into management strategies based on lessons learnt from the adjacent Broadmeadow subsidence monitoring results.

8.3.3.1 EPBC Listed Flora and TECs

Where works are required to repair surface cracks from subsidence, this will be done with minimal clearing or damage to vegetation. Small machinery will be used. Grasses and other groundcover will be slashed rather than cleared to allow access.

Where machinery is required to repair cracks or construct subsidence pond drainage channels, vehicles and equipment will be cleaned of all weed seeds and other potential contaminants before entering the site.

Weed monitoring and management programs will be ongoing throughout the mining period.

Rehabilitation will be undertaken as soon as possible as detailed in **Section 8.3.7** of the Red Hill Mining Lease EIS.

8.3.3.2 Fauna

No particular mitigation measures are required to address impacts of subsidence on fauna. Management of vegetation and rehabilitation along the Isaac River and 12 Mile Gully corridors will assist with minimising impacts of habitat loss on fauna.

Progressive rehabilitation of impacted areas as the RHM progresses will reduce long term impacts on fauna. In areas where subsidence causes permanent ponds, rehabilitation efforts should be tailored toward developing sustainable wetland habitats.

8.3.4 Mitigation Measures Specific to Threatened Fauna Species

Due to the availability of suitable habitat elsewhere in the EIS study area or surrounding region, the loss of suitable habitat from the project is not expected to have significant regional impact on any threatened fauna species. Additionally, the adoption of the mitigation strategies identified from the above project activities should reduce the potential for adverse impacts on these fauna.

Habitat in which the ornamental snake (*Denisonia maculata*) was recorded could potentially be altered as a result of subsidence. A targeted field survey of this location and adjacent habitat will be undertaken to determine the presence and extent of the ornamental snake habitat within this area. If the site is deemed as significant habitat a species management plan will be developed.

This plan will outline:

- the level of activity that the habitat can sustain;
- the remediation procedures if tension cracking or vegetation loss occurs; and
- further monitoring requirements.

The ornamental snake species management plan will aim to mitigate the long term impacts on this species within the EIS study area.

8.3.5 Weed and Pest Management

Weed management strategies will be implemented for controlling the spread of weeds and potential proliferation of pest fauna. Weed and pest management measures will include:

- identification of the origin of construction materials, machinery and equipment;
- vehicle and machinery wash down; and
- staff/operator education programs.

The weed management during project construction, rehabilitation and operation periods will include:

- management methods to control spread of declared weed species (in particular *Parthenium hysterophorus*), in keeping with regional management practice;
- ongoing monitoring of the EIS study area to identify any new incidence of weed infestation;
- provision of information for project staff on the identification of declared weeds and their dispersal methods;
- wash down protocols for any vehicles or machinery entering and leaving site;
- methods for weed eradication from the site in accordance with local best management practice from the Isaac Regional Council and/or the DEEDI Pest Fact sheets (DEEDI 2007);
- promotion of awareness of weed management, by inclusion of weed issues, pictures and procedures into the projectôs site induction program; and
- monitoring of weeds and pests throughout the EIS study area will be undertaken.

8.3.6 Continued Vegetation Assessment

Impacts to vegetation from mining operations are based on a current description of vegetation communities and their associated conservation values as assessed at the time of the survey. The majority of vegetation communities surveyed have been impacted from past land use and, as such, are not climax communities but are still in a state of advancing ecological succession. The floristic and structural characteristics of these communities may change before the commencement of future planned mine operations. If the development of operations is undertaken later than five years after this impact assessment, it is proposed that another assessment is undertaken. Reassessment of vegetation will include a flora survey to assess any changes in floristic and structural characteristics, to confirm community types, and to confirm the presence of any significant species or communities.

Ongoing vegetation assessment will also assist in determining the basis for biodiversity offsets.

8.3.7 Rehabilitation of Disturbed Areas

8.3.7.1 Post Construction Rehabilitation

Following construction activities associated with the incidental mine gas management infrastructure and the surface facilities, any unused areas will be stabilised and rehabilitated promptly. This will include the majority of the area of drill pads for the gas drainage wells, as well as land over buried pipelines installed for incidental mine gas drainage.

Rehabilitation of these areas will involve:

- ripping of compacted soils;
- replacement of topsoil; and
- planting of native grass and pasture grass species.

Post-construction rehabilitation measures are discussed further in **Section 5.5** of the Red Hill Mining Lease EIS.

It will not be possible to re-establish woodland vegetation in these areas. Deep rooted species of trees and large shrubs cannot be planted over buried pipelines as roots may interfere with the pipelines. It will not be appropriate to re-establish woodland vegetation too close to the accommodation village, MIA or gas drainage wells as this may present a fire risk. Planting of trees and large shrubs at the base of the dam wall is also not appropriate as this may interfere with required inspections of the wall, and also lead to root invasion into the base of the wall.

8.3.7.2 Post-Subsidence Rehabilitation

Post subsidence revegetation is expected to involve managing remaining native vegetation on the site and re-establishing vegetation consistent with the proposed post mining land use.

In relation to managing remaining native vegetation, management during the life of the mine and post closure period will include weed management and selective enhancement of vegetation communities with native planting. These areas will also provide seedstock for revegetation of other areas. Once mine closure is complete, it is currently anticipated that the land will be returned to the landholder and ongoing management of these areas will be at the discretion of the landholder and subject to any laws in place at the time in relation to vegetation clearing and management.

In relation to re-vegetation, the majority of the site will be revegetated with pasture species consistent with ongoing grazing land use. Revegetation with native trees and shrubs will take place:

- along the Isaac River channel, with a particular focus on re-establishing riparian woodland communities;
- along 12 Mile Gully, with a particular focus on re-establishing brigalow communities;
- between patches of vegetation not cleared during the gas drainage construction; and
- around the edges of permanent ponds to create useful wetland habitat.

The proposed subsidence management plan described in **Section 7** of the Red Hill Mining Lease EIS sets out the adaptive management approach to management of subsidence impacts on watercourses. Management of remaining native vegetation along watercourses and planting of new vegetation will be incorporated into this management plan.

As this rehabilitation will not take place for some time, specific methods are not proposed as new information and methods may be available in future. However, wherever possible, local provenance seed stock will be used for direct seeding and to generate tube stock for planting. Rehabilitation of bushland areas will be undertaken with the intent of establishing floral assemblages in keeping with vegetation communities mapped as occurring on the site, taking into consideration changes in local conditions that may have arisen from subsidence and associated hydrological changes. Revegetation will be progressive as subsidence occurs; however, full restoration of the Isaac River corridor may not occur until the channel has re-established. Further details are included within **Section 5.5** of the Red Hill Mining Lease EIS.

8.3.8 Monitoring

8.3.8.1 Vegetation Monitoring

Monitoring of retained vegetation areas will be undertaken throughout the life of the project. As the subsidence ultimately changes the hydrology of the area, a floristic change will naturally occur over time in areas of retained vegetation. Monitoring will need to focus on whether this change can occur naturally through regrowth of native vegetation from seedstock, or whether intervention is required to replace plants that die at a greater rate than natural re-establishment.

Remnant vegetation will be monitored for foliar discolouration, partial defoliation, increased pathogenic attack, or tree death as signs of vegetation impacts from subsidence. Tree deaths and regrowth in areas affected by subsidence will be monitored to assess whether rehabilitation is required. In areas where natural regrowth is not sufficient to replace dead trees, replanting will be undertaken.

8.3.8.2 Vegetation Rehabilitation Monitoring

Monitoring and evaluation of the rehabilitated areas will be undertaken to ensure long term viability and allow adaptive management of rehabilitation strategies where necessary.

For areas rehabilitated as grazing land, monitoring will focus on establishment of ground cover and invasion with declared weeds.

In areas to be rehabilitated as bushland, monitoring will involve:

- establishment of monitoring sites in rehabilitated areas and, wherever possible, reference sites to allow comparison;
- establishment of photographic transects; and
- annual surveys in rehabilitated areas and associated reference sites to establish dominant species present in each strata, heights of each stratum, relative abundance of each species and stem counts.

Further information on rehabilitation monitoring is provided in **Section 5.5** of the Red Hill Mining Lease EIS.

8.3.8.3 Weed and Pest Monitoring

Weed and pest monitoring will include the following:

- Annual observations by site personnel for weeds of management concern.
- A post-construction weed audit of the surface facilities, well sites, pipeline routes and access tracks at the end of the first wet season after completion of construction activities in each area.
- Monitoring for pest plants and fauna within subsided areas where ponding occurs will be undertaken to determine the need for management.
- Where treatment is required, follow up monitoring within three months to determine the success of the weed or pest eradication program. Additional treatment will be undertaken where eradication is unsuccessful.
- Maintenance of monitoring records for a period of at least five years to aid in the assessment of the long term success of the projectôs weed management program.

8.3.8.4 Ornamental Snake Monitoring

As detailed above, the ornamental snake is a cryptic threatened fauna species known to occur within the EIS study area. A targeted survey will be undertaken prior to the construction of the project to provide a greater understanding of the distribution of ornamental snake across the site and to provide a basis for determining the significance of habitat on the site to ornamental snake populations. Following this survey, if it is determined that the site contains potentially significant ornamental snake populations and habitat, more targeted mitigation measures will be able to be developed. This is likely to also include ongoing monitoring to track ongoing population status and responses to impacts and mitigation efforts.

8.3.9 Biodiversity Offsets

The project will be subject to the Queensland Biodiversity Offset Policy 2011 and EPBC Act Environmental Offsets Policy 2012. A specific biodiversity offset strategy for the project will be developed utilising the EPBC Act Environmental Offsets Policy 2012 as guidance. There are five key aims of the policy including:

1. Ensure the efficient, effective, timely, transparent, proportionate, scientifically robust and reasonable use of offsets under the EPBC Act;

2. Provide proponents, the community and other stakeholders with greater certainty and guidance on how offsets are determined and when they may be considered under the EPBC Act;
3. Deliver improved environmental outcomes by consistently applying the policy;
4. Outline the appropriate nature and scale of offsets and how they are determined; and
5. Provide guidance on acceptable delivery mechanisms for offsets.

The biodiversity offset strategy will outline the steps to be applied in determining suitable offsets, in line with the eight requirements for suitable offsets under the under the EPBC Act Environmental Offsets Policy 2012. These requirements include:

- Deliver an overall conservation outcome that improves or maintains the viability of the protected matter.
- Be built around direct offsets but may include other compensatory measures. Advanced offset will be considered.
- Be in proportion to the level of statutory protection that applies to the protected matter and be tailored specifically to the attribute of the protected matter that is impacted.
- Be of a size and scale proportionate to the residual impacts on the protected matter.
- Effectively account for and manage the risks of the offset not succeeding.
- Be additional to what is already required, determined by law or planning regulations, or agreed to under other schemes or programs.
- Suitable offsets must be efficient, effective, timely, transparent, scientifically robust and reasonable.
- Have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced.

The biodiversity offsets strategy will outline the type of information that will be presented when final offset management plans are to be implemented for the project. The information that is to be detailed in final offset management plans may include, but not necessarily be limited to:

- details of the protected matter being impacted and the estimated extent of the likely proposed impact;
- area in hectares of required land to offset proposed impact;
- locations of proposed offset areas (including maps);
- communities and habitat types to be secured;
- demonstration of conservation gain;
- timing of securing offset areas;
- details of how the offset areas will be legally binding (mechanisms for long term protection); and
- management and/or rehabilitation programs for the offset areas.

MNES potentially requiring offset are presented below in **Table 8-9**. All final offset requirements are subject to the final clearing footprint and assessment and approval from Department of the Environment.

Table 8-9 MNES Requiring Offsets

MNES	Area potentially impacted (ha)	Comments
Dichanthium setosum potential habitat	114 (high potential habitat)	Final offset ratios are subject to approval and conditioning from the Department of the Environment.
Dichanthium queenslandicum potential habitat	114 (high potential habitat)	
Digitaria porrecta potential habitat	114 (high potential habitat)	
Brigalow (*Acacia harpophylla* dominant and co-dominant) TEC	188	
Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin TEC	114	
ornamental snake	759 (high potential habitat)	
koala	946 (potential habitat)	

Section 09 Conclusion

The following MNES have the potential to be impacted by the proposed action:

- Brigalow (*Acacia harpophylla* dominant and co-dominant) TEC;
- *Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin* TEC;
- *Dichanthium setosum* (bluegrass);
- *Dichanthium queenslandicum* (king bluegrass);
- *Digitaria porrecta* (finger panic grass);
- squatter pigeon (*Geophaps scripta scripta*);
- ornamental snake (*Denisonia maculata*); and
- koala (*Phascolarctos cinereus*).

An assessment of the significance of impacts on each species under the assessment guidelines of the EPBC Act was undertaken, with potential impacts including:

- clearing for incidental mine gas (IMG) infrastructure and subsidence associated with the RHM footprint and Broadmeadow extension; and
- direct clearing for surface facilities (Red Hill MIA, Red Hill accommodation village, conveyor, and Red Hill CHPP).

The impact assessment determined that the project could potentially impact on MNES primarily through the loss and alteration of habitat. However, it was determined that overall impacts to important populations or critical habitat for species were unlikely. A range of mitigation and offset strategies are proposed within this report to minimise and mitigate potential impacts to MNES, including:

- avoidance of high value areas where practicable;
- management of threatening processes within retained habitats;
- control of pest vertebrates and weeds;
- assisted natural regeneration and active rehabilitation;
- ongoing flora and fauna monitoring; and
- the extent and timing for offsetting of residual impacts to TECs and EPBC Act listed species habitat.

These strategies will minimise the impacts the proposal is considered to have on matters of national environmental significance. Given the scale of the potential impacts and mitigation measures recommended the proposal is considered unlikely to have significant adverse impacts on MNES.

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Appendix A – EPBC Protected Matters Search

Australian Government

Department of Sustainability, Environment, Water, Population and Communities

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

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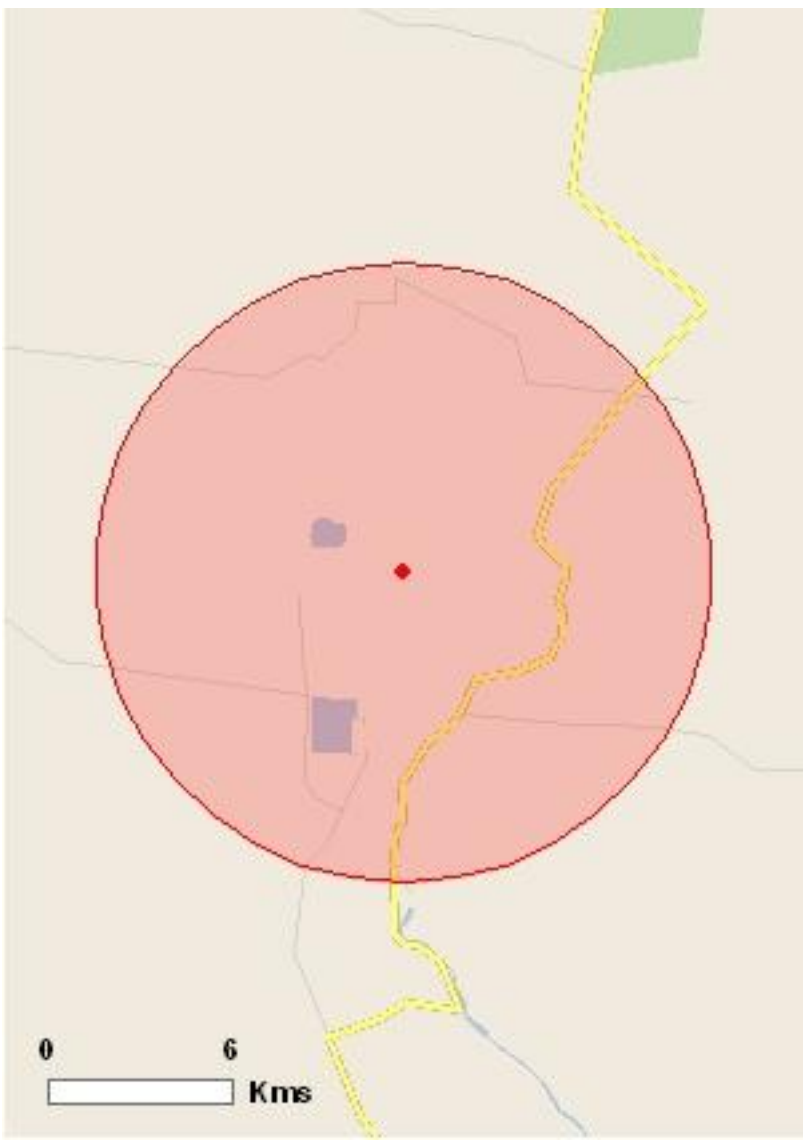

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Coordinates

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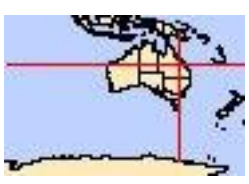

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Areas:	None
Listed Threatened Ecological Communities:	2
Listed Threatened Species:	16
Listed Migratory Species:	8

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place and the heritage values of a place on the Register of the National Estate.

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	9
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

Place on the RNE:	None
State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	20
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Brigalow (Acacia harpophylla dominant and co-dominant)	Endangered	Community known to occur within area
Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin	Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Erythrotriorchis radiatus		
Red Goshawk [942]	Vulnerable	Species or species habitat likely to occur within area
Geophaps scripta scripta		
Squatter Pigeon (southern) [64440]	Vulnerable	Species or species habitat known to occur within area
Neochmia ruficauda ruficauda		
Star Finch (eastern), Star Finch (southern) [26027]	Endangered	Species or species habitat likely to occur within area
Rostratula australis		
Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Mammals		
Dasyurus hallucatus		
Northern Quoll [331]	Endangered	Species or species habitat may occur within area
Nyctophilus corbeni		
South-eastern Long-eared Bat [83395]	Vulnerable	Species or species habitat may occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)		
Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory)	Vulnerable	Species or species habitat likely to occur

Name	Status	Type of Presence
[85104]		within area
Other		
Cycas ophiolitica		
[55797]	Endangered	Species or species habitat likely to occur within area
Plants		
Dichanthium queenslandicum		
King Blue-grass [5481]	Endangered	Species or species habitat likely to occur within area
Dichanthium setosum		
bluegrass [14159]	Vulnerable	Species or species habitat likely to occur within area
Digitaria porrecta		
Finger Panic Grass [12768]	Endangered	Species or species habitat likely to occur within area
Reptiles		
Denisonia maculata		
Ornamental Snake [1193]	Vulnerable	Species or species habitat known to occur within area
Egernia rugosa		
Yakka Skink [1420]	Vulnerable	Species or species habitat may occur within area
Furina dunmalli		
Dunmall's Snake [59254]	Vulnerable	Species or species habitat may occur within area
Lerista allanae		
Allan's Lerista, Retro Slider [1378]	Endangered	Species or species habitat may occur within area
Rheodytes leukops		
Fitzroy River Turtle, Fitzroy Tortoise, Fitzroy Turtle, White-eyed River Diver [1761]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Haliaeetus leucogaster		
White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Merops ornatus		
Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis		
Black-faced Monarch [609]		Species or species habitat likely to occur within area
Migratory Wetlands Species		
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Gallinago hardwickii		
Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Rostratula benghalensis (sensu lato)		
Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat likely to occur within area
Gallinago hardwickii		
Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster		
White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Merops ornatus		
Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis		
Black-faced Monarch [609]		Species or species habitat likely to occur within area
Pandion haliaetus		
Osprey [952]		Species or species habitat likely to occur within area
Rostratula benghalensis (sensu lato)		
Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area

Extra Information

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Frogs		
Bufo marinus Cane Toad [1772]		Species or species habitat likely to occur within area
Rhinella marina Cane Toad [83218]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
[Sus scrofa](#) Pig [6]		Species or species habitat likely to occur within area
[Vulpes vulpes](#) Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
[Acacia nilotica subsp. indica](#) Prickly Acacia [6196]		Species or species habitat may occur within area
[Cryptostegia grandiflora](#) Rubber Vine, Rubbervine, India Rubber Vine, India Rubbervine, Palay Rubbervine, Purple Allamanda [18913]		Species or species habitat likely to occur within area
[Jatropha gossypifolia](#) Cotton-leaved Physic-Nut, Bellyache Bush, Cotton-leaf Physic Nut, Cotton-leaf Jatropha, Black Physic Nut [7507]		Species or species habitat likely to occur within area
[Lantana camara](#) Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
[Parkinsonia aculeata](#) Parkinsonia, Jerusalem Thorn, Jelly Bean Tree, Horse Bean [12301]		Species or species habitat likely to occur within area
[Parthenium hysterophorus](#) Parthenium Weed, Bitter Weed, Carrot Grass, False Ragweed [19566]		Species or species habitat likely to occur within area
[Vachellia nilotica](#) Prickly Acacia, Blackthorn, Prickly Mimosa, Black Piquant, Babul [84351]		Species or species habitat likely to occur within area
Reptiles		
[Hemidactylus frenatus](#) Asian House Gecko [1708]		Species or species habitat likely to occur within area

Coordinates

-21.759 147.96902

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World Heritage and Register of National Estate properties, Wetlands of International Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Department of Environment, Climate Change and Water, New South Wales
-Department of Sustainability and Environment, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment and Natural Resources, South Australia
-Parks and Wildlife Service NT, NT Dept of Natural Resources, Environment and the Arts
-Environmental and Resource Management, Queensland
-Department of Environment and Conservation, Western Australia
-Department of the Environment, Climate Change, Energy and Water
-Birds Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-SA Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Atherton and Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
-State Forests of NSW
-Geoscience Australia
-CSIRO
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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