Chapter 35

Matters of National Environmental Significance

TABLE OF CONTENTS

Tables

Figures

35. MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

35.1 Introduction

Byerwen Coal Pty Ltd (Byerwen Coal) is proposing to develop an open cut coal mine and infrastructure, referred to as the Byerwen Coal Project (the project).

Byerwen Coal has no proceedings against it under a law of the Commonwealth or a State for the protection of the environment or the conservation and sustainable use of natural resources. Byerwen Coal's safety, health and environment policy (implemented as part of a broader environmental planning framework) is included as **Figure 35-1**. The environmental planning framework followed by Byerwen Coal, provides a defined process of planning through to implementation and review, which comprises accepted key components of an environmental management system, as per the following:

- environmental policy
- planning
  - environmental aspects
  - legal and other requirements
  - objectives, targets and programs
- implementation and operation
  - resources, roles, responsibility and authority
  - competence, training and awareness
  - communication
  - documentation and document control
  - operational control
  - emergency preparedness and response
- checking
  - monitoring and measurement
  - evaluation of compliance
  - nonconformity, corrective and preventive action
  - control of records
  - internal audit
- management review.

The project is a significant project under the *State Development and Public Works Organisation Act 1971* (Qld) (SDPWO Act). The project was referred to the Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) given its potential to have a significant impact on Matters of National Environmental Significance (MNES) protected under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The project was determined to be a controlled action on 13 January 2010 (reference EPBC 2010/5778). The controlling provisions are:

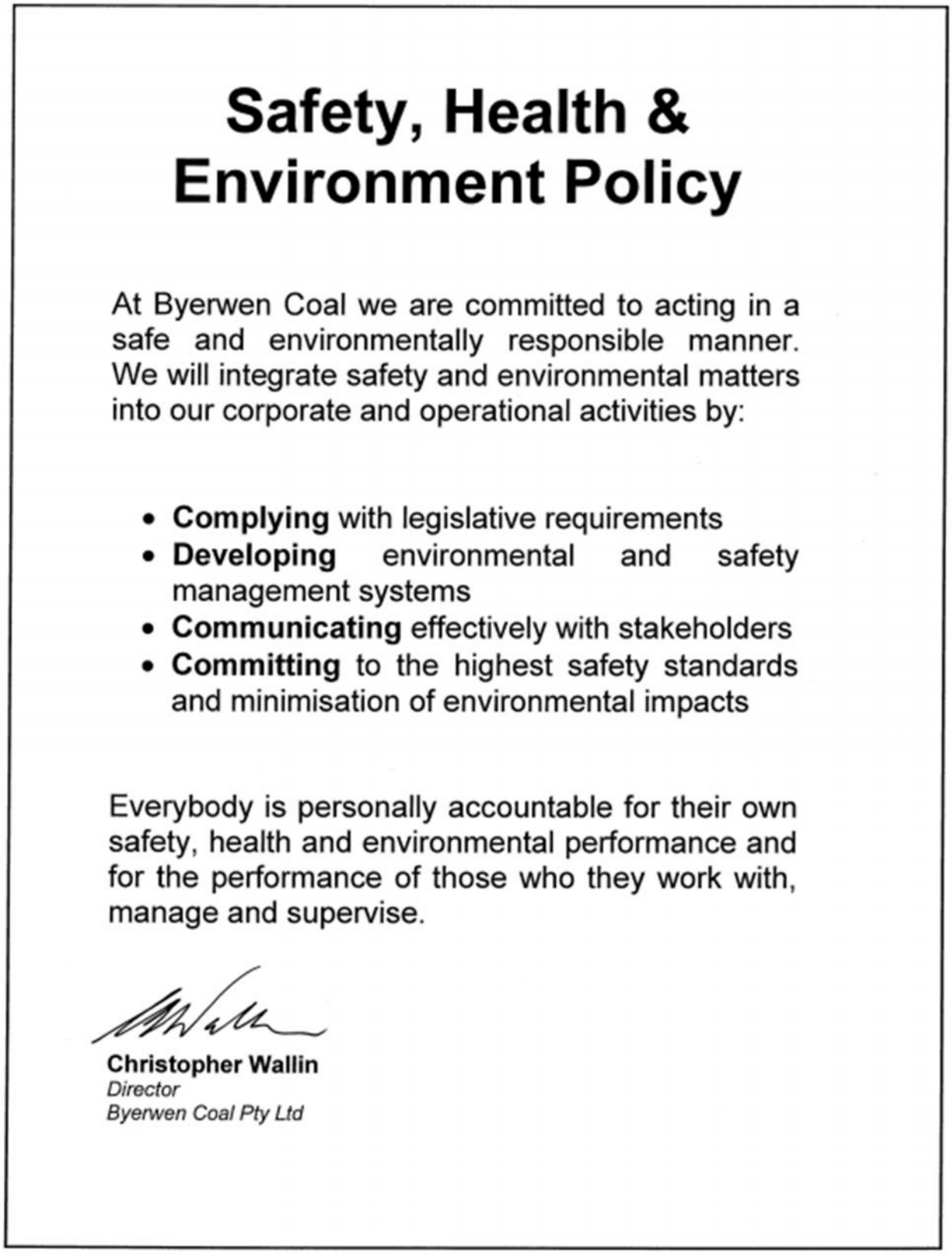
- sections 18 and 18(a) (listed threatened species and communities)

- sections 20 and 20(a) (listed migratory species).

This Environmental Impact Statement (EIS) has been prepared on behalf of Byerwen Coal pursuant to the bilateral agreement between the Commonwealth and Queensland governments for the purposes of the Commonwealth Government's assessment under part 8 of the EPBC Act.

The EIS was prepared by a range of qualified and experienced consultants. The names and details of qualifications for those involved in the preparation of the EIS are provided in EIS **Appendix 4**. The qualifications and details of those specifically involved in the MNES assessment are provided in **Section 35.2**.

The following chapter addresses the MNES component of the EIS and the requirement to prepare a stand-alone MNES assessment. The information presented in this chapter is based on the Matters of National Environmental Significance Assessment Report prepared by AMEC and provided in **Appendix 22** of the EIS. The chapter summarises the results of desktop and field studies undertaken as part of the terrestrial ecology assessment to define the MNES that could be affected by the project. The chapter also assesses the potential impacts of the project on those defined MNES and considers the cumulative impacts of the project in relation to other relevant projects on MNES. Mitigation measures to avoid, minimise or offset adverse impacts associated with the project are proposed in the chapter. For some environmental values with identified potential impacts, a number of potential mitigation options have been identified for consideration. The selection of the preferred options with definitive statements of intent, will be made as management plans and the project are subsequently developed, and in accordance with the requirements of approvals and permitting process.



Safety, Health & Environment Policy

At Byerwen Coal we are committed to acting in a safe and environmentally responsible manner. We will integrate safety and environmental matters into our corporate and operational activities by:

- **Complying** with legislative requirements
- **Developing** environmental and safety management systems
- **Communicating** effectively with stakeholders
- **Committing** to the highest safety standards and minimisation of environmental impacts

Everybody is personally accountable for their own safety, health and environmental performance and for the performance of those who they work with, manage and supervise.

Christopher Wallin
Director
Byerwen Coal Pty Ltd

Figure 35-1 Byerwen Coal Safety, Health and Environment Policy

35.2 MNES Study Team

35.2.1 David Stanton

David has 17 years experience in the disciplines of impact and ecological risk assessment, resource mapping, floristic assessment and conservation planning. He has worked across a range of industry sectors including mining, infrastructure and as a consultant to government organisations throughout Queensland, the Northern Territory, North-Western Australia and Papua New Guinea. His particular expertise lies in tropical forest ecology including floristic and structural classification, and associated mapping of those features.

During a consultancy period to the Wet Tropics Management Authority spanning 14 years in association with Peter Stanton, David's comprehensive mapping of flora associations within the world heritage area greatly increased the understanding of ecological function in one of the world's most botanically diverse regions. The culmination of this work, a series of 38 1:50 000 scale vegetation community maps and descriptive reports form the basis for regional ecosystem classification in Queensland's Wet Tropical Bioregion. David's professional career was initiated in the resources industry working as a regional exploration geologist in Papua New Guinea (Milne Bay Province). He has also recently completed several major landform and geological assessments on properties throughout northern Australia.

35.2.2 Bruce Thomson

Dr Bruce Thomson has approximately 30 years of experience in a broad range of conservation, environmental assessment and management areas. He has provided consulting services since 2008 as a Principal Ecologist with a Brisbane-based firm where he has worked primarily with gas and mining sectors to conduct fauna habitat assessments, fauna surveys and specialist botanical services.

35.2.3 David Moore

David is an aquatic ecologist with 10 years consulting experience on projects undertaken in QLD, NSW, ACT, VIC, NT and PNG. Most recently David has been involved in various aquatic assessments for pipelines and gas field developments in the Surat and Bowen basins. David has been engaged by the Cooperative Research Centre for Freshwater Ecology to assist with a four state and territory assessment of streams, including testing and comparison of biological methods for analysing stream health. He has also been engaged by the Australian Government to assist with the ecological characterization of marine, estuarine and freshwater wetlands of the Cobourg Peninsula, NT – Australia's first listed Ramsar site.

David maintains a strong understanding and application of best practice methods for assessing aquatic ecosystem health and has been the lead aquatic ecologist on numerous mining and gas projects, responsible for the delivery of aquatic ecology impact assessment components for EISs, baseline assessments and ongoing monitoring of river health. He is an Australian River Assessment System (AUSRIVAS) accredited ecologist, a Senior Operator in electrofishing practice and has attained status as a Certified Environmental Practitioner (CEnvP) in the fields of aquatic ecology, environmental impact assessment and environmental management.

35.2.4 Jason Richard

Jason Richard is an ecologist with approximately 16 years of professional consulting experience. During this time, he was worked in technical leadership, team management and project management roles within both boutique ecological consultancies and multi-national corporations.

His industry experience spans surface and subsurface mining operations (metalliforous and coal), coal seam gas, electricity generation and distribution, communications infrastructure development, urban

development and transport infrastructure projects. Jason has also worked on a range of strategic environmental planning projects, biodiversity monitoring studies and integrated pest and threat management plans for Government clients.

Jason's technical expertise is based on extensive field survey experience in NSW, Qld, the Northern Territory and South-east Asia. He has a well developed knowledge of policy and legislation pertaining to biodiversity management across Australia (and abroad) including the various State and Commonwealth nature conservation and vegetation management frameworks, associated offset policies and approval processes. He has contributed to a large number of Referrals under the *Environment Protection and Biodiversity Conservation Act 1999* and the review and negotiation of approval conditions for many Significant Projects in Qld.

Jason is a Certified Environmental Practitioner and is a member of the peak Environmental and Ecological Societies of Australia. He formerly sat on the national review panel for both terrestrial flora and fauna for SKM and has been engaged as an independent peer reviewer for technical studies by a range of multi-national corporations for domestic and international projects, including mining projects in Vietnam, the Philippines and Papua New Guinea.

He has extensive remote area experience on large ecological survey projects including biodiversity studies for the Australian Government (Department of Defence) in the Northern Territory and the Queensland Government (Foreign Aid) in Sumatra.

Jason's core expertise relates to the ecosystems and species of Queensland, and particularly biodiversity values of the South-east Queensland, Brigalow Belt, Gulf Plains and Mt Isa Inlier Bioregions.

35.2.5 Jeromy Claridge

Jeromy Claridge has extensive environmental impact assessment and project management experience. Jeromy has over 17 years of experience providing environmental advice through all project development phases from preliminary planning and site/route selection through to project feasibility, environmental assessment and approvals and on-site environmental management. He also has experience coordinating and obtaining environmental approvals for the construction of rail, roads, power, gas and mining projects.

Jeromy is a Certified Environmental Practitioner and managed multidisciplinary teams undertaking environmental impact assessments often for complex projects involving numerous approvals and environmental issues. Through these projects he has undertaken extensive consultation with Federal, State and Local Government agencies, facilitated community engagement and gained a comprehensive understanding of environmental legislation at the Commonwealth, State and local government level.

35.2.6 Kate Hourigan

Kate is a Senior Environmental Planner with 10 years' experience in development assessment and the preparation of multi-disciplinary studies for major infrastructure projects. On recent projects, she has been involved with the scoping and management of technical studies and a principal coordinator and joint author of several environmental impact statements under the *Environmental Protection Act 1994*, *State Development and Public Works Organisation Act 1972* and the *Environment Protection and Biodiversity Conservation Act 1999.*

Kate has provided advice on environmental constraints, approval and offset requirements to project teams in the mining, rail and water sectors. She is experienced at liaising with clients and project design teams to develop and refine projects to respond to these constraints. Kate has a background in ecological assessment and has written and managed a number of terrestrial flora and fauna baseline studies and impact assessments for mining and linear infrastructure projects.

35.3 Background

35.3.1 Project Area

The project area comprises the project's six mining lease application (MLA) areas. Hence, the project area is defined as the area of land contained within MLA 10355, MLA 10356, MLA 10357, MLA 70434, MLA 70435 and MLA 70436. Collectively, the six MLAs cover an area of approximately 22,697 hectares. Project mining leases are shown in **Figure 35-2**.

35.3.2 Project Description

The project involves the development of a proposed new open cut coal mine, located in the Northern Bowen Basin, approximately 20 km west of Glenden and 140 km west of Mackay. The project's location and regional context is shown in **Figure 35-3**.

The proposed life of the project is 50 years, including the construction, operation and decommissioning phases. Coal will be extracted from the open cut mine using conventional large excavators and trucks in combination with electric rope shovels and dragline. Mining activities will be carried out on a full time basis (i.e. 24 hours, 7 days per week, 52 weeks per year).

Four mining zones have been identified for the project (north, south, east and west), comprising eight open pits. The south phase comprises mining zones in the south, east and west. The north phase comprises mining zones in the north.

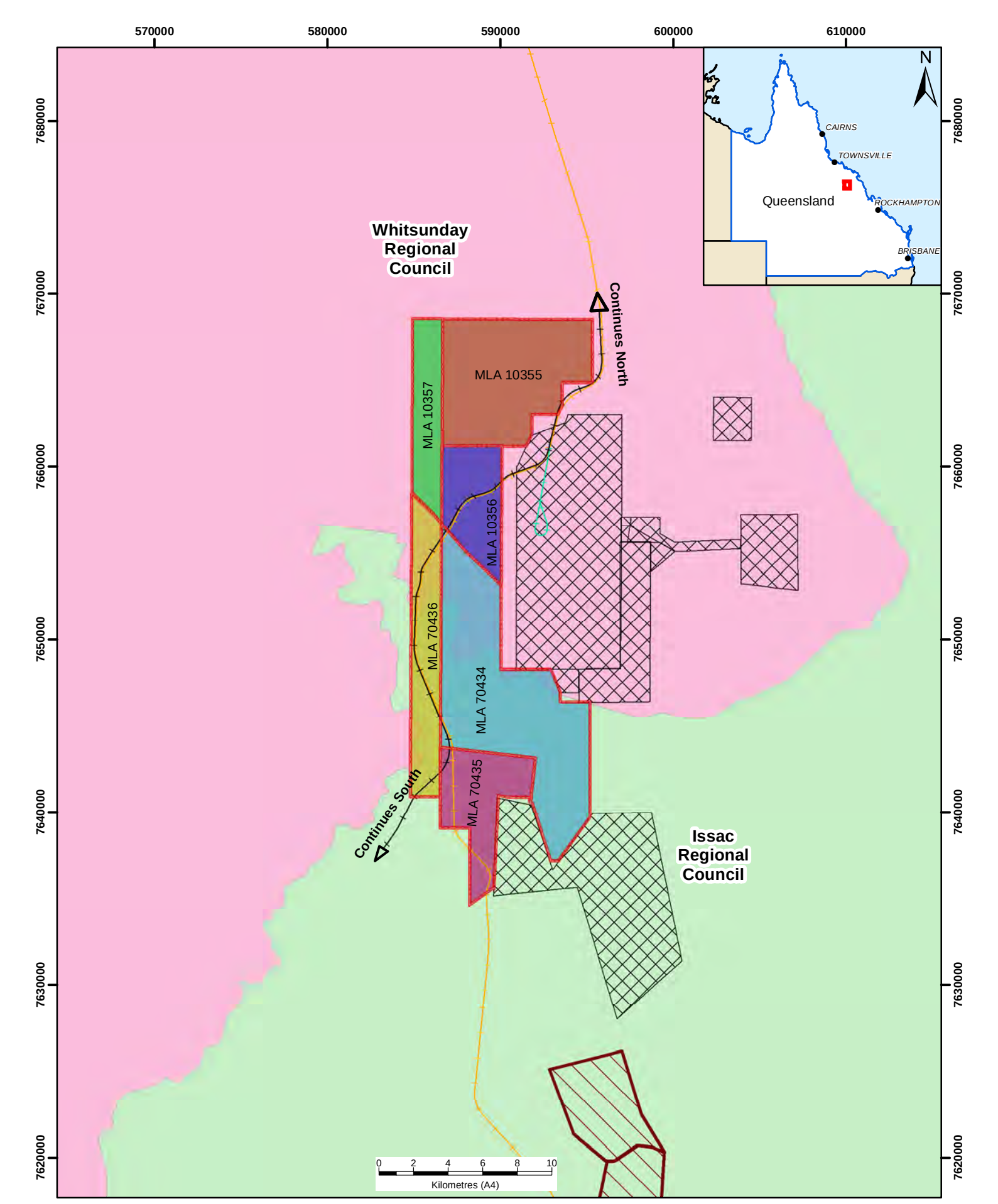
Detailed design for the project will be conducted during the planning phase, prior to construction.

Construction in the southern tenement area for the south phase will occur prior to any operations and include construction of the southern coal handling and preparation plant (CHPP), mine infrastructure area (MIA) water management infrastructure, and southern train loading facility (TLF). In approximately Year 15 of mining operations, construction in the northern tenement area for the north phase will commence to coincide with the planned commencement of operations of the open pit in the north in Year 17. Construction in the northern tenement area will include the northern CHPP, MIA, water management infrastructure and northern TLF. The proposed mine layout and associated infrastructure is shown in **Figure 35-4**. The project as assessed in this report includes:

- Progressive development of several open cut pits. The North and West Pits form single footprints while the South and East Pits are split. For the purposes of this impact assessment, six separate pit footprints are discussed – the North Pit, West Pit (comprising West Pit 1, West Pit 2 and West Pit 3), South Pit 1, South Pit 2, East Pit 1 and East Pit 2.
- Waste rock dump areas external to the pits will be used for placement of overburden material from initial box cuts.
- A Northern Infrastructure Area servicing the North Pit, comprising a CHPP and MIA, associated run-of-mine (ROM) and product coal stockpiles, raw water storage, tailings and reject co-disposal areas, various roads and conveyors. This area also includes a train loading facility (rail loop and rail spur connecting to the Goonyella to Abbott Point (GAP) rail line).
- A Southern Infrastructure Area servicing the remaining open cut pits, comprising a separate CHPP and MIA, associated ROM and product coal stockpiles, raw water storage, co-disposal areas, roads, conveyors, a separate train loading facility connecting to the GAP rail line.
- A proposed 60 m wide central infrastructure corridor connecting the Northern and Southern Infrastructure Areas, including road, water supply pipeline, power supply and crossings across tributaries of Kangaroo Creek.

- Access roads and internal haul roads connecting the pits and MIA.
- Diversions of existing creek lines (two tributaries of the Suttor River and a tributary of Kangaroo Creek).
- Diversions of existing power infrastructure.
- Mine water management infrastructure, including mine affected water dams, sediment affected water dams and associated pipelines.

Decommissioning and rehabilitation will be completed in the final two years of the mine life although rehabilitation will be progressive throughout the mine life.



Legend

- Byerwen Project Mining Lease Boundaries
- Isaac Regional Council
- Whitsunday Regional Council
- BHP Granted MLs
- Xstrata Granted MLs
- Alpha Coal Project Rail Line
- GAP Rail line
- Newlands Mine Rail Loop

Project Mining Leases	QCOAL GROUP
Figure 35-2	**Byerwen Coal Project**
Date: *5/02/2013*	**Author:** Shahram.Nasiri
	Map Scale: 1:275,000
Revision: R1	**Coordinate System:** GDA 1994 MGA Zone 55
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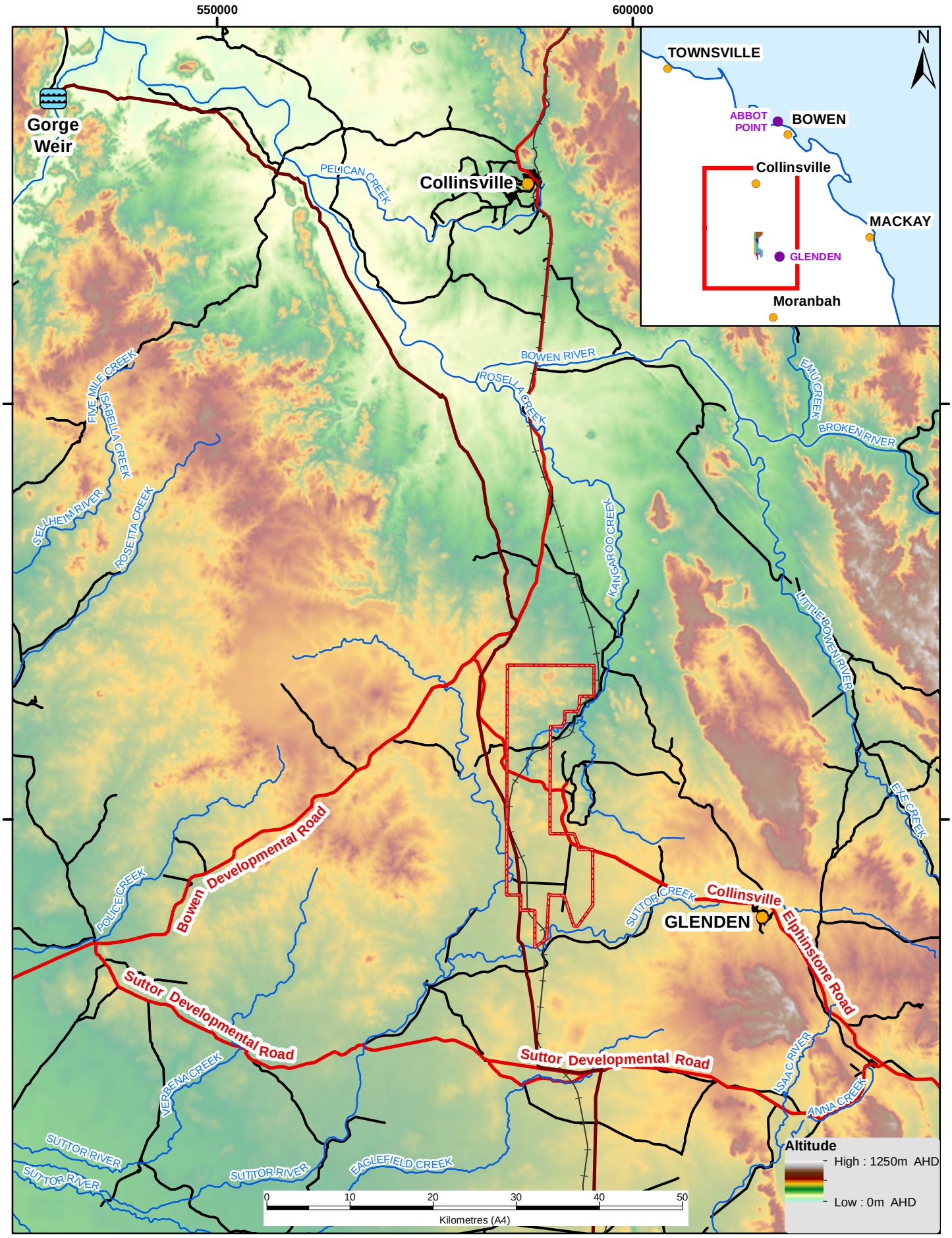

Legend

- Project Area
- Main Towns
- Burdekin to Moranbah Pipeline
- Watercourses
- GAP Rail line
- Highway
- Main Road
- Local Roads (formed & unformed)

Regional Project Location		QCOAL GROUP
Figure 35-3	**Byerwen Coal Project**	elp environmental and licensing professionals pty ltd
Date: *5/02/2013*	**Author:** Shahram.Nasiri	
	Map Scale: 1:600,000	
Revision: R1	**Coordinate System:** GDA 1994 MGA Zone 55	
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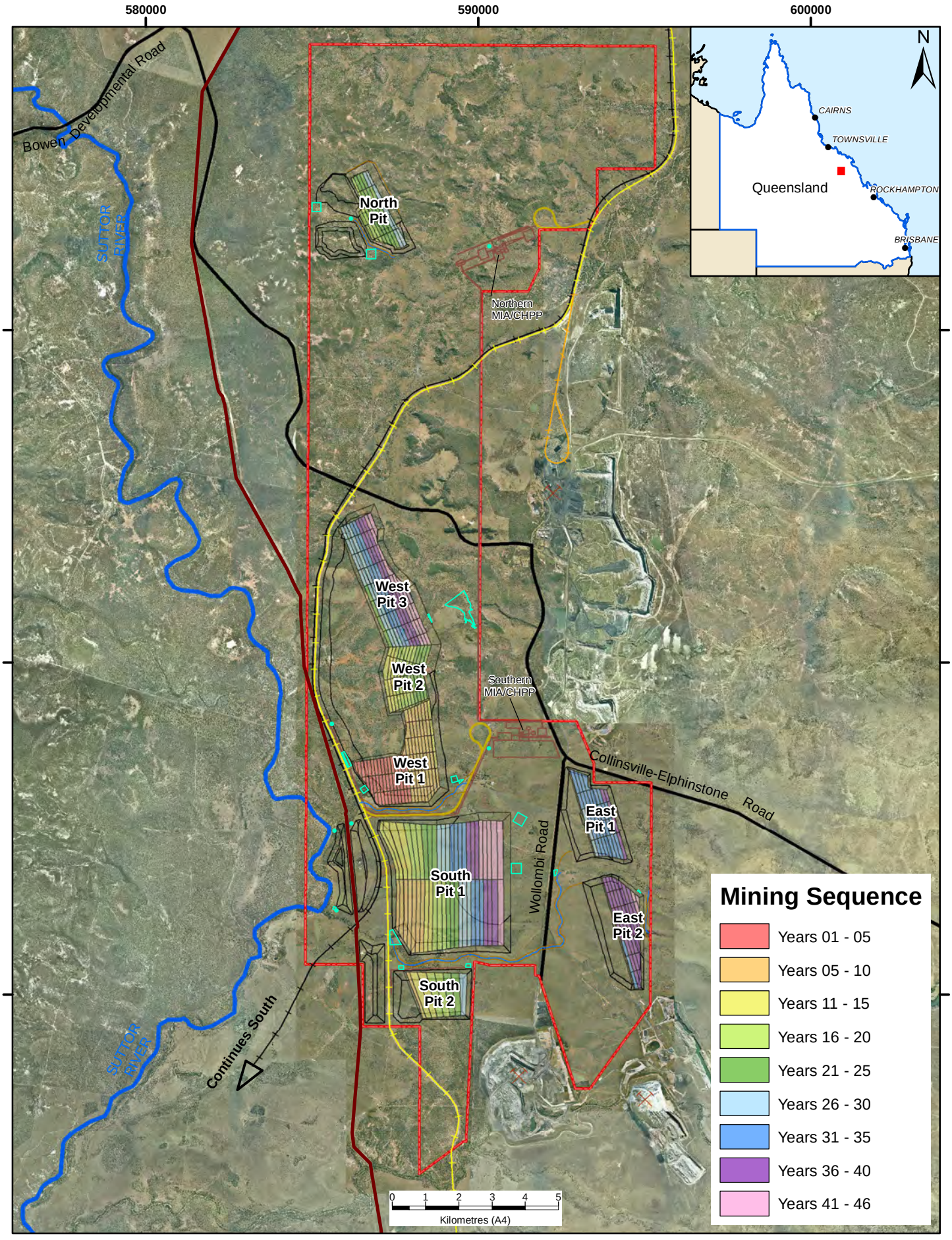

Legend

- Project Area
- Waste Rock Dumps and Pits
- Burdekin to Moranbah Pipeline
- GAP Rail line
- Newlands Mine Rail Loop
- Alpha Coal Project Rail Line
- Train Loading Facilities
- Dam (mine affected, sediment affected, clean water)
- Drainage Bund
- Drainage Diversion
- Formed Road
- Mine Infrastructure
- Existing Mine Site

Proposed Mine Layout

Figure 35-4 — **Byerwen Coal Project**

Date: *28/02/2013*

Author: samuel.ferguson

Map Scale: 1:150,000

Revision: R1

Coordinate System: GDA 1994 MGA Zone 55

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35.3.3 Public Consultation

A range of consultation activities have been undertaken throughout the project's pre-feasibility and EIS phases including consultation with DSEWPaC regarding MNES.

A full list of the major stakeholders engaged during the consultation process is provided in **Table 35-1**.

Table 35-1 Stakeholder List

Stakeholder category	Organisation or agency
Political	▪ State Members of Parliament ▪ Isaac Regional Council, Mackay Regional Council and Whitsunday Regional Council Mayors, CEOs, and Councillors
Government Agencies and Emergency Services	▪ the Australian Government Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) ▪ the State of Queensland Department of Aboriginal and Torres Strait Islander and Multicultural Affairs (DATSIMA) ▪ the State of Queensland Department of Community Safety (formerly Department of Emergency Services) ▪ the State of Queensland Department of Environment and Heritage Protection (EHP – formerly the Department of Environment and Resource Management) ▪ the State of Queensland Department of Natural Resources and Mines (DNRM – formerly Department of Employment, Economic Development and Innovation (DEEDI) Mines and Energy) and the Social Impact Assessment Unit (now within the Department of State Development, Infrastructure and Planning (DSDIP)) ▪ the State of Queensland Department of Employment, Education and Training (DETE – formerly Department of Education) ▪ the State of Queensland Department of Local Government and Planning (now also linked with the Department of State Development, Infrastructure and Planning (DSDIP)) ▪ the State of Queensland Department of Families, Youth and Community Care (DFYC- formerly Department of Communities) ▪ the State of Queensland Department of Transport and Main Roads ▪ Queensland Fire and Rescue Service ▪ Queensland Rural Fire Service ▪ Queensland Police Service ▪ Queensland Health ▪ Queensland Ambulance Service ▪ Department of Emergency Services ▪ Queensland State Emergency Services
Landholders and occupiers	▪ Six directly affected landowners ▪ Adjacent landowners
Education and community services	▪ Glenden State School ▪ Glenden Creche and Kindergarten Association Limited (C&K) Community

Stakeholder category	Organisation or agency
	Childcare Centre ■ Skills Queensland ■ Construction Skills Queensland ■ Central Queensland Institute of TAFE
Businesses	■ Thirteen businesses in Glenden ■ Numerous businesses in the surrounding region
Business groups	■ Bowen Pastoral and Agricultural Association ■ Bowen Tourism & Regional Development Bureau Inc ■ Chamber of Commerce and Industry Queensland – Mackay ■ Whitsundays Marketing and Development (WM&D) (merger between Enterprise Whitsundays and Tourism Whitsundays) ■ Mackay Area Industry Network (MAIN) ■ Mackay Whitsunday Regional Economic Development Corporation (REDC)
Utilities and Infrastructure	■ Ergon Energy ■ QR National ■ SunWater ■ Telstra Regional
Industry and industry groups	■ Abbots Point Bulk Coal Pty Ltd ■ Arrow Energy Limited ■ Belyando Suttor Implementation Group ■ Bowen Tourism ■ Burdekin Solutions Pty Ltd ■ Coal Connect Alliance ■ Glenden Stakeholder Engagement Group (SEG) ■ Housing Industry Association Ltd ■ Navaho Gold Pty Ltd ■ Newlands Coal Project ■ Mackay Area Industry Network ■ Mackay Regional Council ■ Mining & Energy Services Council of Australia ■ Ports Corporation Queensland ■ QCoal Foundation ■ Regional Development Australia – Mackay Whitsunday. ■ Regional Economic Development Corporation ■ Xstrata Coal Queensland Pty Ltd
Special interest groups	■ Capricorn Conservation Council ■ Dalrymple Landcare Committee ■ Mackay Conservation Group

Stakeholder category	Organisation or agency
	▪ Mining Communities United Inc ▪ Moranbah Action Group
Indigenous groups	▪ Representatives of the Birriah-Gubba People (Birriah People) ▪ Birriah Enterprises ▪ Representatives of the Jangga People (Jangga People) ▪ Jangga Operations Limited
Health services	▪ Collinsville Hospital. ▪ Glenden Community Health Centre ▪ Glenden Medical Centre ▪ Glenden Dentist ▪ Moranbah Hospital ▪ Royal Flying Doctor Service
Media	▪ ABC Capricornia ▪ Bowen Independent ▪ Queensland Country Life ▪ Daily Mercury ▪ Courier-Mail
Community groups	▪ Community groups in Glenden and the region
Community services	▪ Community services in Glenden and the region

Further details regarding the public consultation process are provided in **Chapter 4**.

35.3.4 Social and Economic Impacts

Public consultation findings informed the social impact assessment (SIA) (refer **Chapter 31**) for the project. A range of action plans have been developed as part of the Social Impact Management Plan (SIMP) for the project, provided as **Appendix 10**, to address identified social impacts associated with the project. The project is expected to result in a range of positive and negative social impacts.

The most highly significant negative social impacts relate to the influx of the project workforce into the town and include:

- increased demand for regional and local health services throughout the construction and operations phases
- increased overall demand on regional emergency services including ambulance, police and fire services.

The most highly significant positive social impacts include:

- provision of employment opportunities
- increased demand on education services

- injection of wealth into local and regional economy.

On balance it was assessed that following the implementation of mitigation measures and management strategies outlined in the SIMP, the project will have a generally positive social impact on the local and regional area. Further details of the social impacts associated with the project are provided in **Chapter 31**.

The project is also estimated to contribute significant economic benefits to the region and the wider domestic economy over the life of the project (refer **Chapter 30**). The operations phase of the project is estimated to have the following average annual (following the initial four years of ramp up) direct and indirect economic benefits:

- $2,299 million per annum in output
- $1,133 million per annum in gross value added (outputs less inputs)
- $482 million per annum in household incomes
- 6,206 full time equivalent jobs per annum (direct and indirect).

There is potential to deliver both beneficial and adverse economic impacts.

Beneficial impacts include:

- increased economic activity, including gross regional product, employment and incomes
- direct benefits for industries other than mining, e.g. construction, port activities and retail
- increased government revenues through taxation and royalties.

Adverse impacts include:

- population growth placing demand on social infrastructure
- labour shortages through labour demand for mining and construction workers
- upward pressure on wages due to labour shortage, and potential to increase the gap between wages in other economic sectors
- direct impacts on agricultural land and production due to competition for land.

35.4 Methodology

A combination of desktop assessments and field surveys were conducted to determine existing terrestrial ecology values, including MNES for the project area. A summary of the methodology used to undertake these tasks is provided below.

35.4.1 Desktop Assessment

The most recent desktop assessment was undertaken in March 2012 and included a review of the Commonwealth and State databases listed below:

- DSEWPaC Protected Matters Search Tool to identify MNES within approximately 20 km of the project area
- DSEWPaC Species Profiles and Threats Database (SPRAT)
- Department of Environment and Heritage Protection (EHP) Wildlife Online database to identify flora and fauna species potentially occurring within approximately 20 km of the project area
- Queensland Herbarium HERBRECS search

- Queensland Museum Records within the project area
- EHP Regional Ecosystem Mapping (Version 6.1), High Value Regrowth Mapping (Version 2), Essential Habitat Mapping (Version 2)
- EHP Regional Ecosystem Description Database (REDD)
- EHP Environmentally Sensitive Area (ESA) mapping
- EHP Biodiversity Planning Assessment (BPA) for the Brigalow Belt Version 1.3 (DERM, 2008)
- Birds Australia Bird Atlas search
- EHP Wetland Mapping to determine the classification, extent and significance of wetlands within the project area
- Directory of Nationally Important Wetlands (Environment Australia, 2001a)
- Protected Area Estate Mapping
- EHP watercourse mapping
- published ecological information on threatened flora and fauna species and vegetation communities.

Previous studies and reports prepared for the project and for other nearby mines were also reviewed including:

- Flora and Fauna Assessment of the Exploration Permit Coal (EPC) 614 project area near Glenden, Central Queensland, a report to QCoal Pty Ltd by the Centre for Environmental Management, Central Queensland University (CQU) (Wormington *et al*, 2009)
- Byerwen Coal Baseline Flora and Fauna Study, a report to QCoal Pty Ltd by Unidel (Unidel, 2011)
- Byerwen Coal 2011 Wet Season Baseline Limnology Survey (NRA, 2011)
- environmental impact statements for the Ellensfield, Caval Ridge and Daunia coal mine projects.

35.4.2 Field Survey

35.4.2.1 Flora

Separate flora field surveys have been undertaken in the project area comprising:

- general surveys to verify 1:100,000 scale Regional Ecosystem (RE) mapping and to identify and prioritise terrestrial flora values in the project area
- a targeted survey to assess whether native grasslands in the eastern part of the project area met the criteria for the 'Natural grasslands of the Queensland Central Highlands and northern Fitzroy Basin' threatened ecological community (Natural grasslands Threatened Ecological Community (TEC))
- targeted surveys to assess populations of the previously undescribed *Kelita uncinella* recorded in the initial surveys by CQU (Wormington *et* al, 2009).

Terrestrial flora field surveys and the timing for each are summarised in **Table 35-2**.

Table 35-2 Summary of Terrestrial Flora Field Surveys

Purpose	Project area	Wet season survey	Dry season survey
General flora survey (CQU)	EPC 614	30 March - 10 April 2009	3 August 2009
General flora survey	EPC 739	-	14 - 22 October 2010

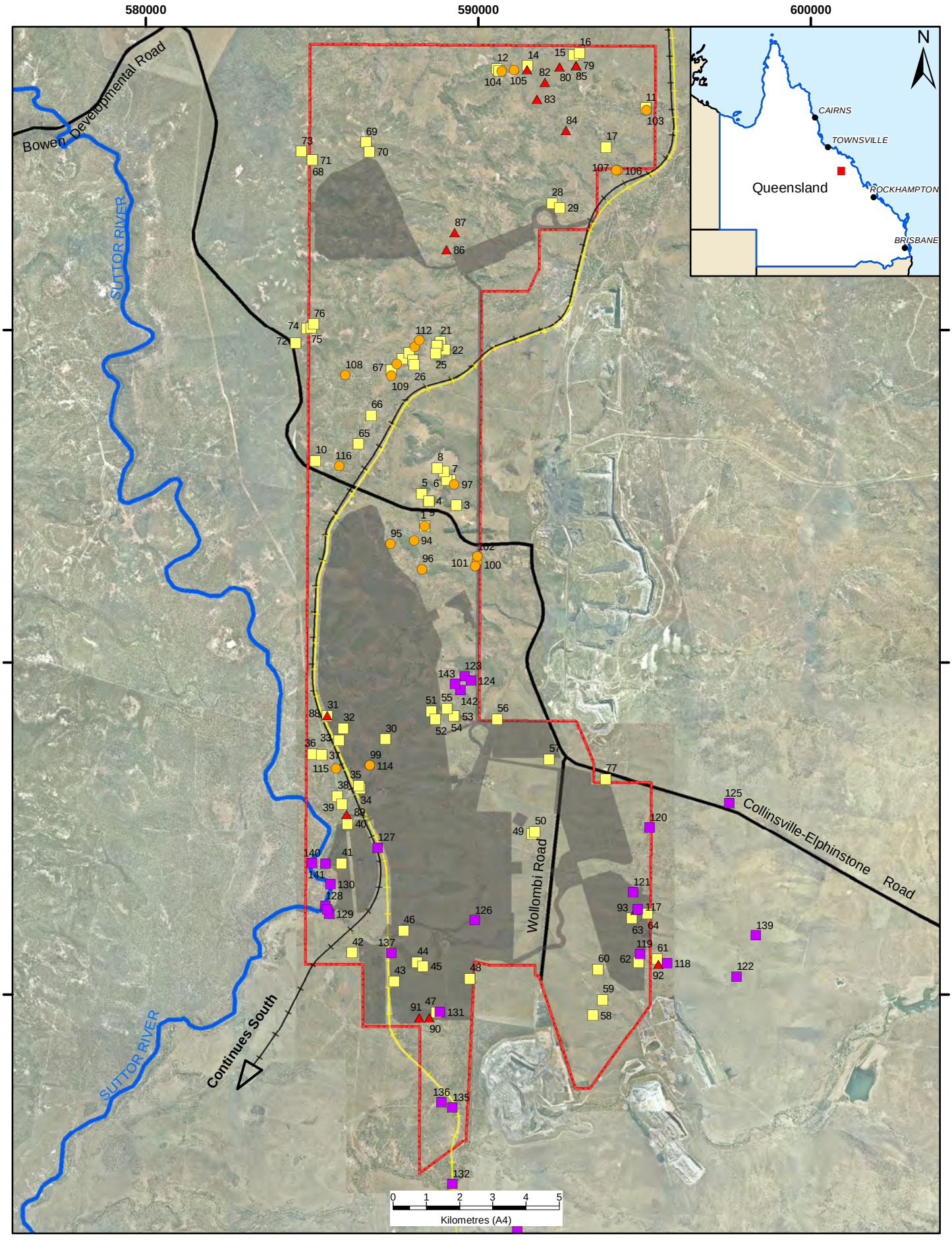
Purpose	Project area	Wet season survey	Dry season survey
Targeted grassland survey	EPC 739	-	2 - 3 June 2011
Targeted surveys for *Kelita uncinella*	EPC 739	-	5 - 30 June 2011 24 - 29 July 2011
General flora survey	EPC 739 and EPC 614	5 - 9 March 2012	-

The primary objective of these surveys was to identify and describe vegetation communities and terrestrial flora values and to ground-truth existing RE mapping for the project area. Surveys were carried out in accordance with the Queensland Herbarium's 'Methodology for the Survey and Mapping of REs and Vegetation Communities in Queensland' (Neldner *et al,* 2005). For flora species unable to be identified by field surveys, specimens were submitted to the Queensland Herbarium for identification. Site data was recorded in a form compatible with the Queensland Herbarium CORVEG database. Vegetation mapping and data will be submitted to the Queensland Herbarium to assist with updating the CORVEG database, as part of the approvals process.

A total of 143 sites across the project area were assessed over three surveys. The location of these sites is shown in **Figure 35-5** and a summary of survey effort is provided in **Table 35-3**.

Table 35-3 Number of Sites and Information Collected by Site Type

Site type	No. of sites	Information collected
Secondary	16	Complete species list for 10 x 50 m plot, species structure, assemblage, diversity and abundance, record of general vegetation condition and presence of weed species.
Tertiary	23	Species structure, assemblage, diversity and abundance, record of general vegetation condition and presence of weed species.
Quaternary	77	Species present.
Not Recorded	27	CQU (2009) notes that survey data was collected from 27 survey sites, but does not describe the level of assessment completed or provide the requisite data sheets. However, subsequent floristic survey by Unidel (now AMEC) overcomes this limitation by establishing supplementary sampling sites in the areas assessed by CQU.



Legend

- Project Area
- Project Ecological Footprint
- Formed Roads
- GAP Rail Line
- Alpha Coal Project Rail Line

Flora Survey Type

- Secondary
- Tertiary
- Quaternary
- CQU (2009) 2500m^2 Plot

Flora Survey Sites	QCOAL GROUP
Figure 35-5	**Byerwen Coal Project**
Date: *5/02/2013*	**Author:** Shahram.Nasiri
	Map Scale: 1:150,000
Revision: R1	**Coordinate System:** GDA 1994 MGA Zone 55
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35.4.2.2 Fauna

Three separate fauna surveys were conducted in the project area between 2009 and 2012 (**Table 35-4**). Baseline fauna surveys involved fauna trapping at 13 sites and secondary habitat assessments at 22 sites within representative habitat types (**Table 35-5**). Trapping and habitat assessment sites in the project area are shown on **Figure 35-6**.

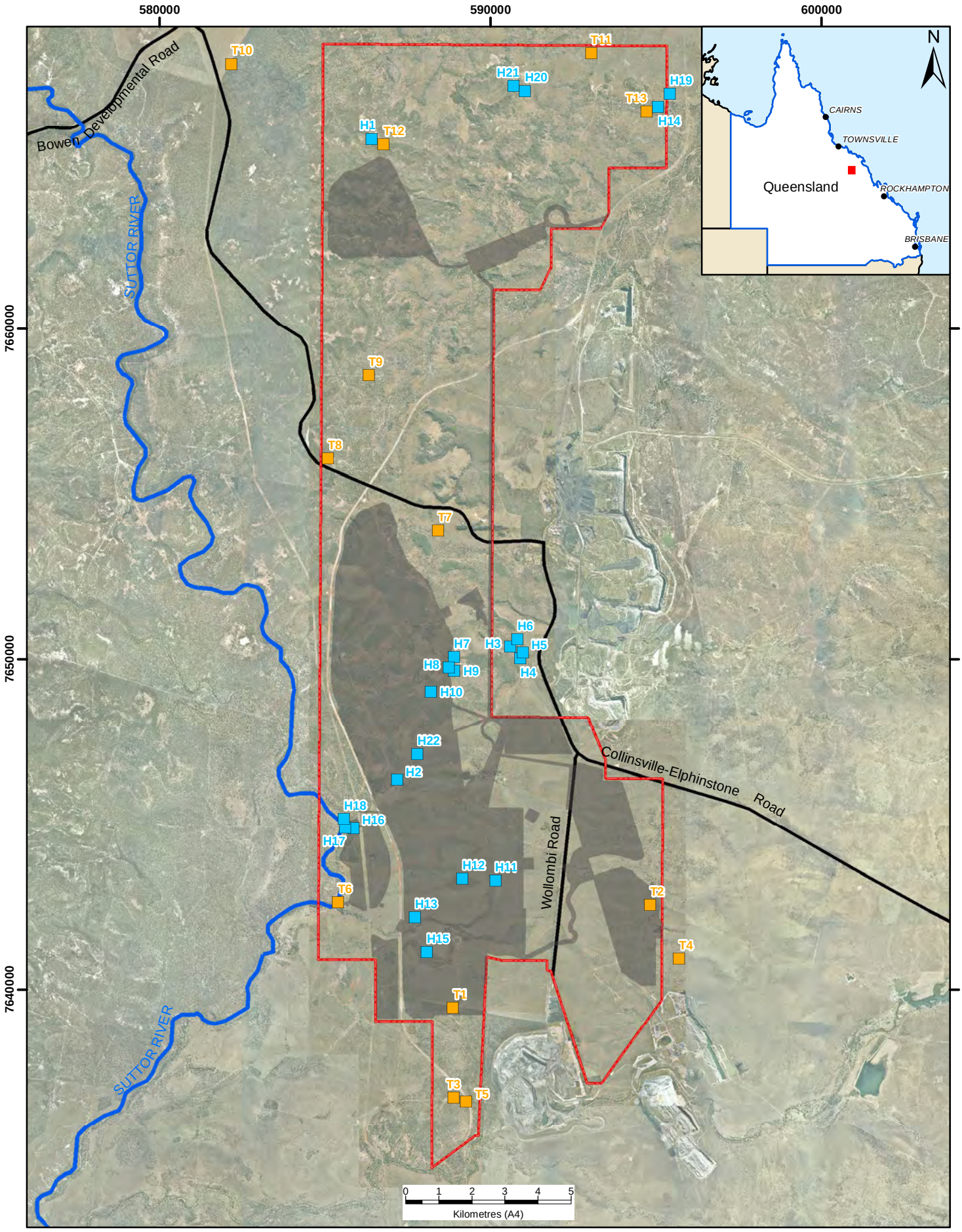
Table 35-4 Summary of Terrestrial Fauna Field Surveys

Purpose	Project area	Wet season survey	Dry season survey
General fauna survey (CQU)	EPC 614	30 March - 10 April 2009	3 - 12 August 2009
General fauna survey	EPC 739	-	14 - 22 October 2010
General fauna survey	EPC 739	5 - 9 March 2012	-

Table 35-5 Habitat Types Sampled by Survey Event

Survey	Lateritic uplifts	Undulating black cracking clays	Undulating sandy plains	Clay floodplains with gilgai	Alluvial floodplains	Wetlands	Cleared
CQU (2009)	-	-	✓	✓	✓	-	✓
AMEC (2010)	✓	✓	✓	-	✓	-	-
AMEC (2012)	✓	✓	✓	✓	✓	✓	✓

Detailed fauna survey methodologies including a summary of trapping hours and techniques are provided in **Appendix 19.**



Legend

- Project Area
- Project Ecological Footprint
- Formed Roads
- Trapping Location
- Habitat Assessment

Fauna Survey Sites	
Figure 35-6	**Byerwen Coal Project**
Date: *5/02/2013*	**Author:** Shahram.Nasiri
	Map Scale: 1:150,000
Revision: R1	**Coordinate System:** GDA 1994 MGA Zone 55
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35.4.3 Habitat Assessments

Habitat assessments captured specific microhabitat data from numerous locations within different vegetation groups across the project. This assessment of habitat features identified the presence, abundance and quality of microhabitat features considered critical for the survival of threatened, near threatened and regionally significant fauna species. Consideration of habitat quality as a predictor of the likelihood of occurrence is considered to be a precautionary approach and is particularly relevant for cryptic species.

Targeted fauna habitat assessments were carried out at 22 sites of approximately 100 m x 100 m within the project area with the aim of identifying microhabitat features for target fauna species identified through the desktop analysis. The location of these sites is shown on **Figure 35-6**.

35.4.4 Species Assessments

The likelihood of occurrence for individual species has been determined based on a review of previous records, a review of known habitat preferences and an assessment of habitat availability and the presence of microhabitat features within the project area. This included known RE associations for each species, known records and distribution ranges. Species were assigned to one of the following categories:

- **Known to occur**: this category includes species or communities which have been recorded from the project area
- **Likely to occur**: this category includes species previously recorded in proximity to the project area, and which have suitable habitat features available on site which may support the species
- **May occur**: this category includes those species where suitable habitats or RE associations are present in the project area but where there are no known records in the area
- **Unlikely to occur**: this category includes those species for which the project area offers limited or no potential habitat, is outside their known range and/or is without broader habitat requirements.

Impacts on potential habitat for flora and fauna species have been calculated based on RE associations for individual species derived from known habitat associations and published literature. RE associations provide an indication of the presence of suitable habitat but do not take account of the actual distribution of suitable microhabitat (e.g. logs, leaf litter) or niche habitat (e.g. suitable nesting sites) within each RE. The areas are therefore likely to represent an overestimate of actual habitat availability for most species.

35.5 Existing Environment

35.5.1 Drainage, Waterways and Wetlands

Drainage, waterways and wetlands are described in detail in **Chapter 15** and **Chapter 19**.

The project area is located in the Burdekin River catchment. The northern and most of the central sections of the project area are within the Bowen sub-catchment and are drained by Plum Creek, Kangaroo Creek and their tributaries, which form part of the Broken River sub-catchment. The southern section of the project area is within the Suttor sub-catchment and is drained by the Suttor River and its tributaries (refer **Figure 35-7**). Watercourses in the project area are ephemeral and flow only after sustained or intense rainfall in the catchment. Stream flows are highly variable, with flows typically occurring during the wetter months (January through March) with low to no flow for the rest of the year.

No Ramsar or Nationally Important Wetlands occur within, or immediately downstream of the project area. Freshwater wetlands (palustrine, lacustrine (farm dams) and riverine) are mapped for and were observed within the project area. These include:

- a palustrine wetland situated on a closed depression of the Suttor River floodplain in the western portion of the project area and continuing outside the project area
- a large farm dam at site H2 (approximately 5 ha)
- gilgai wetland habitats on clay plains
- a smaller dam at site H13, occurring within a wide alluvial system along a tributary of the Suttor River in the south-east of the project area
- a smaller dam at site H19, in the northern part of the project area.

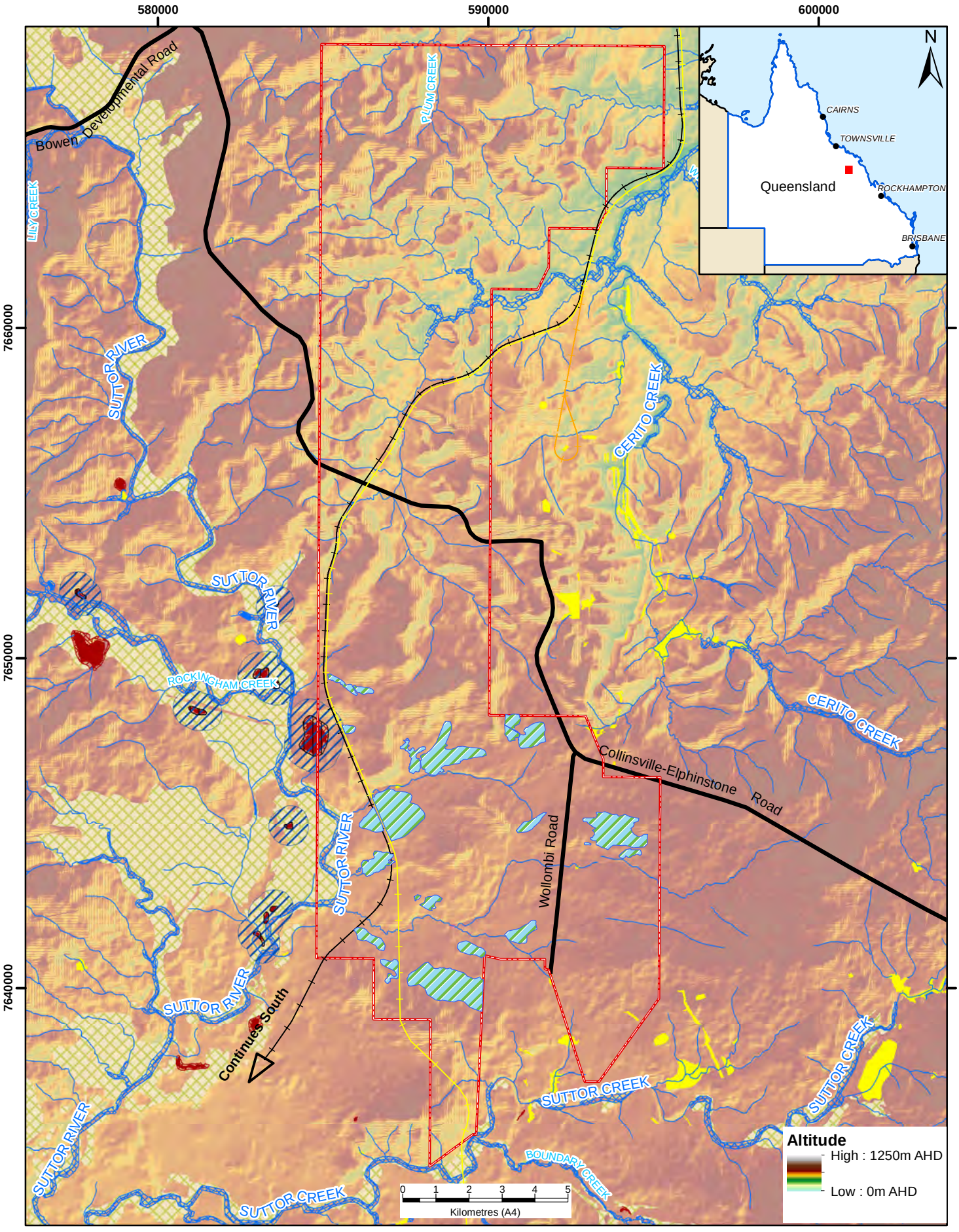
35.5.2 Connectivity and Wildlife Corridors

Habitat connectivity within the project area is linked to riparian corridors associated with the Suttor River and Kangaroo Creek and contiguous areas of remnant vegetation in the central and northern parts of the project area. Riparian corridors associated with Kangaroo Creek within the project area are intersected by the existing GAP Rail Line and Collinsville-Elphinstone Road.

Areas to the south and north of the project form part of large bioregional corridors listed as having state significance in accordance with BPA mapping (**Figure 35-8**). A section of the corridor to the north is mapped within the project boundary but does not occur within the project footprint.

Other bioregional corridors listed as having State and regional significance in accordance with BPA mapping are mapped along the Suttor River and intersect the western project boundary. Only the regionally significant corridor occurs within the project footprint.

A large area of contiguous vegetation is located to the west of the project area. Wildlife dispersal within these patches of remnant vegetation is likely to be relatively unrestricted and may facilitate fauna movement across the project area.



Legend

- Project Area
- Formed Roads
- Drainage Lines
- Indicative extent of gilgai wetland habitat

Water Bodies
- Riverine
- Lacustrine
- Palustrine

Wetland Regional Ecosystem
- Riverine
- Palustrine

Areas that may include wetlands
- Remnant regional ecosystem 1-50% wetland (mosaic units)

Great Barrier Reef Wetland Protection Area
- Wetland
- Trigger Area

Wetlands and Drainage Features	QCOAL GROUP
Figure 35-7	**Byerwen Coal Project**
Date: *23/04/2013*	**Author:** samuel.ferguson
	Map Scale: 1:150,000
Revision: R1	**Coordinate System:** GDA 1994 MGA Zone 55
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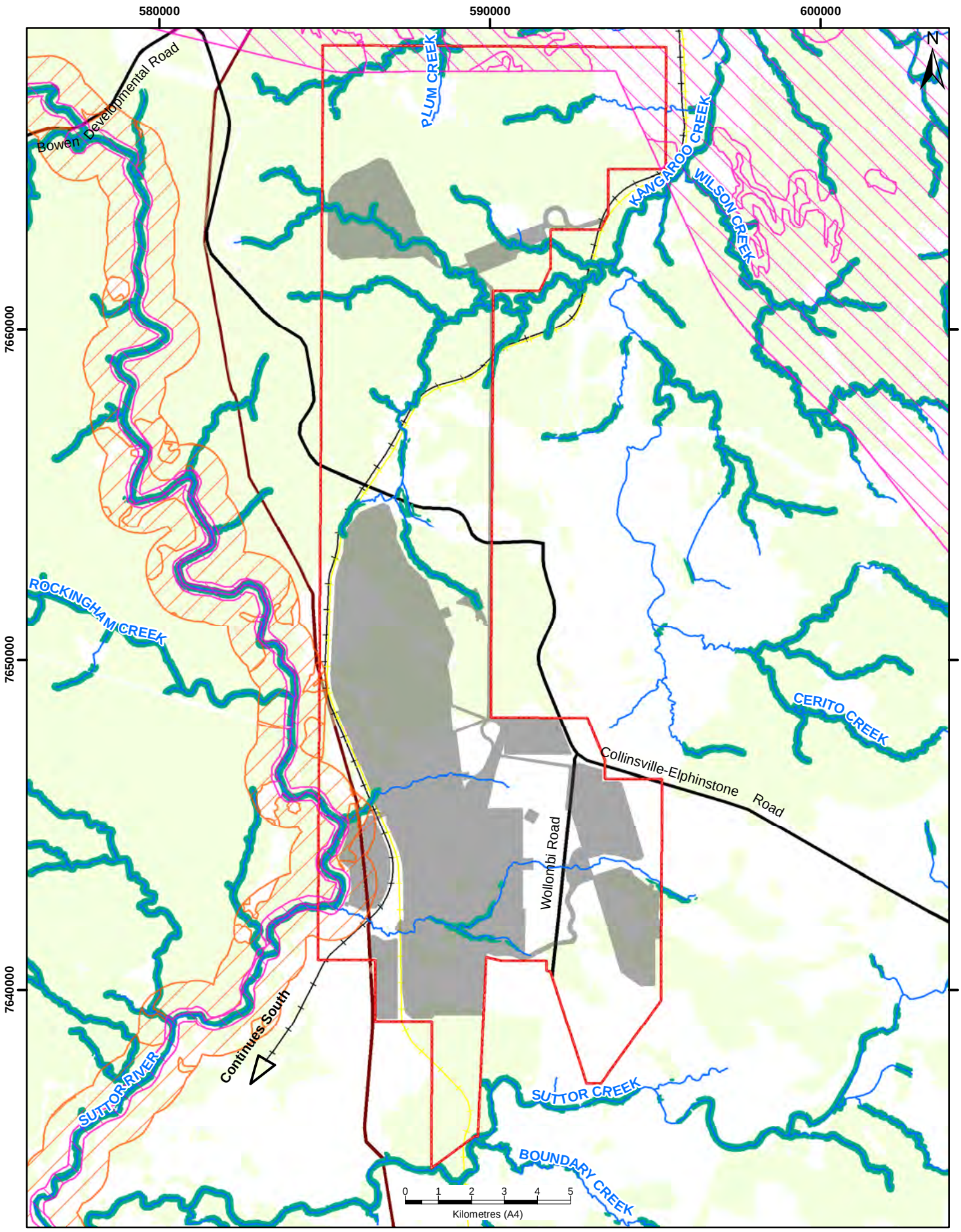

Legend

- Project Area
- Project Ecological Footprint
- GAP Rail Line
- Alpha Coal Project Rail Line
- Burdekin Moranbah Pipeline
- Formed Roads
- Stream Order (2 and above)
- Riparian Corridor
- Remnant Vegetation

BPA Corridor

- State
- Regional

Connectivity

Figure 35-8	**Byerwen Coal Project**
Date: *14/03/2013*	**Author:** samuel.ferguson
	Map Scale: 1:150,000
Revision: R1	**Coordinate System:** GDA 1994 MGA Zone 55

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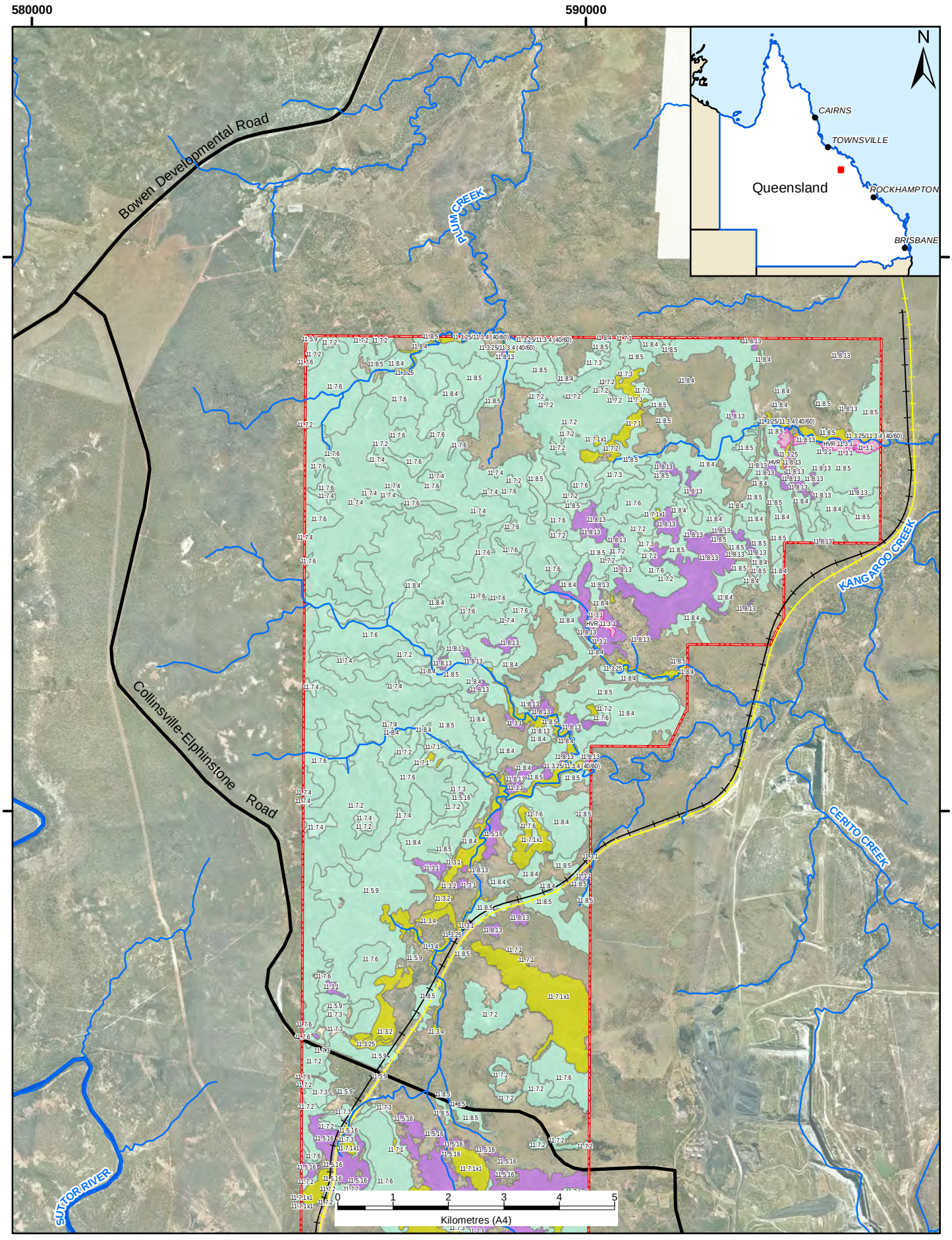
35.5.3 Regional Ecosystems

Current certified RE mapping (Version 6.1) shows 24 REs occur across the project area. Certified RE mapping was verified in the field to confirm the extent and description of vegetation communities in the project area. The revised RE mapping was used as the basis for the assessment of terrestrial flora values in the project area and is presented in **Figure 35-9** and **Figure 35-10**.

Revised RE mapping shows that 50% of the project area (approximately 11,411 ha) supports remnant vegetation. The balance of the project area (approximately 11,211 ha) is non-remnant or regrowth vegetation, comprising mostly cleared grazing land and regrowth vegetation.

Details of certified and revised RE mapping is provided in **Table 35-6**.



Legend

- Project Area
- Formed Roads
- GAP Rail Line
- Alpha Coal Project Rail Line

Regional Ecosystems

- Endangered
- Of Concern
- No Concern
- HVR containing E; HVR containing LC

Revised RE Map (North)		QCOAL GROUP
Figure 35-9	**Byerwen Coal Project**	elp environmental and licensing professionals pty ltd
Date: *5/02/2013*	**Author:** Shahram.Nasiri	
	Map Scale: 1:90,000	
Revision: R1	**Coordinate System:** GDA 1994 MGA Zone 55	
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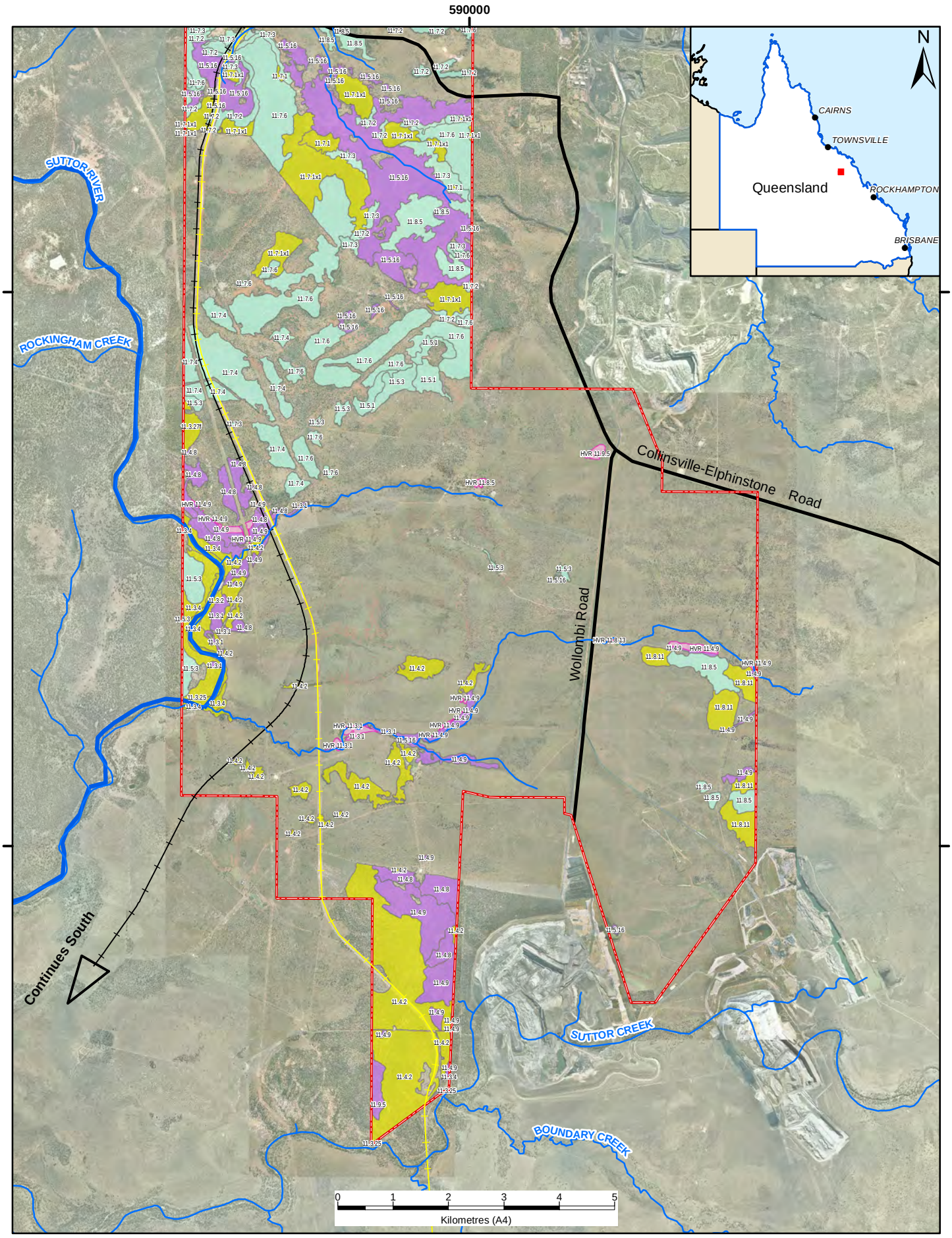

Legend

- Project Area
- Formed Roads
- GAP Rail Line
- Alpha Coal Project Rail Line

Regional Ecosystems

- Endangered
- Of Concern
- No Concern
- HVR containing E; HVR containing LC

Revised RE Map (South)		QCOAL GROUP
Figure 35-10	**Byerwen Coal Project**	elp environmental and licensing professionals pty ltd
Date: *5/02/2013*	**Author:** Shahram.Nasiri	
	Map Scale: 1:90,000	
Revision: R1	**Coordinate System:** GDA 1994 MGA Zone 55	
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Table 35-6 Area of Regional Ecosystems in the Project Area from Certified RE Mapping (Version 6.1) and Revised RE Mapping Prepared for the Project

RE	Description	Management status			Area (ha) (certified RE mapping)[e]	Area (ha) (revised RE mapping)	Ground truth site	Extent in reserves
		Biodiversity status[a]	VM Act[b] status[c]	EPBC Act[d] status				
11.3.1	*Acacia harpophylla* and/or *Casuarina cristata* open forest on alluvial plains.	E	E	Brigalow TEC	18	118	T35, T40, Q80, Q106	Low
HVR 11.3.1	Advanced regrowth *Acacia harpophylla* and/or *Casuarina cristata* open forest on alluvial plains.	E	E	Brigalow TEC	–	36	T21	–
11.3.2	*Eucalyptus populnea* woodland on alluvial plains.	OC	OC	–	97	78	T34, Q104, Q105	Low
11.3.4	*Eucalyptus tereticornis* and/or *Eucalyptus* spp. tall woodland on alluvial plains.	OC	OC	–	15	223	T39, Q36	Low
11.3.10	*Eucalyptus brownii* woodland on alluvial plains.	NC	LC	–	3	–	Not observed	Low
11.3.25	*Eucalyptus tereticornis* or *Eucalyptus camaldulensis* woodland fringing drainage lines.	OC	LC	–	140	157	Q20, T21, Q38	Low
11.3.27 (11.3.27f)	Freshwater wetlands/ Lacustrine wetland (e.g. lake)/Palustrine wetland (e.g. vegetated swamp)/ *Eucalyptus coolabah* and/or *E. tereticornis* open woodland to woodland fringing swamps.	OC	LC	–	29	20	Q68	Low
11.4.2	*Eucalyptus* spp. and/or *Corymbia* spp. grassy or shrubby woodland on Cainozoic clay plains.	OC	OC	–	–	566	Q73, Q76, Q77, Q78, Q79, Q86, T83	Low

RE	Description	Management status			Area (ha) (certified RE mapping)[e]	Area (ha) (revised RE mapping)	Ground truth site	Extent in reserves
		Biodiversity status[a]	VM Act[b] status[c]	EPBC Act[d] status				
11.4.8	*Eucalyptus cambageana* woodland to open-forest with *Acacia harpophylla* or *A. argyrodendron* on Cainozoic clay plains.	E	E	Brigalow TEC	–	155	Q65, Q66, Q75, Q81, Q85, T70, T75	Low
11.4.9	*Acacia harpophylla* shrubby open forest to woodland with Terminalia oblongata on Cainozoic clay plains.	E	E	Brigalow TEC	887	237	Q3, T15, T16, Q72, Q74, Q81, S82, T83	Low
HVR 11.4.9	Advanced regrowth *Acacia harpophylla* shrubby open forest to woodland with Terminalia oblongata on Cainozoic clay plains.	E	E	Brigalow TEC	–	18	Not observed	–
11.5.1	*Eucalyptus crebra*, *Callitris glaucophylla*, *Angophora leiocarpa*, *Allocasuarina luehmannii* woodland on Cainozoic sandplains/remnant surfaces.	NC	LC	–	–	58	Q14, Q90, Q91, Q93, T33	Low
11.5.2	*Eucalyptus crebra*, *Corymbia* spp., with *E. moluccana* on lower slopes of Cainozoic sand plains/remnant surfaces.	NC	LC	–	39	–	Not observed	Low
11.5.3	*Eucalyptus populnea* +/-*E. melanophloia* +/-*Corymbia clarksoniana* on Cainozoic sand plains/ remnant surfaces.	NC	LC	–	1,357	93	Q14, T33, Q61, S63, Q81, S82, T83, Q88, Q103	Low
11.5.9 (b, c)	*Eucalyptus crebra* and other *Eucalyptus* spp. and *Corymbia* spp. woodland on Cainozoic sand plains/remnant surfaces.	NC	LC	–	1,142	450	Q103, Q107, Q108, Q109, Q110, Q111, Q112, Q113, Q114, Q115	Low
11.5.15	Semi-evergreen vine thicket on Cainozoic sand plains/remnant surfaces.	E	LC	SEVT TEC	335	–	T2, Q3, T5, Q6, Q7, Q8, T9, Q10, Q13, T15, T16, T18, T19, T31	Low

RE	Description	Management status			Area (ha) (certified RE mapping)[e]	Area (ha) (revised RE mapping)	Ground truth site	Extent in reserves
		Biodiversity status[a]	VM Act[b] status[c]	EPBC Act[d] status				
11.5.16	*Acacia harpophylla* and/or *Casuarina cristata* open forest in depressions on Cainozoic sand plains/ remnant surfaces.	E	E	Brigalow TEC	–	581	T2, T5, T19	Low
11.7.1	*Acacia harpophylla* and/or *Casuarina cristata* and *Eucalyptus thozetiana* or *E. microcarpa* woodland on lower scarp slopes on Cainozoic lateritic duricrust.	OC	LC	–	–	71	Q4, T17, T25, Q41	Low
(11.7.1 x 1)	Semi-evergreen vine thicket.	OC	LC	–	–	534	T1, Q43	Low
11.7.2	*Acacia* spp. woodland on Cainozoic lateritic duricrust. Scarp retreat zone.	NC	LC	–	1,612	2,302	Q6, Q7, Q8, T9, Q10, Q13, T18, Q23, T33, Q43, Q47, Q103, Q107, Q108, Q109, Q110, Q112, Q113, Q114, Q115	Low
11.7.3	*Eucalyptus persistens*, *Triodia mitchellii* open woodland on stripped margins of Cainozoic lateritic duricrust.	NC	LC	–	61	296	Not observed	Low
11.7.4	*Eucalyptus decorticans* and/or *Eucalyptus* spp., *Corymbia* spp., *Acacia* spp., *Lysicarpus angustifolius* on Cainozoic lateritic duricrust.	NC	LC	–	1,064	291	Q24, T60, Q61, Q62, Q65, Q87, Q88, Q90, Q91	Low
11.7.6	*Corymbia citriodora* or *Eucalyptus crebra* woodland on Cainozoic lateritic duricrust.	NC	LC	–	–	1,942	T9, T18, Q42, T60, Q62, Q87, Q112	Low
11.8.3	Semi-evergreen vine thicket on Cainozoic igneous rocks.	OC	OC	–	626	–	T1, Q4, T17, Q23, Q24, T25, Q41	Low
11.8.4	*Eucalyptus melanophloia* woodland on Cainozoic igneous rocks. Hillsides.	NC	LC	–	–	1,422	Q28, Q30, Q37, Q44, Q50	High

RE	Description	Management status			Area (ha) (certified RE mapping)[e]	Area (ha) (revised RE mapping)	Ground truth site	Extent in reserves
		Biodiversity status[a]	VM Act[b] status[c]	EPBC Act[d] status				
11.8.5	*Eucalyptus orgadophila* open woodland on Cainozoic igneous rocks.	NC	LC	–	2,776	1,334	Q3, T15, T16, S22, T26, Q27, Q28, Q29, Q30, T32, T35, Q36, Q37, Q38, T39, T40, Q44, Q45, Q46, S51, S52, S53, S54, S55, S56, S57, S58, S59, Q61, S97, S98, Q99, Q100, S102, Q104, Q105, Q106	Low
HVR 11.8.5	*Eucalyptus orgadophila* open woodland on Cainozoic igneous rocks.	NC	LC	–	–	3	Not observed	–
11.8.11	*Dichanthium sericeum* grassland on Cainozoic igneous rocks.	OC	OC	Natural grasslands TEC	773	117	S22, T26, Q27, Q28, Q29, Q30, S51, S52, S53, S54, S55, S56, S57, S58, S59, S97, Q98, Q99, Q100, Q101, S102	Low
11.8.13	Semi-evergreen vine thicket and microphyll vine forest on Cainozoic igneous rocks.	E	E	SEVT TEC	1,008	345	Q29, Q46, Q49, T31, T48	Low
HVR 11.8.13	Semi-evergreen vine thicket and microphyll vine forest on Cainozoic igneous rocks.	E	E	–	–	8	Not observed	–
11.9.1	*Acacia harpophylla-Eucalyptus cambageana* open forest to woodland on fine-grained sedimentary rocks.	E	E	Brigalow TEC	39	–	Not observed	Low
11.9.2	*Eucalyptus melanophloia* +/- *E. orgadophila* woodland on fine-grained sedimentary rocks.	NC	LC	–	286	–	Q20, T21	Medium
11.9.3	*Dichanthium* spp., *Astrebla* spp. grassland on fine-grained sedimentary rocks.	NC	LC	Natural grasslands TEC	57	–	Q20, T21	Low

RE	Description	Management status			Area (ha) (certified RE mapping)[e]	Area (ha) (revised RE mapping)	Ground truth site	Extent in reserves
		Biodiversity status[a]	VM Act[b] status[c]	EPBC Act[d] status				
11.9.5	*Acacia harpophylla* and/or *Casuarina cristata* open forest on fine-grained sedimentary rocks.	E	E	Brigalow TEC	79	21	Not observed	Low
HVR 11.9.5	*Acacia harpophylla* and/or *Casuarina cristata* open forest on fine-grained sedimentary rocks.	E	E	Brigalow TEC	–	6	Not observed	–
11.9.9	*Eucalyptus crebra* woodland on fine-grained sedimentary rocks.	NC	LC	–	445	–	Not observed	Low
11.9.10	*Eucalyptus populnea*, *Acacia harpophylla* open forest on fine-grained sedimentary rocks.	E	OC	–	28	–	Not observed	Low
Non-remnant	N/A	N/A	N/A	–	9,740	11,211	Q11, Q12, Q27, Q45, S51, S52, S53, S54, S55, S56, S57, S58, S59, Q64, Q67, Q68, Q69, Q71, Q75, Q76, Q77, Q78, Q79, Q84, Q85, Q86, Q89, Q92, Q94, Q95, Q96, Q101, Q116,	–

a Biodiversity Status: Detailed in the Regional Ecosystem Description Database or as assessed during field surveys: NC – No concern at present, OC – Of concern, E – Endangered
b VM Act – *Vegetation Management Act 1999*
c VM Act Status: LC – Least concern, OC – Of concern, E - Endangered
d EPBC Act – *Environmental and Biodiversity Conservation Act*
e Current certified RE mapping (Version 6.1)
TEC Threatened Ecology Community
SEVT Semi-Evergreen Vine Thicket
HVR High Value Regrowth

35.6 Matters of National Environmental Significance

35.6.1 Threatened Ecological Communities

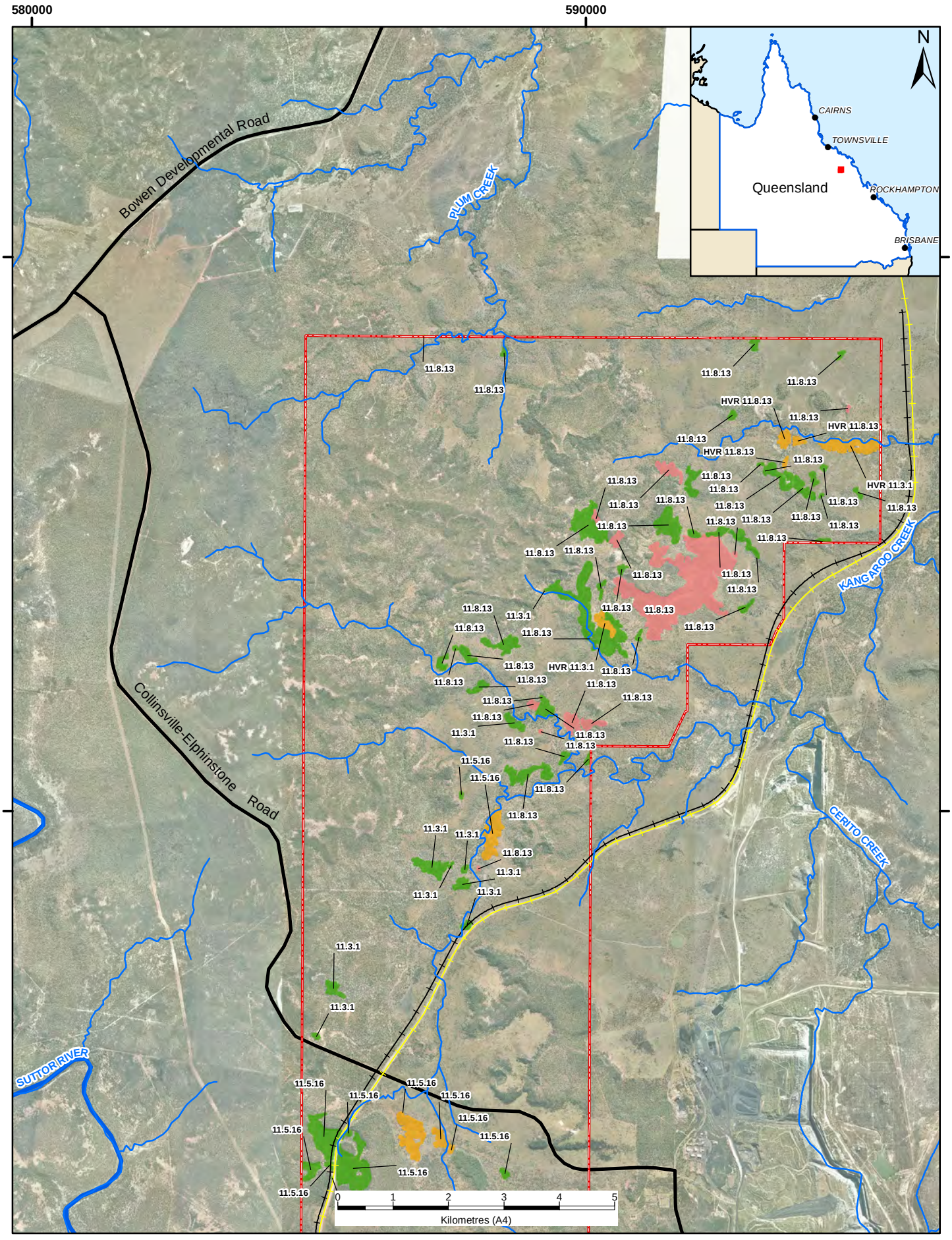
Three of the EPBC Act listed threatened ecological communities (TECs) identified by the desktop assessment as potentially occurring were confirmed as present within the project area. The area of each TEC and its constituent REs is summarised in **Table 35-7**. The distribution and extent of TECs in the project area is shown in **Figure 35-11** and **Figure 35-12** and discussed in **Sections 35.6.1.1** to **35.6.1.3**.

Table 35-7 TECs and Analogous REs Mapped as Occurring within the Project Area

EPBC community description	EPBC Act status[a]	Equivalent RE	Area of RE within project area (revised mapping) (ha)
Brigalow (*Acacia harpophylla*) dominant and co-dominant[b]	E	11.3.1	118
		HVR 11.3.1	36
		11.4.8	155
		11.4.9	237
		HVR 11.4.9	18
		11.5.16	581
		11.9.5	21
		HVR 11.9.5	6
		Total Brigalow TEC	**1,172**
Semi-evergreen vine thickets of the Brigalow Belt (north and south) and Nandewar Bioregions	E	11.8.13	345
Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin	E	11.8.11	117

a EPBC Status: E - Endangered

b Estimated areas for brigalow TEC take into account the regrowth vegetation more than 15 years old which meets the listing requirements for the TEC (Environment Australia, 2001b).



Legend

- Project Area
- Formed Roads
- GAP Rail Line
- Alpha Coal Project Rail Line

TEC

- Brigalow TEC (Regrowth)
- Brigalow TEC (RE)
- SEVT TEC (RE)
- Natural Grassland

Threatened Ecological Communities (North)	QCOAL GROUP
Figure 35-11	**Byerwen Coal Project**
Date: *5/02/2013*	**Author:** Shahram.Nasiri
	Map Scale: 1:90,000
Revision: R1	**Coordinate System:** GDA 1994 MGA Zone 55
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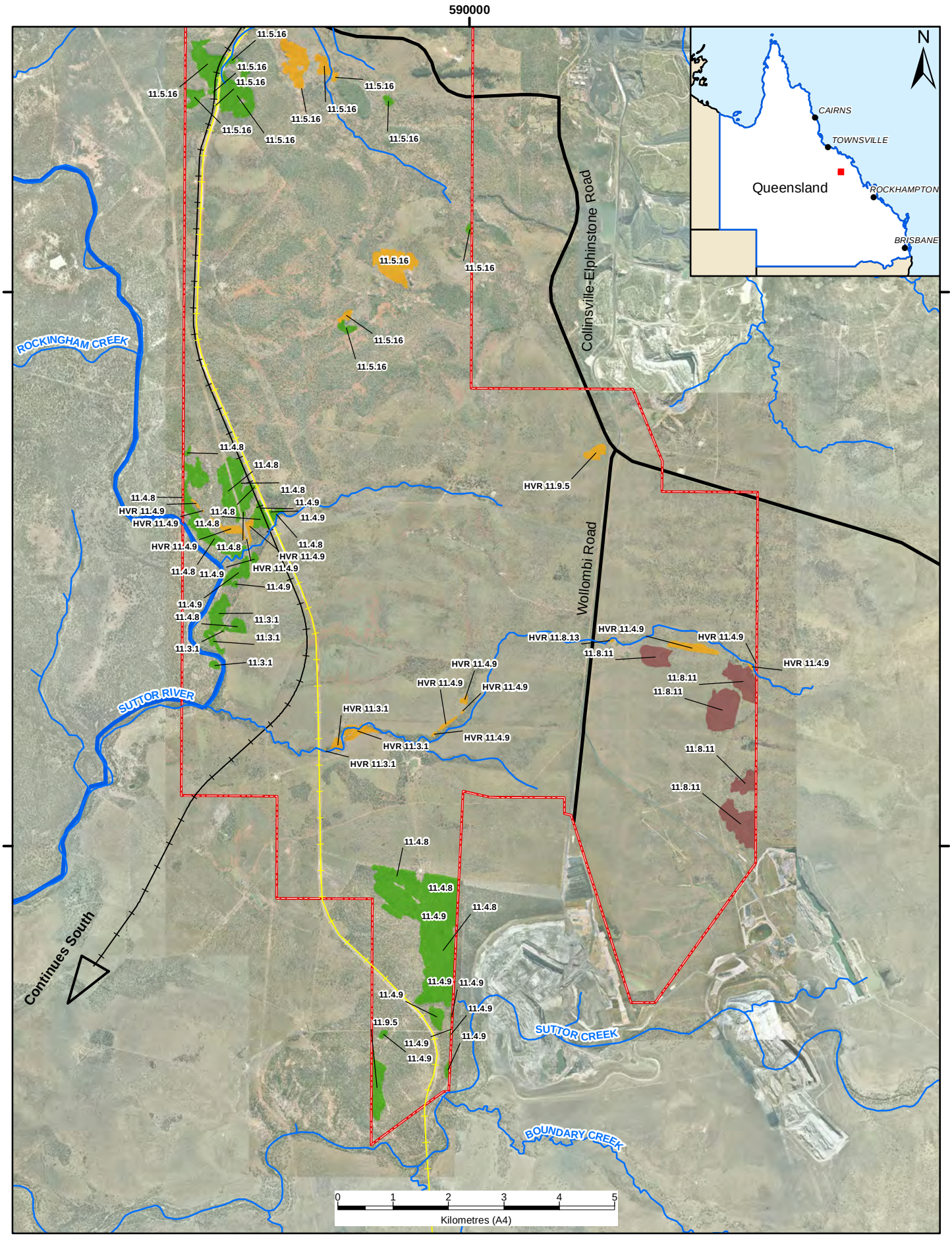

Legend

- Project Area
- Formed Roads
- GAP Rail Line
- Alpha Coal Project Rail Line

TEC

- Brigalow TEC (Regrowth)
- Brigalow TEC (RE)
- SEVT TEC (RE)
- Natural Grassland

Threatened Ecological Communities (South)	QCOAL GROUP
Figure 35-12	**Byerwen Coal Project**
Date: *5/02/2013*	**Author:** Shahram.Nasiri
	Map Scale: 1:90,000
Revision: R1	**Coordinate System:** GDA 1994 MGA Zone 55
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35.6.1.1 Brigalow

The brigalow (*Acacia harpophylla* dominant and co-dominant) TEC occurs as small remnants across the entire project area, with larger tracts of this community located within the central and southern portions of the project area. REs representative of this community observed within the project area are:

- RE 11.3.1 - *Acacia harpophylla* and/or *Casuarina cristata* open forest on alluvial plains
- RE 11.4.8 - *Eucalyptus cambageana* woodland to open forest with *Acacia harpophylla* or *A. argyrodendron* on Cainozoic clay plains
- RE 11.4.9 - *Acacia harpophylla* shrubby open forest to woodland with *Terminalia oblongata* on Cainozoic clay plains
- RE 11.5.16 - *Acacia harpophylla* and/or *Casuarina cristata* open forest in depressions on Cainozoic sand plains/remnant surfaces
- RE 11.9.5 - *Acacia harpophylla* and/or *Casuarina cristata* open forest on fine-grained sedimentary rocks.

These REs are assigned a Biodiversity Status of endangered.

RE 11.3.1 generally occurs as fragmented linear strips along drainage lines or as isolated pockets amongst more extensive flood plain vegetation. Very few intact examples were recorded. Most areas consisted of established regrowth brigalow trees, assessed as being greater than 15 years old through examination of historical aerial photography (T21, T35, T40, Q80, Q106). Typically, canopy heights were 8 m to 12 m. While this extent of regrowth fails to satisfy the VM Act remnant status criteria (refer Neldner *et al*, 2005), it achieves the criteria for identification as Brigalow TEC (refer Environment Australia, 2001b). All areas of occurrence were heavily impacted by grazing. Weeds declared as Class 2 weed species under the *Land Protection (Pest and Stock Route Management) Act 2002* (LP Act), including: parthenium (*Parthenium hysterophorus*); Harrisia cactus (*Harrisia martini*); and prickly pear (*Opuntia stricta*) were also common.

Areas of RE 11.4.8 are located in the southern part of the project area. Fragmented examples of this community were observed along the Suttor River alluvial corridor in the central west portion of the project area (Q65, Q56, Q75). These patches were considered to be of poor condition due to partial clearing, large canopy gaps and/or the presence of weed species such as prickly pear. Other confirmed areas of this RE were observed in a large patch of vegetation in the south-east of the project area (T70, Q81, S82 and Q81). These areas of the RE were characterised by a relatively intact canopy and lower abundance of weed species (compared to Q65, Q66, Q75), and were considered to be in moderate to good condition.

Areas of RE 11.4.9 were also confined to the southern part of the project area fringing the Suttor River and tributaries and along the far south-eastern boundary. Two of these confirmed patches showed evidence of previous disturbance, with regrowth intermixed with intact canopy trees (Q72, Q74). A third location (S82) in the south of the project area exhibits minimal canopy disturbance (canopy cover of 60%) and weed incursion.

RE 11.5.16 was not mapped by EHP, however, field surveys observed this RE in the centre of the project area. RE 11.5.16 is generally associated with broad eroded plains between laterite jump-ups formed from a mixture of colluvial and alluvial wash (a transitional alluvial system) which separates into areas of heavy clay soils (gilgai) in topographic depressions. The remnants generally comprised regrowth vegetation greater than 15 years of age. However canopy gaps attributable to historic and more recent clearing were evident at sites T2 and T5. The most advanced regrowth was observed at site T19, where canopy cover exceeded 50% and canopy height was 14 m. The Class 2 declared weed

species prickly pear (*Opuntia stricta*) and harrisia cactus (*Eriocereus martinii*) were occasional to frequent occupants of the shrub and ground layers, and buffel grass (*Cenchrus ciliaris*) formed a dominant ground cover in many areas observed.

RE 11.9.5 was mapped in a single location - west of the GAP railway on the far southwest boundary of the project area. This location was outside of the impact area and no site-specific information for this small vegetation unit was collected during field surveys.

Areas mapped as brigalow HVR were viewed in aerial imagery and ground truthed to establish whether the regrowth qualified as a brigalow TEC. Generally, regrowth that has been cleared within the past 15 years would not have regained the structure and species composition typical of remnant Brigalow and therefore does not qualify as the TEC. A proposal to clear regrowth Brigalow must be approved under the EPBC Act if:

- clearing of the regrowth requires a permit under Queensland legislation (e.g. the regrowth is mapped as HVR)
- the regrowth brigalow is more than 15 years old (Environment Australia, 2001b).

Based on the revised mapping it is estimated that approximately 60 ha, also mapped as HVR in the revised RE map, meets the listing criteria for brigalow TEC. This regrowth has been included in the revised brigalow TEC areas provided in **Table 35-7**. The revised RE mapping indicates that approximately 1,172 ha of brigalow TEC occurs in the project area.

35.6.1.2 Semi-evergreen Vine Thickets

The semi-evergreen vine thickets (SEVT) of the Brigalow Belt (North and South) and Nandewar Bioregions TEC is shown by the certified RE map as RE 11.8.13 (Semi-evergreen vine thicket and microphyll vine forest on Cainozoic igneous rocks, lowlands) and RE 11.5.15 (Semi-evergreen vine thicket on Cainozoic sand plains/remnant surface). Flora surveys confirmed the presence of RE 11.8.13, but found RE 11.5.15 to be absent from the project area (**Figure 35-9** and **Figure 35-10**).

The revised RE mapping has significantly reduced the extent of SEVT TEC in the project area (from 1,343 ha to 345 ha). This reduction is largely due to a revision of landzone boundaries. On the certified RE mapping, the basaltic horizon is consistently mapped at a higher altitude in the landscape, upslope or along lateritic scarps and plateaus. Field survey confirmed that extensive areas mapped as this TEC (e.g. RE 11.8.3) occur on laterite rather than basaltic scree, and are therefore more appropriately assigned to RE 11.7.1 (which is not representative of the SEVT TEC). Furthermore, areas mapped as RE 11.5.15 were generally found not to exhibit the appropriate landform characteristics to be considered this TEC. The revised RE mapping shows that the SEVT TEC is restricted to the northern portions of the project area, where it occurs as RE 11.8.13. The SEVT TEC was confirmed at sites Q29, T31, Q46, T48 and Q49.

Trees and shrubs in areas of confirmed RE 11.8.13 exhibited typical microphyll leaf sizes characters. Common canopy species encountered were: native acalypha (*Acalypha eremorum*), small-leaved plum (*Planchonella cotinifolia*), dogwood (*Erythroxylum australe*), white croton (*Croton insularis*), python tree (*Gossia bidwillii*), white myrtle (*Drypetes deplanchei*) and native olive (*Notelaea microcarpa*), with emergents of broad-leaved bottle tree (*Brachychiton australis*). Canopy height ranged from 3 m –7 m with emergent trees reaching heights of 20 m. Small pockets of brigalow open forest on basalt were also mapped within this community.

SEVT TEC condition varied depending on slope and substrate. Where the community was located on rockier scree slopes, the rock talus was effective in excluding fire and limiting grazing pressure. Native groundcover was evident at these sites. Where the community was located in areas with a

developing soil profile (site Q49) there was evidence of both fire and grazing, and of reduced canopy structure and coverage.

The revised RE mapping shows that 345 ha of this TEC occurs within the project area.

35.6.1.3 Natural Grasslands

The Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin TEC (Natural Grasslands TEC) occurs in eight subregions of the Brigalow Belt Bioregion (TSSC, 2008a), including Province 6 (Northern Bowen basin) in which the project area is located. The Natural Grasslands TEC is typically composed of perennial native grasses. It is 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. They occur in areas with relatively high summer rainfall and where the tree canopy is usually absent. If tree cover is present, the projective crown cover is no more than 10% (TSSC 2008a). TSSC (2008a) sets out key diagnostic characteristics for the Natural Grasslands TEC.

The certified RE mapping shows that two REs characteristic of the Natural Grasslands TEC occur in the project area:

- RE 11.8.11 - *Dichanthium sericeum* grassland on Cainozoic igneous rocks
- RE 11.9.3 - *Dichanthium* spp., *Astrebla* spp. grassland on fine-grained sedimentary rocks.

Flora surveys specifically targeted the areas of RE 11.8.11 and RE 11.9.3 shown on the certified RE map (sites S22, T26, Q27, Q28, Q29, Q30, S51, S52, S53, S54, S55, S56, S57, S58, S59, S97, Q98, Q99, Q100, Q101, S102, Q20, T21). The surveys confirmed that the Natural Grasslands TEC was present in the project area, but that RE 11.9.3 was absent, and the extent of RE 11.8.11 was significantly less than shown by the certified RE map[1]. The 116 ha of RE 11.8.11 shown on the revised RE map is restricted to the south eastern corner of the project area (refer sites S97, Q98, S102) (**Figure 35-11**).

The areas of RE 11.8.11 were found to be in good condition, with limited visible weed infestation and light grazing pressure. Secondary site S97 (which is representative of natural grassland habitats within the project area but not located in the project area) was found to have three Natural Grassland TEC indicator species (TSSC, 2008a). Secondary site 102 supported three indicator species, and its environs were considered an example of the Natural Grasslands TEC in good condition.

Flora surveys across the northern parts of the project area found that the grassland communities in these areas (sites S51, S52, S53, S54) were dominated by the exotic Indian bluegrass (*Bothriochloa pertusa*) and lacked the necessary indicator species for identification as the Natural Grasslands TEC. Based on revised mapping, approximately 117 ha of the Natural Grasslands TEC occurs within the project area.

35.6.2 Threatened Flora Species

No aquatic flora species listed as threatened under the EPBC Act were recorded in the project area. Of the aquatic flora species known to occur in the Burdekin Basin, two are listed as threatened under the EPBC Act; salt pipewort (*Eriocaulon carsonii*), which is 'Endangered'; and frogbit (*Hydrocharis dubia*), which is 'Vulnerable'. Habitat requirements and an assessment of the likelihood of occurrence for these species is provided in **Table 35-8**. As shown, both species are considered unlikely to occur in the project area.

[1] The certified RE map showed 773 ha of RE 11.8.11. The revised RE map showed 116 ha of RE 11.8.11.

No terrestrial flora species listed as threatened under the EPBC Act were recorded or are considered likely to occur in the project area. Desktop assessments identified nine threatened terrestrial flora species with the potential to occur in the project area. Habitat requirements and an assessment of the likelihood of occurrence for these species is provided in **Table 35-9**.

Table 35-8 Description, Habitat and Likelihood of Occurrence for Threatened Aquatic Flora Species

Scientific name	Common name	EPBC Act status[a]	Source[b]	Description and habitat	Assessment summary
Unlikely to Occur					
Eriocaulon carsonii	Salt pipewort	E	AquaBAMM BOT *WetlandInfo*	Restricted to saturated soil adjacent to flowing mound springs (Sainty and Jacobs, 2003).	Current known distribution is not in proximity to the Project area. Mound springs not known to occur within the Project area. Preferred habitat unlikely to be present within the Project area.
Hydrocharis dubia	Frogbit	V	AquaBAMM BOT *WetlandInfo*	Prefers to grow in small shallow freshwater bodies or swamps (DSEWPaC, 2008).	Recorded only from south-east Queensland, and from Ayr and Charters Towers in the northern Burdekin basin (Stephens and Dowling, 2002). Although suitable habitat occurs within the broader project area, this species has not been recorded from the Bowen or Belyando catchments of the Burdekin basin (i.e., the catchments that encompass the Project site).

a EPBC Act Status: V – Vulnerable, E – Endangered

b Source: AquaBAMM - *Aquatic Conservation Assessments, using AquaBAMM, for the non-riverine wetlands of the Great Barrier Reef catchment: Burdekin region* (Inglis and Howell, 2009)
BOT - *Burdekin Natural Resource Management Region – Back on Track Actions for Biodiversity* (DERM, 2010)
WetlandInfo - *WetlandInfo – Burdekin Basin – Wetland Summary Information (DERM, 2012)*

Table 35-9 Description, Habitat and Likelihood of Occurrence for Threatened Terrestrial Flora Species

Species	Common name	EPBC Act status[a]	Source[b]	Description and habitat	Assessment summary
May Occur					
Dichanthium queenslandicum	king blue grass	V	EPBC HERBRECS WO	An erect perennial grass to 80 cm which is known from Brigalow Belt north and south bioregions. The species inhabits both remnant and non-remnant grasslands. The primary habitat for this species is RE 11.8.11.	A single HERBRECS record occurs just outside the eastern boundary of the project area in non-remnant grassland immediately west of the Newlands Coal Mine. Detailed survey of the species' primary habitat (RE 11.8.1) was undertaken without additional specimens being located[2]. This degree of survey effort is considered sufficient to exclude D. queenslandicum as a known occurrence.
Dichanthium setosum	Blue grass	V	WO[3]	*Dichanthium setosum* is associated with heavy basaltic black soils and stony red-brown hardsetting loam with clay subsoil (Ayers *et al* 1996; DEC 2005a) and is found in moderately disturbed areas such as cleared woodland, grassy roadside remnants, grazed land and highly disturbed pasture. The primary habitat for this species is RE 11.8.11.	This species was not recorded within the project area, nor within a 20 km radius of the project area. However, there are nine Queensland Herbarium specimen records from the broader Isaac Regional Council local government area, and *D. setosum* is often co-located with *D. queenslandicum*. Detailed survey of the species' primary habitat (RE 11.8.11) (refer discussion above for *D. queenslandicum*) is considered sufficient to exclude *D. setosum* as a known

[2] The areas mapped as RE 11.8.11 (and a 2 km radius surrounding these polygons) in the southeast of the project area have been subject to the following survey effort: (i) three 2,500 m^2 survey plots were established by CQU within (or in the ecotone) of the RE 11.8.11 - mapped polygons (Wormington *et al,* 2009) (polygons 117, 119 & 121 (Figure 3.1); (ii) three 500 m^2 polygons were established within (or in the ecotone) of the RE 11.8.11 - mapped polygons (Unidel, 2011) (Polygons 62, 63 & 93); (iv) two 2,500m^2 survey plots were established within 2 km of the RE 11.8.11 - mapped polygons (CQU 2009) (Polygons 118 & 120); (v) six 500 m^2 polygons were established within 2 km of the RE 11.8.11-mapped polygons (Unidel, 2011) (Polygons 58-61; 64 & 92) and (vi) significant traverse within the area bound by the noted survey plots was undertaken to define the extent of the RE 11.8.11 polygons.

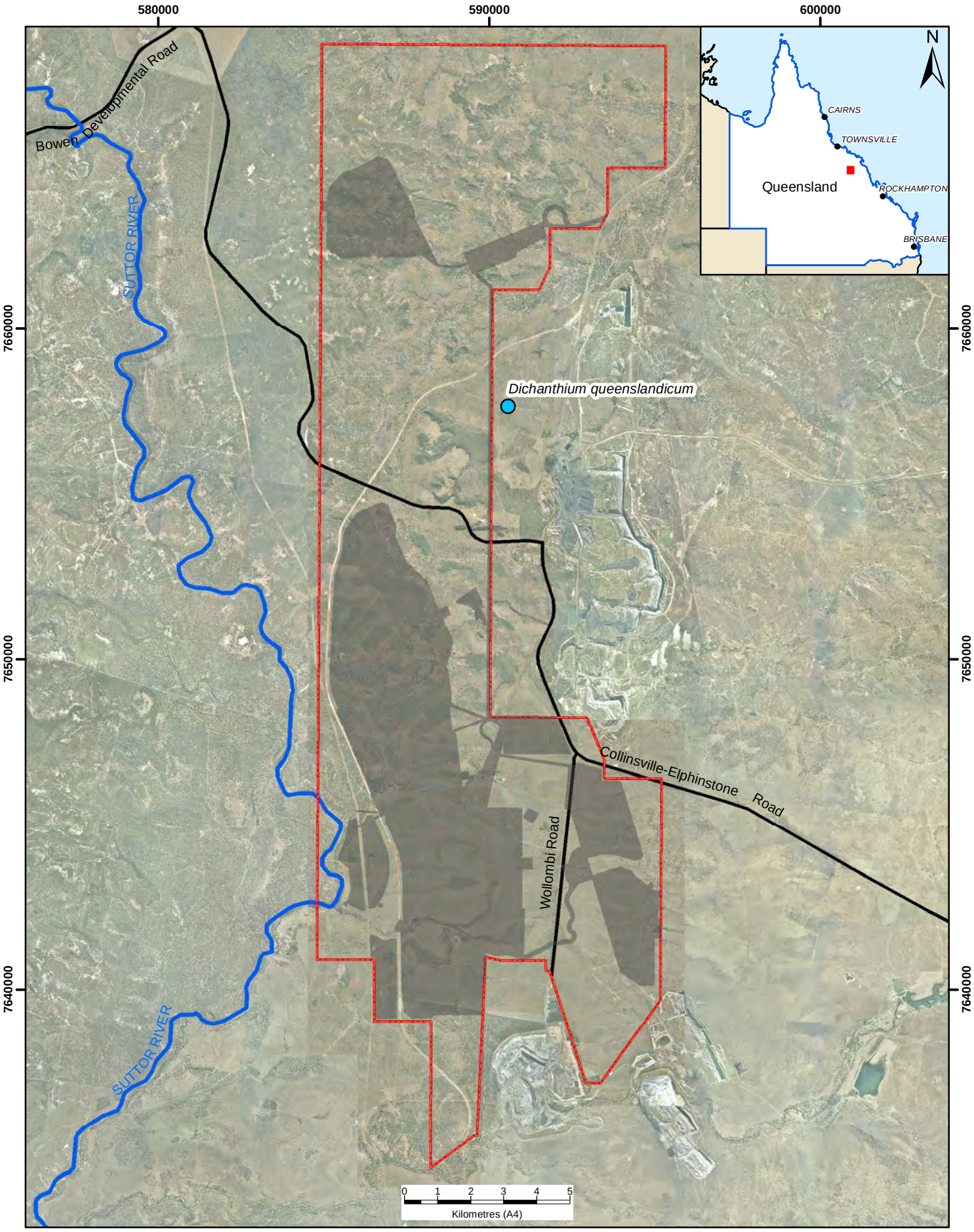
[3] This species was not recorded in the PMST or Wildlife online database searches. However, there are nine Queensland Herbarium specimen records from the broader Isaac Regional Council local government area, and it is recognised that *Dichanthium setosum* can co-occur with *Dichanthium queenslandicum*. On this basis, *D. setosum* has been identified as a species requiring further consideration.

Species	Common name	EPBC Act status[a]	Source[b]	Description and habitat	Assessment summary
					occurrence.
Croton magneticus	-	V	HERBRECS	A deciduous small tree or shrub growing to 5 m. Its distribution ranges from Greenvale to near Collinsville, extending to the coastal islands of Magnetic and Gloucester. It inhabits vine thickets on sandstone, acid volcanic or granitic substrates. A single Queensland Herbarium (HERBRECS) record occurs approximately 10 km north of the project area.	This species was not recorded during field surveys may occur in vine thicket communities in the northern part of the project area.
Digitaria porrecta	finger panic grass	E	EPBC	*Digitaria porrecta* is a loosely tufted perennial grass growing to 60 cm, known from four disjunct populations with a range extending over 1,000 km. Major populations are found in the Dalby area although the species is known from the Central Highlands district near Nebo (TSSC, 2008a) but no records exist for the South Kennedy pastoral district in which the project area is located. The nearest records are located 100 km south of the project area.	This species was not recorded during field surveys but may occur in areas of REs 11.8.11 and RE 11.8.5 as well as disturbed areas on heavier clay soils.
Eucalyptus raveretiana	black ironbox	V	EPBC	*Eucalyptus raveretiana* is a tree reaching 30–40 m that is endemic to central coastal and sub coastal Queensland. It typically occurs along rivers and streams where it may grow in association with Queensland blue gum (*Eucalyptus tereticornis*), Moreton Bay ash (*Corymbia tessellaris*), river oak (*Casuarina cunninghamiana*) and paperbark (*Melaleuca* spp.), or in coastal habitats as an emergent to rainforest on alluvium. Its distribution is scattered and disjunct, being known from the tributaries of the Fitzroy River, the Suttor and its upper tributaries; the Bowen, Burdekin, Don, Bogie, Broughton, O'Connell, and Andromache rivers.	This species was not recorded during field surveys may occur along the Suttor River and tributaries in association with RE 11.3.25.
Unlikely to Occur					
Acacia ramiflora	-	V	EPBC	A slender shrub, similar in appearance to *Acacia simsii*. It is geographically restricted to the Great Dividing Range. It has been observed on sandstone hills in the Torrens Creek/Pentland area and Robertson River area. Its distribution is not known to overlap with any EPBC Act significant ecological communities (TSSC 2008b). Known populations of this species are located within White Mountains National Park, approximately 400 km north-west of the project area.	There are no known records in the vicinity of the project area and this species is considered unlikely to occur in the project area.
Cajanus	-	E	EPBC	This species occurs in *Melaleuca-Acacia*, *Eucalyptus-Callitris* and/or	There are no known records in the vicinity

Species	Common name	EPBC Act status[a]	Source[b]	Description and habitat	Assessment summary
mareebensis				*Eucalyptus-Corymbia* grassy woodlands on sandy soils derived from granite with a lower horizon of impeded drainage.	of the project area and this species is considered unlikely to occur in the project area.
Cycas ophiolitica	-	E	EPBC	A trunked cycad that rarely grows to 4 m. *Cycas ophiolitica* grows on hills and slopes in sparse, grassy open forest at altitude ranges 80–400 m above sea level. Preferred habitat includes shallow, stony, infertile soils, which are developed on sandstone and serpentinite, and is associated with species such as *Corymbia dallachiana*, *C. erythrophloia*, *C. xanthope* and *Eucalyptus fibrosa*. *Cycas ophiolitica* has also been found on mudstone in association with *Corymbia dallachiana*, *C. erythrophloia* and *Eucalyptus crebra*, and on alluvial loams with *Corymbia intermedia*, *Eucalyptus drepanophylla* and *E. tereticornis* (Hill, 1998a; Queensland Herbarium, 2007).	There are no known records in the vicinity of the project area and this species is considered unlikely to occur in the project area.
Leucopogon cuspidatus	-	V		*Leucopogon cuspidatus* occurs in eastern Queensland from Blackdown Tableland in the south to the Mount Stewart area near Homestead Township in the north occurs in open forests, woodlands and heath on rocky slopes with granitic or serpentinite substrates (DSEWPaC, 2008).	There are no known records in the vicinity of the project area and this species is considered unlikely to occur in the project area.

a EPBC Act Status: V – Vulnerable, E – Endangered

b Source: EPBC – EPBC Protected Matters Search
HERBRECS – Queensland Herbarium
WO – Wildlife Online



Legend

- Project Area
- Project Ecological Footprint
- Formed Roads

Flora Species Significance

- Threatened Species

Threatened Flora Species	QCOAL GROUP
Figure 35-13	**Byerwen Coal Project**
Date: *5/02/2013*	**Author:** Shahram.Nasiri
	Map Scale: 1:150,000
Revision: R1	**Coordinate System:** GDA 1994 MGA Zone 55
G:\CLIENTS\A-TO-D\BYEGEN - Byerwen EIS\GIS\Maps\EIS Chapters\EIS_Chpt_35_MNES\BYEGEN_threat_flora.mxd	

35.6.3 Threatened Fauna Species

Of the aquatic fauna species known to occur in the Burdekin Basin, only one species is listed as threated under the EPBC Act, the Australian lungfish (*Neoceratodus forsteri*), which is listed as 'Vulnerable'. The species is restricted to south-east Queensland, where it occurs naturally in the Burnett and Mary rivers, and possibly the Brisbane River (Pusey *et al.* 2004). As the species was last recorded in the Burdekin basin in 1870 and its current known distribution is not in proximity to the project site, the Australian lungfish is considered unlikely to occur in the project area.

Two terrestrial fauna species listed as threatened under the EPBC Act were recorded during fauna surveys in the project area: the squatter pigeon (*Geophaps scripta scripta*) and ornamental snake (*Denisonia maculata*). The black-throated finch (*Poephila cincta cincta*) was tentatively recorded from two brief sightings made without the aid of binoculars. The black-throated finch (southern) may be confused with the chestnut-breasted mannikin (*Lonchura castaneothorax*) in particular, which is common along the north east coast of Australia and from which it cannot be distinguished without close examination. As such, the presence of this species has not been confirmed. For the purpose of this assessment, a precautionary approach has been adopted and the species is considered as a likely occurrence. The Australian painted snipe (*Rostratula australis*) is also considered likely to occur in the project area.

Habitat requirements and an assessment of the likelihood of occurrence for terrestrial fauna species listed as threatened under the EPBC Act, identified through the desktop assessment is provided in **Table 35-10**.

The location of EPBC Act listed threatened fauna species records in the project area are shown on **Figure 35-14**.

Those EPBC Act listed threatened fauna species known to occur or considered likely to occur in the project area are considered MNES that could be affected by the project. Details of the distribution, ecology and habitat preferences of these species are provided in the sections below.

Table 35-10 Description, Habitat and Likelihood of Occurrence for Threatened Terrestrial Fauna Species

Common name	Species	EPBC Act status[a]	Habitat requirements	Assessment summary
Known to Occur				
Ornamental snake	*Denisonia maculata*	V	Woodlands and open forests containing brigalow (*Acacia harpophylla*), gidgee (*Acacia cambagei*), blackwood (*Acacia argyrodendron*) or coolabah (*Eucalyptus coolabah*) communities or pure grassland associated with gilgais or other wetlands. Microhabitat features include coarse woody debris such as fallen timber as well as rocky areas and deep soil cracks.	The ornamental snake was recorded during the 2009 and 2012 surveys from riparian forests associated with the Suttor River floodplain and brigalow communities in the southern part of the Project area. The habitat condition on the site is considered generally poor relative to pre-clearing or remnant condition (due to thinning and grazing impacts); however the habitat quality for this species is moderate to high and provides important habitat. This species occurs in many disturbed areas, including cleared land with gilgai microrelief.
Squatter pigeon (southern)	*Geophaps scripta scripta*	V	Open dry eucalypt woodland on sandy soil near permanent water.	Squatter pigeons were detected during the 2009, 2010 and 2012 surveys from grassy woodlands in the southern parts of the project area and sites (T5, T8 and H19). Despite its conservation status, this species is widespread in central Queensland (Wormington *et al* 2009) and is expected to occur in grassy woodland habitats in proximity to watering points across the site. Overall habitat quality for this species is moderate to high within remnant vegetation and low in previously cleared lands and regrowth vegetation.
Likely to Occur				
Black-throated finch (southern)	*Poephila cincta cincta*	E	Riparian areas within open eucalypt, acacia or melaleuca forest and woodlands.	Two individuals suspected to be *Poephila cincta cincta* were recorded during baseline surveys, although a positive identification was not made. Although they could not confidently be attributed to *P. cincta cincta* in the field, a precautionary approach is adopted and the species has been considered as a likely occurrence.
Australian painted snipe	*Rostratula australis*	V	Ephemeral and permanent shallow, freshwater wetlands and inundated grasslands, sewage ponds and dams.	The large dam (H2) within the south-west of the project area and the ephemeral gilgai wetlands afford habitat for this species.
May Occur				
Red goshawk	*Erythrotriorchis radiatus*	V	Coastal and sub coastal tall, open forest, tropical savannah, woodland, rainforest edges and gallery forest along, or adjacent to, watercourses and wetlands	Eucalypt forest and woodlands adjacent to the Suttor River and the south-west of the project area afford foraging and potentially breeding habitat. This species was not detected during the survey.
Mount Cooper striped lerista	*Lerista vittata*	E	Woodlands dominated by ironbark (*Eucalyptus crebra* and *E. melanophloia*) and bloodwood (*Corymbia clarksoniana* and	This species was not detected during fauna surveys, however lower quality habitat in RE 11.5.9 and SEVT vegetation areas exists in the north-west

Common name	Species	EPBC Act status[a]	Habitat requirements	Assessment summary
			C. intermedia) with shrub and/or grassy ground layers on deep red earths, undulating plains and steep hills on granitic rocks as well as SEVT which extends onto areas of ironstone (duricrust) and spinifex communities.	section of the project area.
Yakka skink	*Egernia rugosa*	V	Dense ground cover and abundant course woody debris (e.g. hollow logs) or rock in a variety of vegetation types including: poplar box (*Eucalyptus populnea*), ironbark, brigalow (*Acacia harpophylla*), cypress pine (*Callitris glaucophylla*), mulga (*A. aneura*), bendee (*A. catenulata*) lancewood (*A. shirleyi*) woodlands and open forests.	This species was not detected during fauna surveys but habitat may be suitable within remnant vegetation on the uplifts and escarpments in the north-western parts of the site within areas that have dense ground cover and fallen hollow logs.
Star finch	*Neochmia ruficauda ruficauda*	E	Damp grasslands, sedgelands or grassy woodlands (composed of *Eucalyptus coolabah*, *E. tereticornis*, *E. tessellaris*, *Melaleuca leucadendra*, *E. camaldulensis* and *Casuarina cunninghamii*) near permanent water or regularly inundated areas.	Not recorded during field surveys, nor are there records in proximity to the project area. Poplar box/blue gum woodlands associated with the Suttor River may represent potential habitat for this species.
Northern quoll	*Dasyurus hallucatus*	E	Forest or woodland with rocky areas and complex vegetation structure in a variety of vegetation types including: eucalypt forest and woodlands, rainforests, sandy lowlands, shrublands and grasslands.	Not recorded in the project area despite active searching for scats and overhangs which may provide shelter for denning purposes. It is still possible that this species may utilise the area although undetected.
Koala	*Phascolarctos cinereus*	V	Eucalyptus dominated temperate, sub-tropical and tropical forest, woodland and semi-arid habitats.	No koala observations were recorded during the fauna survey. Eucalyptus woodland in riparian corridor (RE 11.3.25) may afford habitat however if koala are present within the project area they are expected to be unlikely.
South-eastern long-eared bat	*Nyctophilus corbeni*	V	Inland woodland vegetation dominated by eucalypt and bloodwood species as well as box, ironbark and cypress pine woodlands. Loose bark, fissures and hollows on trees afford roosting habitat.	This species was not recorded during the fauna surveys, however potentially suitable habitat occurs in woodland vegetation dominated by eucalypt and bloodwood species as well as box, ironbark and cypress pine woodlands. Loose bark, fissures and hollows on trees afford roosting habitat.
Unlikely to Occur				
Brigalow scaly-foot	*Paradelma orientalis*	V	Open forests and woodland containing remnant vegetation, including: brigalow, cypress, bull oak, spotted gum, vine thickets and *Acacia falciformis*, with abundant coarse woody debris and dense leaf litter.	Open forests and woodland containing remnant vegetation with abundant coarse woody debris and dense leaf litter in the central and southern parts of the project area afford habitat however, this species reaches its northern distributional limit near Nebo. Numerous surveys conducted over the last decade between Nebo and Collinsville have failed to detect this species further north and, as such, it is considered unlikely to occur in the project area.
Stripe-tailed delma	*Delma labialis*	V	Dense leaf litter or other ground cover in low and tall open forests,	The distribution of this species is not expected to extend past the Clarke

Common name	Species	EPBC Act status[a]	Habitat requirements	Assessment summary
			open woodland (all with grassy understory), wet sclerophyll forest, coastal microphyll / notophyll vine forests/thickets, eucalypt forest and woodland with dense grass trees (*Xanthorrhoea* sp.) and acacia mid-storey to understory, spinifex, and seasonally dry tea-tree (*Melaleuca viridiflora*) swamp.	Range approximately 100 km west of the project area. If present, it would be expected to be found in areas of remnant vegetation located on the foothills of uplifts in the north-western parts of the project area.
Retro slider	*Lerista allanae*	E	Non-cracking black soils on undulating plains formed on basalt, shale, sandstone and unconsolidated sediments.	All known records taken from the Basalt Downs subregion near Clermont (Young *et al* 1999). Considered unlikely to occur because of its restricted distribution.

a EPBC Act Status: V – Vulnerable, E – Endangered

35.6.3.1 Ornamental Snake

The ornamental snake (*Denisonia maculata)* is listed as vulnerable under the EPBC Act. It is endemic to Queensland and occurs in the Dawson and Fitzroy River drainage system of central coastal Queensland (Cogger *et al*, 1993).

It is found in woodlands and open forests associated with water, particularly gilgais, in Land Zone 4 (Tertiary-early Quaternary clay plains). Vegetation of woodland and open woodland include brigalow (*Acacia harpophylla*), gidgee (*Acacia cambagei*), blackwood (*Acacia argyrodendron*) or coolibah (*Eucalyptus coolabah*) dominated vegetation communities, or pure grassland associated with gilgais (*Brigalow Belt Reptiles Workshop 2010*).

During the day the species shelters under fallen timber, coarse woody debris, rocks, bark and in deep soil cracks on gilgai mounds, particularly during dry periods. At night, the species forages near water, almost exclusively on frogs. The ornamental snake gives birth to live young with an average litter size of seven offspring.

A EHP mapped essential habitat area for the snake occurs on the western boundary of the project area in proximity to the Suttor River (**Figure 35-15**). This species was not found in proximity to this essential habitat area, but was observed approximately 5 km to the south within an area mapped as RE 11.3.4 located within floodplains of the Suttor River (H17). Dominated by Queensland blue gum and river red gum, this site is considered to form part of a faunal corridor that exists along the Suttor River and associated low flow terrace. Given both the essential habitat area (based on the prior recordings) and 2012 record of this species are located within this riparian corridor it is considered likely to represent important habitat for this species.

The area in which this species was recorded contained preferred micro-habitat features for this species including a high density of fallen timber and debris, associated with regular flooding events and historical tree felling. The species was recorded under a log that was overturned during active searches. The ornamental snake was also recorded during the 2009 surveys within a brigalow community (RE 11.4.9) located in the south of the project area (Wormington *et al,* 2009).

35.6.3.2 Squatter Pigeon

The squatter pigeon (*Geophaps scripta scripta*) is listed as vulnerable under the EPBC Act and was observed during surveys in 2009, 2010 and 2012.

This species is patchily distributed through Queensland and is commonly observed in more open areas of dry eucalypt woodland on sandy soil dissected by low gravelly ridges, and close to permanent water (QPWS, 1999a). The diet of this species consists of fallen grass seeds, herbs and shrubs.

The squatter pigeon breeds from March to September (in the tropics) in a scrape in the ground lined with dry grass. It is often seen in pairs or in small family groups. Movement is restricted as this species is ground dwelling and flies to nearby trees only when flushed or for courtship.

This species was incidentally recorded in the southern section of the project area in poplar box grassy woodlands in 2009 and at Site T8 in 2010 in grassy eucalypt and acacia woodland. In 2010, four individuals were recorded at Site T2 and were observed both on the ground and resting on logs. In 2012, the species was observed watering at a small farm dam occurring on sandy plains (H19). This species would be expected to utilise a wide range of habitat types and would be expected to have a common presence in the project area.

35.6.3.3 Black-throated Finch (Southern)

The black-throated finch has two subspecies. *Poephila cincta cincta*, the southern subspecies, has a white rump, is found south of Townsville and is listed as endangered under the EPBC. The northern subspecies, *Poephila cincta atropygialis*, has a black rump and is found north of Cairns with its range extending south (Zann, 1976). The latter of these species is not listed under the EPBC Act.

This southern subspecies is largely constricted to the northern part of its former distribution, which extended from north-east NSW to Queensland's Atherton Tablelands and west to central Queensland. It inhabits grassy open woodlands and forest typically dominated by eucalyptus, acacia and melaleuca species often along or near watercourses or in the vicinity of water (BTF Recovery Team 2007). Almost all known records of this species south of the tropics are within riparian habitats (BTF Recovery Team, 2007). According to the National recovery plan for the Black-throated finch southern subspecies (*Poephila cincta cincta*) (BTF Recovery Team, 2007) REs in which this species has been recorded within the Brigalow Belt North Bioregion include REs 11.3.12, 11.3.25b, 11.3.27, 11.3.30, 11.3.35 and 11.11.19.

The black-throated finch feeds on fallen grass seed and requires daily water. It can breed all year, however breeding activity peaks in February and May. They nest in loose colonies in trees and shrubs (DEWHA, 2009b). The movement patterns on this species are poorly understood, however a study of foraging ecology (Mitchell, 1996) suggested that the finch may undertake some movements in response to rainfall or drought prompted by food availability. It is also suggested that outside of breeding periods there may be some local movement away from nesting areas in search of food resources (Mitchell, 1996).

This species was targeted during the survey with repeat visits to dams and wetlands with the goal of recording this species coming in to water. Two individual birds suspected to be the black-throated finch were observed in proximity to the large wetland in the south-west of the project area. The birds were not viewed through binoculars and were sighted for a short period of time. The black-throated finch (southern) may be confused with the chestnut-breasted mannikin (*Lonchura castaneothorax*) in particular, which is common along the north east coast of Australia and from which it cannot be distinguished without close examination. As such, the presence of this species has not been confirmed. For the purpose of this assessment, a precautionary approach has been adopted and it is assumed that the species observed is the threatened southern sub-species.

Given this species preference to riparian habitats it is considered that it may travel along the Suttor River riparian corridor which located approximately 2 km to the south west of where this species was observed. It is considered that this species would be a rare vagrant to the project area and may have dispersed into this area following a number of good seasons.

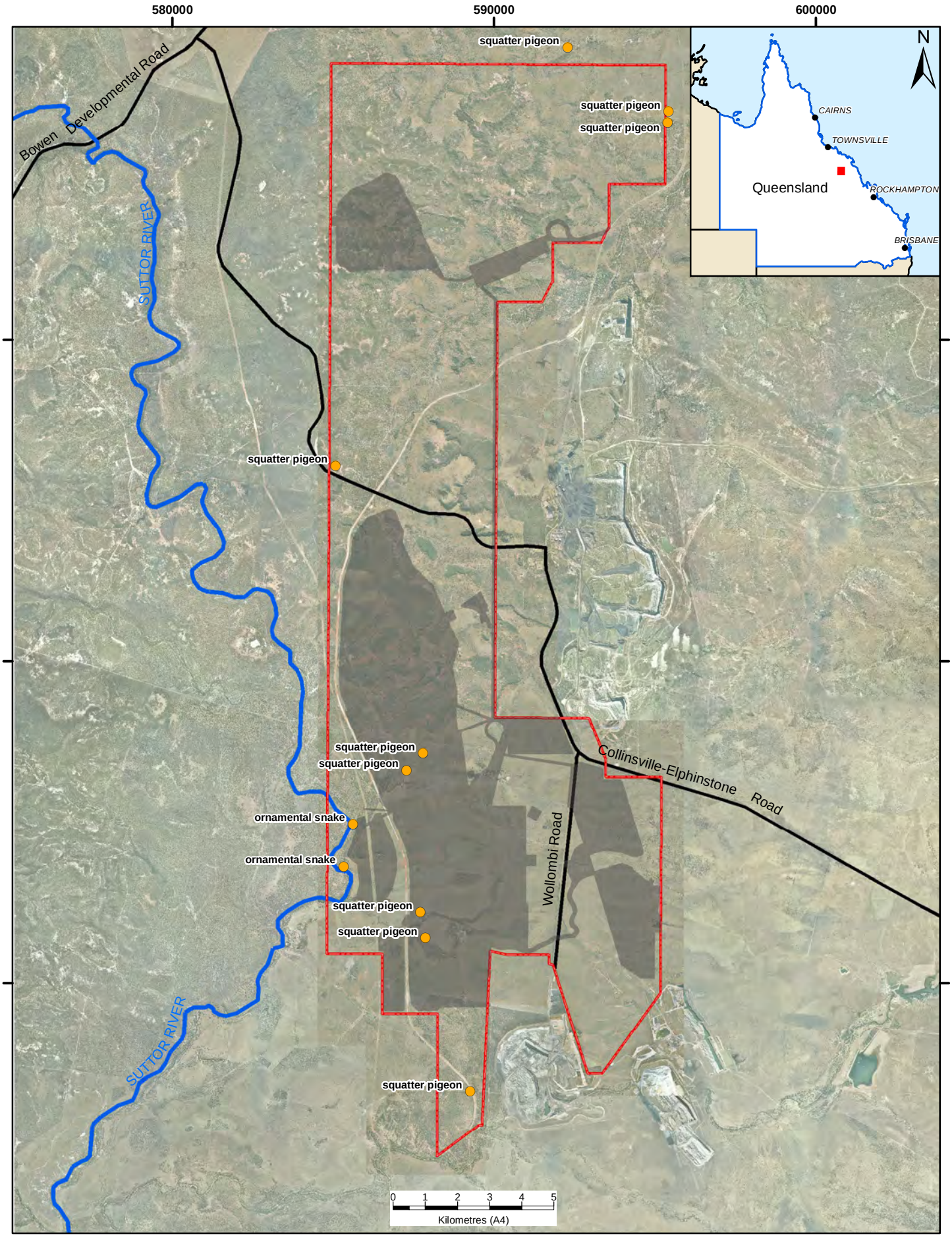
35.6.3.4 Australian Painted Snipe

The Australian painted snipe (*Rostratula australis*) is listed as vulnerable under the EPBC Act. It is also listed as a migratory species under the EPBC Act. This species has a scattered distribution throughout Queensland and south-eastern Australia but has also been recorded less frequently in Tasmania, South Australia, the Northern Territory and Western Australia.

This species inhabits inland and coastal shallow freshwater ephemeral and permanent wetlands. It has also been recorded using artificial habitats such as dams, sewage ponds and waterlogged grasslands. It forages nocturnally on mud flats and in shallow water (DSEWPaC, 2003).

The Australian painted snipe nests on the ground among tall vegetation, in a scrape in the ground lined with grass and leaves. It breeds September to December. Some individuals are apparently resident while others appear to be nomadic, temporarily occupying areas where suitable habitat exists (DSEWPaC, 2003).

This species was not observed during the field surveys, however has been previously recorded within 100 km. The species is unlikely to be resident in the project area however, it is likely to occur as a rare vagrant. Potential habitat for this species within the project area includes the large dam located to the south-west and the ephemeral gilgai wetlands which occur in the south.



Legend

- Project Area
- Project Ecological Footprint
- Formed Roads

Significant Fauna

- Threatened Fauna

Threatened Fauna Species		QCOAL GROUP
Figure 35-14	**Byerwen Coal Project**	elp environmental and licensing professionals pty ltd
Date: *5/02/2013*	**Author:** Shahram.Nasiri	
	Map Scale: 1:155,000	
Revision: R1	**Coordinate System:** GDA 1994 MGA Zone 55	
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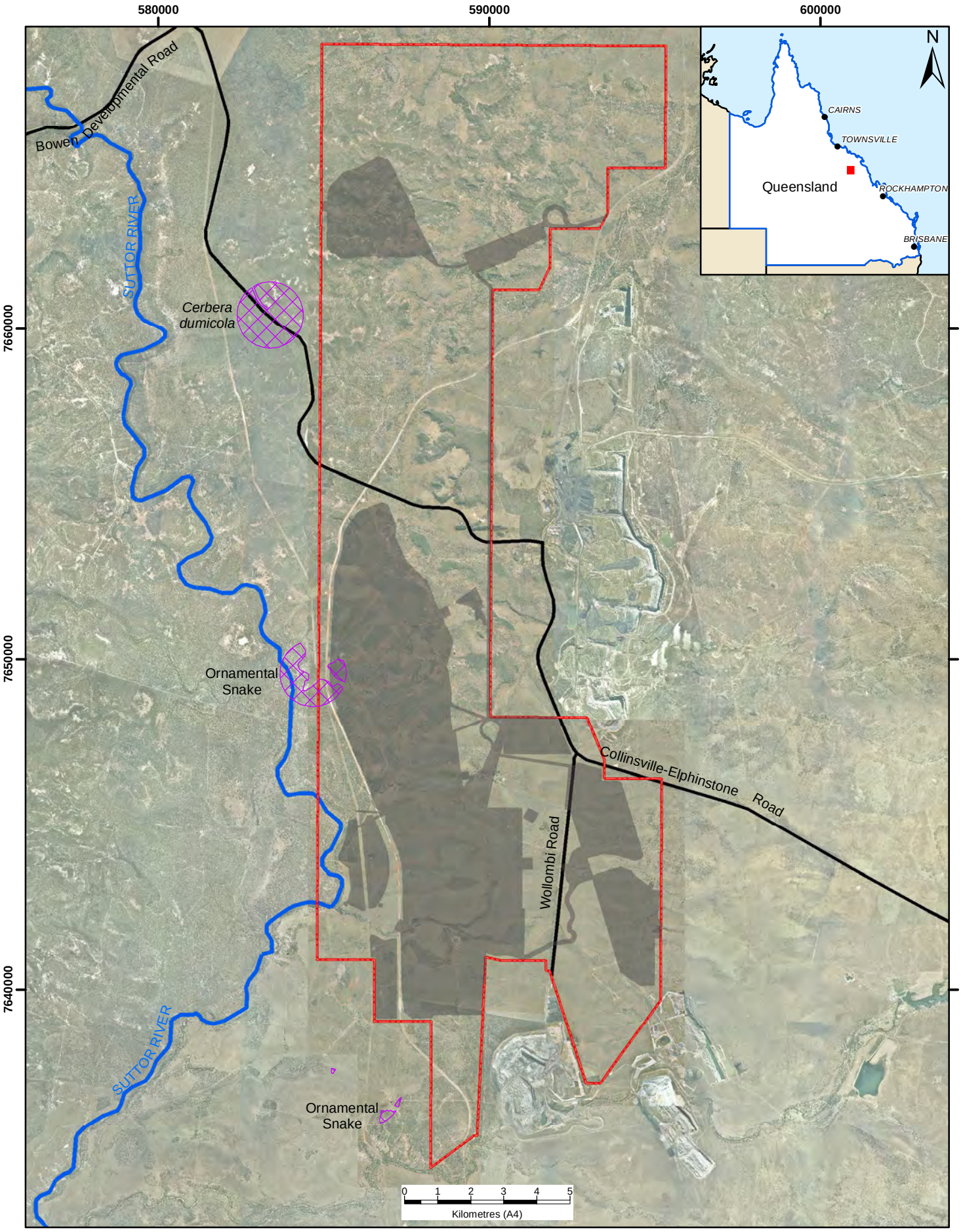

Legend

- Project Area
- Project Ecological Footprint
- Formed Roads
- VMA Essential Habitat

Essential Habitat	
Figure 35-15	**Byerwen Coal Project**
Date: *5/02/2013*	**Author:** Shahram.Nasiri
	Map Scale: 1:150,000
Revision: R1	**Coordinate System:** GDA 1994 MGA Zone 55
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35.6.4 Migratory Species

Five species listed as migratory under the EPBC Act were recorded during fauna surveys in the project area: the eastern great egret (*Ardea modesta*), white-bellied sea-eagle (*Haliaeetus leucogaster*), Latham's snipe (*Gallinago hardwickii*), rainbow bee-eater (*Merops ornatus*) and rufous fantail (*Rhipidura rufifrons*). A further five species are likely to occur in habitats within the project area including the cattle egret (*Ardea ibis*), fork-tailed swift (*Apus pacificus*), white-throated needletail (*Hirundapus caudacutus*), Australian painted snipe (*Rostratula australis*), and satin flycatcher (*Myiagra cyanoleuca).*

A number of migratory species were recorded using farm dams and wetland areas in the project area, which are considered to provide the most suitable habitat. Inundated gilgai areas are also expected to provide temporary wetland habitats for migratory species, in particular species such as the Latham's snipe (*Gallinago hardwickii*) and the Australian painted snipe (*Rostratula australis*).

Habitat requirements and an assessment of the likelihood of occurrence for migratory species identified through the desktop assessment are provided in **Table 35-11**. The location of migratory species records in the project area are shown in **Figure 35-16**. Overall the habitat values for migratory species are limited and of low value.

The Australian cotton pygmy-goose (*Nettapus coromandeliance albipennis*) and black-faced monarch (*Monarcha melanopsis*) were identified as part of the desktop assessment through the DSEWPaC Protected Matters Report (generated in December 2010) as migratory species potentially occurring in the project area. These species have been delisted as migratory species since the DSEWPaC Protected Matters Report was generated and as such are not mentioned further in this chapter.

Details of the distribution and life history of migratory species known to occur or considered likely to occur in the project area are provided in the sections below.

Table 35-11 Description, Habitat and Likelihood of Occurrence for Migratory Species

Common name	Species	Habitat requirements	Assessment summary
Known to Occur			
Eastern great egret	*Ardea modesta*	Freshwater wetlands and intertidal mudflats.	Recorded utilising farm dams within the project area. No suitable nest sites were observed in the project area.
White-bellied sea-eagle	*Haliaeetus leucogaster*	Permanent waterbodies including: estuaries, dams and wetlands.	Recorded at a small farm dam adjacent to Kangaroo Creek to the north east of the project area. Could nest in proximity to the Suttor River
Latham's snipe	*Gallinago hardwickii*	Open, freshwater wetlands with low, dense vegetation including: swamps, flooded grasslands or heathlands and bogs.	Recorded at large dam (H2) located to the south west of the project area. Inhabits open, freshwater wetlands with low, dense vegetation. Suitable habitat present in association with Palustrine wetland (S3). Foraging habitat rather than breeding habitat as species does not breed in Australia.
Rainbow bee-eater	*Merops ornatus*	Ubiquitous, potentially foraging over any habitat type. Nests in soft, loamy soil or flat ground of a bank.	This species was detected numerous times during the fauna surveys. Stream banks in the project area may provide burrow sites for this species.
Rufous fantail	*Rhipidura rufifrons*	The undergrowth of woodlands, forests, coastal and sub-coastal scrub including semi evergreen vine thicket, riparian areas and mangroves.	This species was recorded at H2 and H12 in the project area and is associated with the undergrowth of woodlands, forests and riparian areas. There are no breeding records in proximity to the project area and no suitable nest sites were observed at the time of the fauna survey.
Likely to Occur			
Cattle egret	*Ardea ibis*	Grassy, open pastures and shallow, open wetlands.	Riparian areas of the project area. Suitable habitat present in association with Palustrine wetland (S3).
Fork-tailed swift	*Apus pacificus*	High to low airspace over varied habitat (rainforest to semi-desert).	This species forages aerially over a range of habitat types and is considered likely to occur in the project area.
White-throated needletail	*Hirundapus caudacutus*	Ubiquitous, potentially foraging over any habitat type.	This species forages aerially over a range of habitat types and is considered likely to occur in the project area.

Common name	Species	Habitat requirements	Assessment summary
Australian painted snipe[4]	*Rostratula australis*	The Australian painted snipe inhabits shallows and margins of freshwater wetlands, dams, marshy areas and wet pastures.	Cryptic species with irregular occurrence. The large dam (H2) within the south-west of the project area and the ephemeral gilgai wetlands afford habitat for this species. Suitable habitat present in association with Palustrine wetland (S3).
Satin flycatcher	*Myiagra cyanoleuca*	Inhabits heavily vegetated gullies in eucalypt dominated forests and taller woodlands, often near wetlands and watercourses.	This species was recorded at locations outside the project area and is considered likely to occur in riparian environs along the Suttor River.
May Occur			
Glossy ibis	*Plegadis falcinellus*	Well vegetated freshwater wetlands, wet pastures, flood plains saline areas.	Grassy, open pastures and shallow, open wetlands in riparian areas of the project area. Suitable habitat present in association with Palustrine wetland (S3).
Unlikely to Occur			
Barn swallow	*Hirundo rustica*	Prefers disturbed open agricultural areas and open urban areas for forage and roost.	Prefers disturbed open agricultural areas and open urban areas for forage and roost. Most recordings originate from coastal areas.
Estuarine crocodile	*Crocodylus porosus*	Usually inhabits the lower reaches of coastal rivers, swamps, estuaries, and open sea (Wilson, 2005). In Queensland the species is usually restricted to coastal waterways, and floodplain wetlands (DSEWPaC, 2012a); however, may also be found hundreds of kilometres upstream (Read *et al*, 2004).	Suitable habitat within the Project area is extremely limited. Waterways of the Project area are of relatively low stream order, and positioned high in the catchment. Substantial barriers/weirs occur on the Suttor River downstream of the Project area and are likely to form physical barriers to the passage of estuarine crocodiles.

[4] Since the Terms of Reference for the project were issued (July 2011) the species has undergone taxonomic review. The Australian Painted Snipe (*Rostratula australis*) was previously considered to be a subspecies of the species *Rostratula benghalensis* that occurs in Africa and Asia, however, a taxonomic study by Lane and Rogers (2000) together with a DNA study, (as yet unpublished), verify that the Australian Painted Snipe is a separate species.

35.6.4.1 Eastern great egret

The eastern great egret is a widespread species of southern and eastern Asia and Australasia. Breeding populations are located in Pakistan, India, Sri Lanka, Bangladesh, Burma, Thailand, China, Korea, north-eastern Russia, Japan, Indo-China, Indonesia, Papua New Guinea, Solomon Islands, Australia and New Zealand (Kushlan & Hancock 2005; Martínez-Vilalta & Motis 1992).

In Australia, the breeding season of the eastern great egret is variable, depending to some extent on rainfall (Geering 1993), but generally extends from November to April (Kushlan & Hancock 2005), with pairs at southern latitudes breeding in spring and summer (particularly November and December), and pairs at more northerly latitudes breeding in summer and autumn (Chatto 2000; R.P.; Marchant & Higgins 1990).

Females lay two to six, but usually three to five, pale blue or pale green eggs. The eggs are incubated by both parents, but mostly by the female, for a period of 23–29 days. Nestlings are fed and brooded by both parents. The young begin to clamber from the nest at 25–37 days of age. Fledged young make their final departure from the nest or colony at 55–88 days of age (Kushlan & Hancock 2005; Marchant & Higgins 1990).

35.6.4.2 White-bellied sea-eagle

The white-bellied sea-eagle is distributed from India and Sri Lanka, east to southern China, and south through South-East Asia, the Philippines, Wallacea and New Guinea (including the Bismarck Archipelago) to Australia (del Hoyo et al. 1994; Marchant & Higgins 1993). The white-bellied sea-eagle is distributed along the coastline (including offshore islands) of mainland Australia and Tasmania. It also extends inland along some of the larger waterways, especially in eastern Australia. The inland limits of the species are most restricted in south-central and south-western Australia, where it is confined to a narrow band along the coast (Barrett et al. 2003; Bilney & Emison 1983; Blakers et al. 1984; Marchant & Higgins 1993).

The breeding season extends from June to January (or sometimes February) in southern Australia, but begins one or two months earlier in northern Australia. Pairs usually return to the same breeding territory each year, and often the same nest, although territories tend to contain one or two additional, less developed nests (Favaloro 1944; Marchant & Higgins 1993).

Clutches usually consist of two eggs, but can be between one and three eggs (Marchant & Higgins 1993). The eggs are incubated for approximately six weeks (Bilney & Emison 1983). The nestlings remain in the nest for 65–70 days or more (Brown & Amadon 1968; Cupper & Cupper 1981). Fledged young are fed by the adults for up to three months after leaving the nest. They are then driven out of the breeding territory by their parents approximately four months after fledging (Hollands 2003).

35.6.4.3 Latham's snipe

Latham's snipe breed in Japan and far eastern Russia during the northern hemisphere summer. They migrate south after the breeding season, travelling across Papua New Guinea to winter in eastern Australia (del Hoyo et al. 1996; Higgins & Davies 1996; Naarding 1986; Nechaev 1994). Latham's Snipe have also been recorded as vagrants in New Zealand (Higgins & Davies 1996). Latham's Snipe is a non-breeding visitor to south-eastern Australia, and is a passage migrant through northern Australia (i.e. it travels through northern Australia to reach non-breeding areas located further south) (Higgins & Davies 1996).

No precise information is available on the life expectancy, although banding data indicates that birds are capable of surviving for more than four years (Driscoll 1993). The age of sexual maturity is unknown, but birds probably breed for the first time at one or two years of age (Frith et al. 1977; Naarding 1982).

Latham's snipe does not breed within Australian jurisdiction. The breeding range is confined to Japan and far eastern Russia (Higgins & Davies 1996; Naarding 1986). For summaries of the breeding biology of this species, see del Hoyo et al. (1996) or Driscoll (1993).

35.6.4.4 Rainbow bee-eater

The rainbow bee-eater is widely distributed throughout mainland Australia and eastern Indonesia, including Bali, the Lesser Sundas and Sulawesi, and east to Papua New Guinea, the Bismarck Archipelago and, rarely, the Solomon Islands. It is a vagrant visitor to locations further north including Palau, south-western Micronesia, Saipan, the northern Mariana Islands, and Miyako Island and the southern Ryuku Islands in Japan. The majority of the global population breeds in Australia (including on Rottnest Island and islands in the south-west Torres Strait).

In Australia, the breeding season extends from August to January (Boland 2004; Higgins 1999). The female lays a clutch of two to eight, but normally four or five, pearl-white eggs (Boland 2004; Lill 1993; McGilp 1923) that are incubated for a period of 22 to 31 days (Boland 2004; Courtney 1971; Fry 1984; Lill 1993). The young remain in their natal burrows for a period of 23 to 36 days (Boland 2004; Courtney 1971; Fry 1984; Lill 1993; Morris 1976). They continue to be fed by the adults for another two to four weeks after their first departure from the nest (Boland 2004; Lill & Fell 1997; Morris 1976, 1977).

35.6.4.5 Rufous fantail

The rufous fantail is widespread from the Mariana Islands, south through Yap (Caroline Islands), to Sulawesi, the Moluccas and Lesser Sundas, east through southern Papua New Guinea, Louisiade Archipelago and Santa Cruz, to the Solomon Islands and Micronesia, and south to Australia (Coates 1990; Pratt et al. 1987; White & Bruce 1986). Within Australia the rufous fantail occurs in coastal and near coastal districts of northern and eastern Australia (Lindsey 1992).

The rufous fantail breeds from about September to February, with 81% of eggs laid November-December (Higgins et al. 2006). At elevations of >600 m above sea level in south-east Australia, they breed November to January (Frith 1969). Both sexes incubate, and re-laying may occur if the first nesting attempt is unsuccessful (Higgins et al. 2006). The incubation period is 15–17 days (Huggett 2000). Where outcome was known, of 52 nests, 28 nests fledged at least one young and 24 failed (Higgins et al. 2006). There is no information concerning seasonal or other conditions required for breeding.

35.6.4.6 Cattle egret

The cattle egret was originally native to Africa, south-west Europe, and Asia. Since 1877 the cattle egret has undergone a massive range expansion. The birds range continues to expand, particularly around the Pacific basin. Within Australia the cattle egret is widespread and common according to migration movements and breeding localities surveys.

The cattle egret breeds in colonies in wooded swamps but may also breed in artificial situations or close to urban areas.

East coast colonies operate in a well defined breeding period from October to January, occasionally extending by a month either side. In the Northern Territory, Top End colonies operate mainly November to February with smaller numbers breeding at other times (Chatto 2000).

35.6.4.7 Fork-tailed swift

The fork-tailed swift is a non-breeding visitor to all states and territories of Australia (Higgins 1999).

The fork-tailed swift does not breed in Australia. In their breeding range, they nest on mountain cliffs or island rock caves, inside narrow crevices or in cracks on vertical cliff faces. They are also known to nest in houses and occasionally in holes in trees (Chantler & Driessens 1995; De Schauensee 1984; Grimmett et al. 1999; O.S.J. 1974; Roberts 1991). They breed from April to July, usually in small colonies, producing two or three eggs per brood (Chantler & Driessens 1995; Grimmett et al. 1999; Roberts 1991; Robson 2000).

35.6.4.8 White-throated needletail

The white-throated needletail is widespread in eastern and south-eastern Australia (Barrett et al. 2003; Blakers et al. 1984; Higgins 1999).

This species does not breed in Australia (Higgins 1999). The white-throated needletail lays eggs from late May to early June (Chantler 1999). Clutches usually comprise two eggs (Dement'ev & Gladkov 1951; Yamashina 1962) but some may be as large as seven eggs (Chantler 1999), and these are incubated by both sexes for 21 days (Roberts 1991) or 40 days (Chantler 1999). The chicks, which are blind and naked when they hatch, fledge after 40–42 days (Chantler 1999; Dement'ev & Gladkov 1951; Yamashina 1962).

35.6.4.9 Australian painted snipe

The Australian painted snipe has a scattered distribution throughout many parts of Australia, with a single record from Tasmania. (DEH 2003).

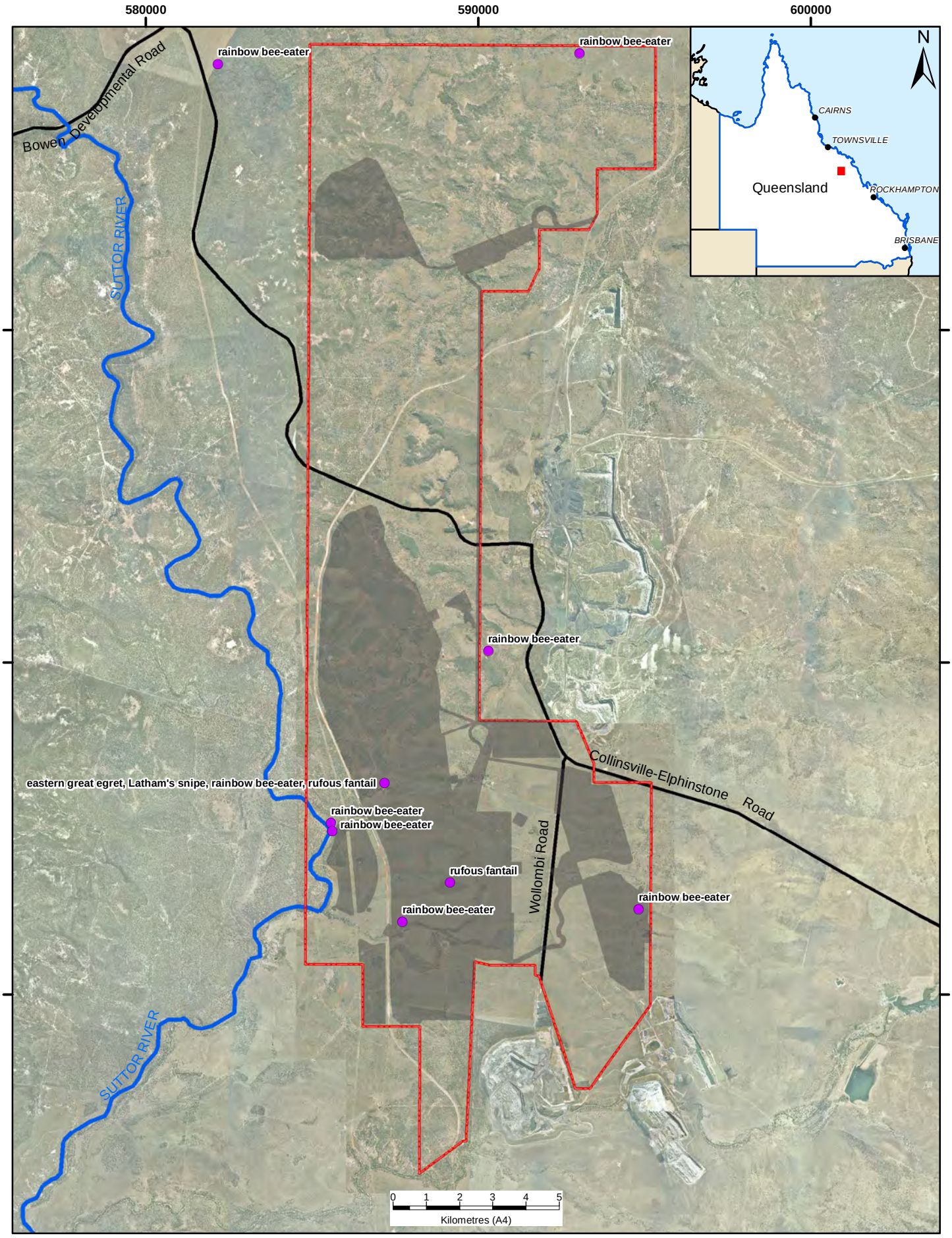
The Australian painted snipe may breed in response to wetland conditions rather than during a particular season with breeding recorded in all months in Australia. In some situations this species is loosely colonial, although nests are widely separated (Lowe 1963). Australian painted snipe are known to lay two to six (usually three or four) eggs, and females may lay up to four clutches in a year. Incubation takes 15–21 days. Chicks are precocial (well-developed, eyes are open and are capable of moving around shortly after birth) and nidifugous (able to leave the nest shortly after hatching), but they are brooded and dependent for the first few days. The incubation of the eggs, and all care of the young, is undertaken by the male (Marchant & Higgins 1993).

35.6.4.10 Satin flycatcher

The satin flycatcher is widespread in eastern Australia and vagrant to New Zealand (Blakers et al. 1984; Coates 1990). The satin flycatcher moves north in autumn to spend winter in northern Australia and New Guinea. They return south in spring to spend summer in south-eastern Australia (Blakers et al. 1984).

Satin flycatchers occur singly or in pairs, and sometimes in groups of three or four (Green & McGarvie 1971; Longmore 1978; McGarvie & Templeton 1974; Morris 1975; Smith & Chafer 1987). Where satin flycatchers breed at elevations of more than 600 m above sea level in south-eastern Australia, they breed from November to early January (Frith 1969).

The clutch size of the satin flycatcher is usually three, occasionally four (BA NRS 2002). The incubation period is reportedly c. 17 days (BA NRS 2002).



Legend

- Project Area
- Project Ecological Footprint
- Formed Roads

Significant Fauna

- Migratory Fauna

Migratory Species	
Figure 35-16	**Byerwen Coal Project**
Date: *5/02/2013*	**Author:** Shahram.Nasiri
	Map Scale: 1:150,000
Revision: R1	**Coordinate System:** GDA 1994 MGA Zone 55
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35.7 General Project Impacts and Mitigation Measures

35.7.1 Impact Footprint

The direct footprint of all mining and infrastructure areas as described in **Chapter 7** totals approximately 7,000 ha. For the purpose of the terrestrial ecology impact assessment this footprint area has been buffered so that any additional areas that will be isolated or cleared as a result of mining and/or associated infrastructure (e.g. non-viable linear corridors between haul roads and pits) are included within the impact footprint. The total impact footprint considered for the terrestrial ecology impact assessment is approximately 7,481 ha. The breakdown of difference between the direct footprint area provided in **Chapter 7** and the buffered footprint area adopted for the terrestrial ecology impact assessment in terms of regional ecosystems (REs), RE category and threatened ecological communities (TECs) is provided in **Table 35-12**, **Table 35-13** and **Table 35-14** respectively.

Table 35-12 Project Footprint RE Breakdown

RE	Direct footprint (a)	Footprint adopted for terrestrial ecology impact assessment (b)	Difference (b-a)
11.3.1	8	9	1
11.3.25	9	9	0
11.3.4	1	2	1
11.4.2	126	156	30
11.4.8	33	35	2
11.4.9	61	62	1
11.5.1	20	20	0
11.5.16	186	190	4
11.5.3	31	31	0
11.7.1	20	20	0
11.7.1x1	194	194	0
11.7.2	217	241	24
11.7.3	40	40	0
11.7.4	172	175	3
11.7.6	791	842	51
11.8.11	79	84	5
11.8.13	15	18	3
11.8.4	59	75	16
11.8.5	177	188	11
HVR 11.3.1	11	11	0
HVR 11.4.9	6	7	1
HVR 11.8.13	0	0	0
HVR 11.8.5	1	1	0

RE	Direct footprint (a)	Footprint adopted for terrestrial ecology impact assessment (b)	Difference (b-a)
HVR 11.9.5	2	2	0
Non-remnant	4751	5069	318
Total	**7010***	**7481**	**471**

***** This is comparable to the total footprint area described in **Chapter 7** (7,000 ha) with the discrepancy an artefact of GIS mapping
Note: Impact calculations rounded to the nearest whole number

Table 35-13 Project Footprint Breakdown by RE Category

RE	Direct footprint (a)	Footprint adopted for terrestrial ecology impact assessment (b)	Difference (b-a)
Endangered RE	303	314	11
Of concern RE	429	465	36
No concern at present RE	1507	1612	105
HVR	20	21	1
Non-remnant	4751	5069	318
Total	**7010***	**7481**	**471**

***** This is comparable to the total footprint area described in **Chapter 7** (7,000 ha) with the discrepancy an artefact of GIS mapping
Note: Impact calculations rounded to the nearest whole number

Table 35-14 Project Footprint TEC Breakdown

RE	Direct footprint (a)	Footprint adopted for terrestrial ecology impact assessment (b)	Difference (b-a)
TEC Brigalow	307	316	9
TEC SEVT	15	18	3
TEC Natural Grasslands	79	84	5
Not TEC	6609	7063	454
Total	**7010***	**7481**	**471**

***** This is comparable to the total footprint area described in **Chapter 7** (7,000 ha) with the discrepancy an artefact of GIS mapping
Note: Impact calculations rounded to the nearest whole number

35.7.2 Land Clearance

Land clearance will occur during the construction phase as a result of the establishment of supporting infrastructure, including the northern and southern mine infrastructure areas (MIAs), internal haul roads, linear infrastructure and creek diversions and during the operational phase as a result of the progressive development of open cut pits and associated waste rock placement areas. No clearing will be required and will therefore be undertaken outside of the project mining leases. Remnant vegetation clearance within the project area has been minimised by concentrating

development within cleared areas in the southern part of the project area. Only very limited clearing of remnant vegetation is required for the establishment of the South and East pits and the southern MIA.

While the need for land clearance has been minimised through the site layout, full development of the project over the 50 year period would result in the loss of approximately 2,391.1 ha of remnant native vegetation and 21.4 ha high value regrowth. The majority of this vegetation would be cleared from the West Pit, North Pit and northern MIA with smaller areas of clearing associated with the other pits as well as the central infrastructure corridor connecting the northern and southern MIAs.

Vegetation clearing over the life of the project would result in a reduction in the extent of endangered and of concern vegetation communities and a reduction in the available habitat for fauna, including threatened and migratory species within the project area. The majority of the remnant vegetation to be cleared (1,612.8 ha) is classified as no concern at present (by biodiversity status), with the remaining area comprised of endangered (313.9 ha) and of concern (465.2 ha) RE types. The effects of land clearance may include:

- loss of vegetation communities or individual threatened species
- reduced species abundance and biodiversity
- loss of habitat, loss of connectivity between habitat areas and associated diminished fauna movement
- loss of land stabilisation and riparian filtration functions.

General mitigation measures to be implemented to reduce the impacts of vegetation clearance and habitat loss include:

- Clear delineation of areas of native vegetation requiring removal to equipment operators and supervisors before any clearance to ensure disturbance is minimised.
- Maintenance of retained areas of existing vegetation to assist in providing a source of seed for mine rehabilitation works.
- Preparation of a Rehabilitation Management Plan and Mine Closure Plan which incorporates rehabilitation monitoring and trials.
- Use of native species for rehabilitation wherever possible. If native species are unsuccessful, introduced stoloniferous grasses may be to achieve rapid surface coverage. Buffel grass or a similar species may be used in areas identified for grazing where a suitable buffer to native vegetation is established using a non-invasive cover crop mixed with native grass seed.
- Monitoring of rehabilitation success including survival of regrowth and return of fauna species conducted at locations representative of the range of conditions impacting the rehabilitating areas. Reviews of monitoring data to assess trends and monitoring program effectiveness.

35.7.3 Habitat Loss

It is important to note that the overall habitat value of the project area has been significantly affected by historical clearing and the ongoing effects of grazing. The project will cause further impact on these (already highly compromised) habitats. However, habitat loss has been minimised by concentrating development in cleared areas as described above. The primary residual impacts on habitat within the project footprint would be expected to arise as a result of:

- Removal of permanent, yet artificial, water sources associated with the dams at H2 and H13. These dams are the only sources of permanent water in the southern part of the project area and

are an important resource for wetland birds and other terrestrial fauna species. This includes species which were observed near site H2 such as the squatter pigeon and cotton pygmy-goose. Removal of these dams represents the loss of a habitat resource for these species and potentially the black-throated finch which was recorded from the same area. Other potentially permanent water sources identified using aerial photography are located approximately 6.5 km to the north-west (adjacent to the Suttor River) and 6 km to the south-west.

- Removal of gilgai wetland habitat from the southern part of the project area. Historic clearing has reduced the habitat value of these wetlands through the removal of vegetation and microhabitat features however, gilgai on cracking clay soils represent a loss of potential habitat for the ornamental snake.
- Encroachment on riparian vegetation associated with Suttor Creek by the waste rock dumps associated with South Pit 1.
- Removal of riparian vegetation associated with the North Pit footprint.
- Removal of habitat, such as tree hollows and coarse woody debris, from within pit and infrastructure footprints.
- Reducing the catchment area of the palustrine wetland on the south-west boundary of the project area (S3). Further discussion is provided in **Section 8.1.3** of the Aquatic Ecology Impact Assessment (AMEC, 2012).

Impacts on habitat and associated fauna will be minimised by:

- minimising vegetation clearance along drainage features in order to maintain bank stability, habitat connectivity and movement corridors for terrestrial fauna species and a habitat refuge for fauna seeking shelter and water
- clearing riparian vegetation in a staged manner to allow fauna to migrate to adjacent habitats
- having a suitably qualified spotter-catcher available when clearing in habitat areas
- progressive rehabilitation of mined areas to incorporate the provision of nest hollows and microhabitat features such as trees and logs.

35.7.4 Habitat Fragmentation/Loss of Connectivity

Habitat fragmentation occurs when continuous areas of habitat, such as forests, woodlands or grasslands, are subdivided into a number of separate components. This term encompasses two interrelated components: habitat loss (i.e. a reduction in the amount of habitat) and fragmentation (i.e. a breaking apart of habitat) (Bennett, 2006). The impacts of habitat fragmentation are also scale-dependent and may differ depending on the species or community under consideration. For example, loss of small areas of habitat that do not present a significant barrier to movement by highly mobile species (e.g. birds of prey) may present a much greater barrier to dispersal of less mobile or far-ranging species (e.g. amphibians or small reptiles such as skinks).

Connectivity across the broader project area has been considered in terms of habitat connections and broader corridors with regional linkages beyond the boundaries of the project area. Within the project area connectivity is linked to riparian corridors associated with the Suttor River and Kangaroo Creek and contiguous areas of terrestrial vegetation in the central and northern portions of the project area.

There are three primary areas of impact on connectivity within the project area as a result of the project, namely:

- Loss of connectivity within the band of terrestrial vegetation in the central part of the project area associated with the establishment of the West Pit. This would result in areas to the east of the pit footprint becoming isolated from large, contiguous tracts of vegetation to the west of the project area. While isolated, this patch of vegetation is still relatively large and will sustain habitat but has the potential to fragment populations of less mobile species.
- Removal of riparian corridors along the tributary of Kangaroo Creek and excise of remnant vegetation from the contiguous band in the northern part of the project area associated with the establishment of the North Pit.
- Reduced connectivity of riparian corridors along Kangaroo Creek associated with the construction of the central infrastructure corridor. Fauna movement along this corridor and access for less mobile species to upstream habitats to the south and west would be restricted. The alignment of the road also increases the potential for interaction between vehicles and fauna moving along the corridor, which would be mitigated by imposing slower speed limits at the crossing point.

The out of pit waste rock dumps associated with South Pit 1 will encroach on the regionally significant corridor associated with the Suttor River, reducing its width and is expected to cause a minor impact to connectivity along this north-south running corridor. Modelling undertaken by KBR (2012) indicates that armouring would be required to prevent scouring of the waste rock dump during a 1,000 year ARI flood event which has the potential to encroach further on both this and the State significant corridors associated with Suttor River. Placement of waste rock would need to be closely supervised to ensure no unnecessary clearing occurs and that water and sediment are managed to avoid impacts on vegetation and water quality within and adjacent to the Suttor River.

These impacts on connectivity are expected to have minor impacts on both regional-scale connectivity as a whole, and the value of State and regional-significant biodiversity corridors.

35.7.5 Edge Effects

A key impact associated with the clearing of vegetation and construction of infrastructure and open cut pits is the creation of smaller patches of vegetation, with a greater edge to surface area ratio. Impacts associated with this increase in edge area are known as ‘edge effects’ and include increased exposure to weed invasion, light and wind penetration (which can alter microclimate features). Plant communities may become susceptible to disease and an overall decrease in health; over time community structure and composition may change as a result. The quality of associated fauna habitats may deteriorate as a result and some species are known to avoid disturbed habitats.

The impacts of edge effects are difficult to quantify as these effects occur gradually over time. Therefore, direct impacts such as vegetation loss and fragmentation are used to determine impacts. Rehabilitation of disturbed areas and the provision of buffers around undisturbed areas of remnant vegetation will help to minimise edge effects. Similarly, adopting other measures described throughout this chapter will help to lessen the impact of edge effects over the life of the project.

35.7.6 Impacts on Surface Water

Impacts on surface waters arising from the project with the potential to impact terrestrial flora and fauna values in the project area are:

- impacts on surface water inflows to the palustrine wetland on the south-western boundary of the project area
- diversion of tributaries of the Suttor River in the southern part of the project area

- diversion of tributaries of Kangaroo Creek in the northern part of the project area
- impacts associated with altered flow paths, flow volumes and water quality associated with waterway crossings (e.g. for roads).

35.7.6.1 Surface Water Inflows to Palustrine Wetland

During mining, the catchment supplying water to the palustrine wetland on the south-western project area boundary would be disrupted, temporarily reducing flow to the wetland (KBR 2012). Impacts and proposed mitigation are discussed in **Chapter 19**.

35.7.6.2 Watercourse Diversions

Watercourse diversions (described in **Chapter 16**) will result in the loss of riparian vegetation and associated habitat resources for fauna species over the short-to-medium term. The loss of stabilisation and filtration functions associated with riparian vegetation can lead to erosion and a reduction in water quality which can have indirect impacts by reducing food sources for terrestrial fauna species. Subject to re-establishment of 'natural' channels which include riparian vegetation and appropriate management to prevent erosion, only minor impacts on terrestrial flora and fauna values are expected as a result of watercourse diversions. Connectivity impacts associated with watercourse diversions are discussed in **Section 35.7.4**.

35.7.6.3 Waterway Crossings

Waterway crossings associated with the central infrastructure corridor will result in the loss of riparian vegetation and reduced access to surface water resources in Kangaroo Creek. In addition to habitat loss, indirect effects such as decreased water quality, particularly sedimentation, may decrease foraging opportunities for waterbirds, such as ducks, storks and egrets. Diminished water quality associated with dust and sediment-laden runoff from roads can also impact aquatic fauna and indirectly impact terrestrial fauna by reducing food sources. Connectivity impacts associated with this waterway crossing are discussed in **Section 35.7.4**. Impacts associated with waterway crossings will be reduced by minimising the number of crossings required, designing to prevent scour and implementing appropriate sediment and erosion controls at crossing points.

35.7.7 Impacts on the Great Barrier Reef

The project is located within the Rosella Creek and Upper Suttor River sub-catchments of the Bowen River catchment and Suttor River catchment respectively. These catchments constitute part of the headwaters of the Burdekin Basin. The Burdekin Basin comprises a number of major sub-catchments, namely the Bowen River, Lower Burdekin River, Upper Burdekin River and Suttor River catchments and enters the Pacific Ocean and Great Barrier Reef World Heritage Area just south of Ayr (refer **Chapter 15**, **Figure 15-1**). The Rosella Creek and Upper Suttor River sub-catchments form a minor portion of the total Burdekin Basin catchment.

It will be necessary for the project to release water to the environment to balance the mine water inventory. This will be achieved through a controlled release strategy allowing discharge into waterways when specific release criteria have been satisfied (refer **Chapter 8**). Release criteria were developed to ensure that releases do not result in unacceptable water quality in the receiving environment and considered several key factors to ensure this objective is met, including receiving environment flow, receiving environment water quality, mine release rate and mine release water quality.

Adherence to the release strategy is expected to protect the environmental values and objectives for water quality within the sub-catchment areas, resulting in minor impacts to surface water quality. As the sub-catchment input constitutes a minor portion of the overall input to the Great Barrier Reef

from the Burdekin Basin catchment, impacts to the Great Barrier Reef from mine water releases are expected to be negligible.

The design of the water management strategy for the project reduces the risk of unplanned discharges to the environment (refer to **Chapter 8**). However, unforseen events may create situations which are beyond design capacity of the management system, or constitute equipment failure or operator error. The time at which such events may occur cannot be predicted, however it is reasonable to assume they would be associated with high rainfall periods when there is also likely to be high flows in the receiving environment.

In terms of water quality impacts, this means that the unplanned release is likely to be a minor component of the existing flow. The main water quality concern associated with the project is salinity, and any salinity associated with unplanned releases would quickly be diluted. Any mine contaminants would be a negligible proportion of the total loads of material transported through the Burdekin Basin catchments to the Great Barrier Reef during such an event. Consequently the impact of unplanned releases on the Great Barrier Reef is expected to be negligible.

35.7.8 Impacts on Groundwater

The groundwater assessment (**Chapter 17**) concluded that there is little or no groundwater-surface water interaction in the project area. In the absence of groundwater baseflows to wetlands and drainage features and the absence of surface expressions of groundwater, any groundwater drawdown is likely to have a negligible impact on terrestrial flora and fauna values in the study area.

Groundwater dependent ecosystems (GDE) fall into four categories:

- Terrestrial GDE (woodlands dependent on shallow groundwater, and vegetation along dry riverbeds). There are no terrestrial GDE in the project area although they may exist along the Suttor River to the west of the project area. It is considered that there is no groundwater - surface water interaction between the aquifer sequences beneath the project area and the Suttor River alluvium so project mining activities will have no impact on terrestrial GDE.
- River Baseflow GDE (ecosystems reliant on groundwater discharging to streams, springs, seeps and swamps). No springs, seeps or swamps are known in the project area and there is no groundwater - surface water interaction between the aquifer sequences beneath the project area and the watercourses that traverse the project area. Project mining activities will have no impact on river baseflow GDE.
- Aquifer GDE (ecosystems that exist in the subsurface, entirely dependent on groundwater). Stygofauna are the subject of a separate study (see **Chapter 20**).
- Wetland GDE There are no records of wetland GDE in the Belyando Suttor river systems.

With the exception of stygofauna (refer **Chapter 20**) it is concluded that there are no GDE which can be impacted by the project's mining activities.

35.7.9 Dust

Dust generation has the potential to smother plants, reducing photosynthesis and resulting in decreased vegetation condition or the death of vegetation. Loss of vegetation also has indirect impacts on terrestrial fauna through the loss of food and habitat resources. Project activities likely to generate dust include open cut mining, waste rock stockpiling, vehicle movements, stockpiling (topsoil, waste rock, ROM and product coal), coal processing and coal transport (e.g. conveyors, haul trucks, etc).

Doley (2006) examined the physical effects of dust on vegetation and suggested that the most sensitive plant functions may be altered with monthly dust loads (deposition) of about 266 mg/m^2/day for dust with medium diameters of 50 µm. Dust deposition contours for the project area generated from air quality modelling provided in **Chapter 22**, indicate a 266 mg/m^2/day deposition rate may be exceeded in the immediate vicinity of mining operations. Areas where this deposition rate may be exceeded appear to be mainly within the project footprint. As limited vegetation will be retained within the project footprint, detrimental dust effects on plant health would be minor.

35.7.10 Noise

Increased noise from blasting, operation of machinery, vehicle traffic and coal processing have the potential to disturb terrestrial fauna and impact on feeding and breeding behaviour. Noise effects on wildlife and other animals are categorised as primary, secondary, or tertiary. Primary effects are direct physical auditory changes, such as eardrum rupture, temporary and permanent hearing threshold shifts, and auditory effects as stress, behavioural changes, interference with mating, and detrimental changes in the ability to obtain sufficient food, water, cover and predation. Tertiary effects are the direct result of both primary and secondary effects, and potentially include population declines. It is unlikely there will be any primary effects on wildlife.

The learning ability of many animal species is discussed by Busnel (1971). The animal's initial reaction to a new noise source is fright and avoidance but if other sensory systems are not stimulated (for instance optical or smell), the animal learns quickly to ignore the noise source, particularly when it exists in the presence of humans.

Migratory birds have the potential to be influenced by noise from the project. Studies of birds (Larkin, 1996) have shown that they will habituate to loud noises that are not biologically meaningful for them. For example if the noise is associated with possible harm such as thunder on a cloudy day, birds will avoid it, but routine noises such as traffic will not disturb them. Examples are provided of sea-birds that voluntarily co-exist with relatively loud noise environments, such as around airports, and birds roosting on light-posts above busy motorways.

Background levels of incidental noise will increase once the mine commences operation. Noise impacts may cause interference with communication within species. The degree of noise disturbance is often species specific and influenced by a number of factors including volume, frequency and noise characteristics. Those species that rely on sound for their basic behaviour such as birds are most likely to be impacted (Coffin, 2007). Some animals are likely to become habituated to the background noise emissions created by the project. For example, wetland birds in the Caley Valley wetland near Bowen have remained in areas impacted by background noise from the existing port facility. Species in the area may have become more tolerant of mining related noise emissions given the proximity to Newlands Mine.

For these reasons, the impact on fauna is not expected to be significant outside of the immediate vicinity of mining operations. High intensity activities such as blasting however will be generally restricted to daylight hours (refer **Chapter 24**) which will to minimise impacts on the breeding and feeding behaviour of nocturnal animals.

35.7.11 Light

Key sources of light generation in the project area will be the open cut pits, the CHPPs and the mine infrastructure areas, associated access roads and rail facilities. Headlights and flashing lights associated with vehicle movements will also contribute. Combined, these sources would also be expected to result in ‘sky glow’ or the general lightening of the night sky. Light spill has the potential to impact on nocturnal species by disrupting feeding behaviour and reducing effective home ranges. It can also impact on the breeding behaviour of some species. Conversely, increased light will attract

insects which may be beneficial for some insectivorous nocturnal feeders. This may benefit a small number of fauna species, such as some bird and bat species. Threatened species which are active at night and may be impacted by light spill in the project area include the brigalow scaly-foot, common death adder, ornamental snake, echidna, northern quoll, koala and Mount Cooper striped lerista.

35.7.12 Traffic Impacts (Mortality, Noise, Dust)

Traffic generation associated with the project has the potential to impact terrestrial flora and fauna in the following ways:

- mortality resulting from vehicle collision
- dust generation, which has the potential to smother roadside plants thereby affecting vegetation condition and reducing available habitat and food resources
- noise disturbance which can disrupt fauna behaviour.

Direct fauna mortality associated with vehicle movement on haul roads, access roads and rail lines has the potential to impact on a number of fauna species. Reptile species which may use road verges as habitat are susceptible to collision as they are less mobile than other species. The slow-moving squatter pigeon is also known to be at risk of vehicle strike.

The highest risk of direct fauna mortality is likely to be associated with vehicles travelling along the central infrastructure corridor. This risk is heightened in the northern section of the project area where the infrastructure corridor crosses fauna movement corridors associated with Kangaroo Creek. These crossings will be designed to minimise the potential for interaction with fauna. Reduced speed limits will also be adopted along the infrastructure corridor to minimise the risk for interaction with fauna by vehicle collision. In addition, lighting may also be provided at major intersections and points of major infrastructure along the corridor.

Other watercourse crossings associated with haul roads connecting open cut pits and the mine infrastructure areas will be designed to minimise the potential for vehicle interaction with fauna. Native fauna injured during construction and operational phases of the project would be taken to a vet or wildlife carer. In the event of injuries to domestic fauna or livestock, personnel would call for veterinary assistance and notify the appropriate landholder.

35.7.13 Increased Fire Risk

The project has the potential to increase fire risk associated with the operation of vehicles, activities undertaken by site personnel (e.g. from welding, cigarette butts) and spontaneous combustion of thermal coal. Uncontrolled fires have the potential to alter ecosystem characteristics and directly and indirectly impact on ecological values in the project area. Appropriate management systems will be put in place to prevent accidental ignition of fires as well as spontaneous combustion of coal. This will include active watering, orientation of stock and waste piles based on wind directions, and wind breaks. Vegetation retained on site will be managed for fuel load and appropriate fire regimes will be put in place to maintain biodiversity values while minimising the risk of bushfire. Fire regimes and management measures will be documented in a site-specific fire management plan.

35.7.14 Weeds

An increase in bare ground and open areas, associated with land clearance required for the project, will favour weedy species, particularly parthenium, which can suppress the regeneration of native species and reduce the available habitat for native species. Vehicles, machinery and material movement associated with the project will also have the potential to introduce new weeds and pests into the area, and/or facilitate the spread of weeds.

Under the LP Act it is the legal responsibility of all land owners to control declared weeds occurring on land under their management. As such the proponent is responsible for the management and control of declared and problem weeds on the project site. As weed species occur throughout the project area, the aim of weed management will be to prevent the introduction of new weed species to the project area and manage existing weed populations to prevent further infestation. Of particular note is the need to manage the potential for parthenium weed to establish in areas of natural grasslands TEC to be retained adjacent to the East Pit 2 footprint.

Weed management measures to be implemented in the project area include:

- Wash down facilities will be constructed at access points for vehicles arriving and departing from the project site. These facilities will be bunded and located away from drainage lines to minimise the risk of weed spread.
- Vehicles entering the project site and leaving properties known to contain declared weeds will be thoroughly washed down before entering clean areas; ensuring that wheels, wheel arches and the undercarriage are free of mud and plant material.
- Radiators, grills and vehicle interiors will be cleaned of accumulated seed and plant material.
- Drivers will be advised to keep vehicles to roads or compacted surfaces (preventative) and reduce vehicle movements in wetted soil where avoidance is not possible.
- Identified weeds of management concern, including declared and environmental weeds, will be controlled in accordance with local best practice management as described in the pest fact sheets published by Biosecurity Queensland and the Department of Agriculture, Fisheries and Forestry.
- Treated areas will be monitored to assess the success of declared weed eradication.
- Weed management will be included in the site induction program for the project to promote awareness of weed management issues.
- Implementation of the Weed and Pest Management Plan provided as part of the Environmental Management Plan (refer **Appendix 9**).

35.7.15 Pest Animals

Feral animals declared as pests under the LP Act represent a threat to primary industries and natural resources and responsibility for control rests with landholders. The following LP Act declared pest animals were observed or are likely to occur within the project area:

- feral dog (*Canis lupus familiaris*)
- dingo (*Canis lupus dingo*)
- feral cat (*Felis catus*)
- feral pig (*Sus scrofa*)
- rabbit (*Oryctolagus cuniculus*)
- goat (*Capra hircus*).

Other introduced species identified within the project area were the cane toad (*Bufo marinus*), house mouse (*Mus musculus*) and house gecko (*Hemidactylus frenatus*). These species are not declared pests and, as such, no formal control is required. However, cane toads are considered to pose a threat to the ornamental snake, common death adder, northern quoll and rainbow bee-eater (through usurping of nesting burrows), and control programs are recommended to mitigate impacts on these species. The impacts of these species are likely to include the following:

- predation on native species
- competition for food resources, which may decrease abundance of prey for native predator species
- habitat changes due to destruction of plants; changed floristic composition; reduced regeneration of plants; alteration of soil structure; increased invasion and spread of weeds
- increased access for non-native predator species
- toxicity to native species
- reduced water quality and availability
- spread of exotic invertebrates and creation of habitats suitable for disease, including the spread of root-rot fungus, *Phytophthora cinnamomi*.

Under the LP Act it is an offence to feed a declared pest animal or take a declared pest. The following general mitigation measures are proposed for the management of pest animal species:

- appropriate disposal and management of wastes on site
- Implementation of the Weed and Pest Management Plan provided as part of the Environmental Management Plan (refer **Appendix 9**).

35.8 Impacts and Mitigation Measures for MNES

Details of potential impacts to those defined MNES (refer **Section 35.6**) that could be affected by the project and the mitigation measures proposed to be undertaken by the proponent are outlined in the sections below. Mitigation measures proposed to be undertaken by government authorities such as those detailed in recovery plans prepared on behalf of the Commonwealth government are also considered in the sections below. There are no mitigation measures currently proposed by state or local governments specific to those MNES that could be affected by the project.

Mitigation measures have been proposed by suitably qualified and experienced ecologists and environmental professionals; and are expected to be effective in managing impacts through a combination of avoidance, minimisation and offsets.

35.8.1 Threatened Ecological Communities

Historically, brigalow TEC has been extensively cleared for cropping and/or pasture improvement over most of its range and has been subject to altered fire regimes and the introduction of exotic plants and animal species (DSEWPaC, 2012b). Any activities which further reduce the extent of the brigalow TEC, will cause a further decline in vegetation condition or impede its recovery are considered the key threats to this TEC (DSEWPaC, 2012b). Continued tree clearing, high total grazing pressure and the proliferation of exotic species are key ongoing threats for this TEC (Young *et. al.* 1999).

Grasslands and grassy woodlands are among the most threatened ecosystems in Australia (DSEWPaC, 2012b). The major threats to the natural grasslands TEC have been identified as the conversion of native pastures for grazing, cropping and pasture improvement, introduction of weeds and pest animals, physical destruction as a result of mining activities and the construction of roads and other infrastructure (DSEWPaC, 2012b).

Semi-evergreen vine thicket (SEVT) is considered an extreme form of dry seasonal subtropical rainforest. It occurs in areas with a subtropical, seasonally dry climate on soils of high to medium fertility and is generally characterised by the prominence of trees with microphyll sized leaves (2.5–7.5 cm long) and the frequent presence of swollen-stemmed “bottle trees” (*Brachychiton australis*, *B.*

rupestris) as emergents from the vegetation. The thickets typically have an uneven canopy 4–9 m high with mixed evergreen, semi-evergreen and deciduous emergent tree species 9–18 m high. Vines, twining or scrambling plants are prominent (McDonald, 2010).

Clearing for the establishment of open cut pits and supporting infrastructure will result in an overall reduction in the extent of TECs in the project area. **Table 35-15** summarises the area of TECs within the project footprint.

Table 35-15 Area of Clearing for Listed TECs

TEC	REs represented	Impact area (ha)
Brigalow (*Acacia harpophylla*) dominant and co-dominant	11.3.1, 11.4.8, 11.4.9, 11.5.16, 11.9.5	316.3
Natural grasslands	11.8.11	84.4
Semi-evergreen vine thicket	11.8.13	18.0

* Estimated areas for Brigalow TEC take into account the regrowth vegetation more than 15 years old which meets the listing requirements for the TEC (refer Environment Australia, 2001b)

Open cut mining activities may result in the altered distribution of cracking clay soils supporting brigalow and natural grassland communities and soils supporting the SEVT TEC. Separate stockpiling of soils from these areas for use in rehabilitation and/or offset areas will be considered. Brigalow and SEVT communities are also fire-sensitive and may be impacted by altered fire regimes in the project area. Management of weeds is required to prevent weed invasion and associated habitat degradation and/or increased fire risk. In particular, management will address:

- edge effects in the areas of SEVT TEC affected by the new rail loop
- measures to prevent the spread of parthenium into adjacent areas of natural grassland TEC in the vicinity of the East Pit 2.

Impacts on TECs in the project area will be minimised as described in **Section 35.7**. Impacts which cannot be minimised in this manner are addressed in the offsets strategy provided in **Section 35.11**.

35.8.2 Threatened Fauna Species

Table 35-16 provides a summary of impacts associated with the project on potential habitat for threatened fauna species known or likely to occur in the project area based on RE associations (i.e. remnant vegetation) within the project footprint. It should be noted that these calculations provide an estimate of habitat loss based on broadly suitable habitat only. As such, areas of broadly suitable habitat which have been identified may not actually be of significance, or therefore require mitigation, when determining impacts on the species in question.

Table 35-16 Impacts on Potential Habitat for Threatened Fauna Species

Species common name	Species scientific name	EPBC Act status[a]	RE associations within the project area	Area (ha) of remnant vegetation Impacted within the project area[b]
Ornamental snake	*Denisonia maculata*	V	11.3.1, 11.3.25, 11.3.4, 11.4.2, 11.4.8, 11.4.9, 11.8.11, 11.8.13, 11.8.4,	E – 123.5 OC – 251.1

Species common name	Species scientific name	EPBC Act status[a]	RE associations within the project area	Area (ha) of remnant vegetation Impacted within the project area[b]
			11.8.5	NC – 262.9
Squatter pigeon	*Geophaps scripta scripta*	V	11.3.2, 11.3.4, 11.3.25, 11.5.1, 11.7.4, 11.7.6,	OC -10.3 NC – 1,037.1
Black-throated finch (southern)	*Poephila cincta cincta*	E	11.3.1, 11.3.2, 11.3.25, 11.3.4, 11.3.27, 11.4.2, 11.4.8, 11.4.9, 11.5.1, 11.5.16, 11.5.3, 11.5.9, 11.8.11, 11.8.13, 11.8.4, 11.8.5	E – 207.9 OC – 160.0 NC – 238.3[c]
Australian painted snipe	*Rostratula australis*	V, M	11.3.25, 11.3.2, 11.3.27, 11.9.5	OC – 8.7

a EPBC Act Status: V – Vulnerable, E – Endangered, M - Migratory
b Area calculation based on RE biodiversity status: E - Endangered, OC - Of concern, NC - No concern at present
c The quantum of impact was determined by buffering potential watering sites for this species by a distance of 1 km and determining the extent of remnant grassy woodland within this area

A description of potential impacts on threatened fauna species known or likely to occur within the project area and proposed mitigation measures are provided below.

35.8.2.1 Ornamental Snake

The loss or degradation of riparian habitat surrounding drainage features, dams, wetlands and particularly gilgai is expected to have the largest impact on the ornamental snake. The main area of high value habitat are the lower areas of the clay floodplains containing regenerating brigalow stands and gilgai located within the footprint of South Pit 2 as well as EHP-mapped essential habitat (refer **Figure 35-15**) within the waste rock footprint associated with the West Pits.

The drainage features within the project area, particularly in the southern half, are also habitat of value for the ornamental snake. The relocation of the watercourse between West Pit 1 and South Pit 1 and the intersection of creek crossing by the central infrastructure corridor is also expected to impact ornamental snake habitat.

The Draft Referral Guidelines for the nationally listed Brigalow Belt reptiles (DSEWPaC, 2011), including the ornamental snake, determined that clearing two or more hectares of "important habitat" represents a significant threat to the ornamental snake. It was also determined that the alteration of water quality or quantity affecting four or more hectares of important riparian habitat is significant to this species. Given the location of the habitat within a central activity area within the project area, there is limited potential for rehabilitation of the disturbed habitat.

Management measures will focus on minimising the impact on riparian vegetation associated with the location of the waste rock dumps within the Suttor River floodplain. Adequate buffers will be maintained from retained vegetation and scour protection provided for the dump to minimise the potential for erosion, sedimentation and associated impacts on water quality, particularly during larger flood events. Vehicle movements around the dump will be minimised, particularly at night, to reduce the risk of vehicle strike and the disruption associated with lighting in this habitat.

The Queensland Brigalow Belt Reptile Recovery Plan (Richardson, 2006) covers 16 threatened reptile species, including the ornamental snake. The overall recovery objective of the plan is to secure and improve the long term survival of the species and their key habitat, and to raise awareness of reptile

conservation issues within the community. The proponent will raise awareness of reptile conservation issues by educating staff as part of the induction process. Training on fauna avoidance will be provided to all staff, with only nominated and trained staff responsible for fauna handling.

Of the management practices recommended in the recovery plan for the continued survival of reptile species (including the ornamental snake), the project will be able to ensure compliance with the following:

- managing the impact of feral animals
- adaptive fire management.

35.8.2.2 Squatter Pigeon

General threats to the squatter pigeon population are primarily associated with habitat degradation and increased predation from introduced species (QPWS, 1999a). Historically, populations of the squatter pigeon declined during the late nineteenth and early twentieth centuries. However, the decline in numbers has now slowed. There is an abundance of suitable available habitat in Central Queensland and the species is relatively widespread and locally abundant throughout its range (DSEWPaC, 2012c). Threats to this species include loss of habitat due to clearing for agricultural or industrial purposes, habitat degradation by grazing herbivores (e.g. sheep, cattle, rabbits) and excessive predation, particularly by cats and foxes.

Grassy woodland habitat will be removed from the project area as a result of the establishment of the West Pit and South Pit 1 footprints. However, this area is likely to represent an overestimate of impacts on habitat for this species, as squatter pigeon typically occurs in proximity to water. Clearing would result in a localised reduction of breeding and foraging habitat in the southern part of the project area however, this habitat type is widespread in the region and impacts on the species as a whole would not be significant.

There is also a risk of mortality to both adult birds and young due to vehicle strike as this species is ground-dwelling. Where possible, clearing in proximity to water would be undertaken outside breeding times (September through October), with fauna spotter-catchers employed to search for nests and/or stir up birds ahead of clearing works outside these times. Speed limits would be imposed on haul roads close to watering points during the construction and early operational phases of the project prior to the removal of suitable habitat from within the project footprint.

35.8.2.3 Black-throated Finch

This species was targeted during the survey with repeat visits to dams and wetlands with the goal of recording this species coming in to water. A pair of black-throated finches was tentatively recorded in proximity to the large wetland at H2. This record is treated as tentative because it is based on a fleeting glimpse of two birds without the aid of binoculars and the fact that the species can be readily confused with other finches. The precautionary principal has been applied and the species is treated as though likely to be present. As there are no previous records of this species in or near the project area, it is thought that these individuals may have dispersed along the Suttor River following consecutive years of high summer rainfall. It is not confirmed whether these individuals were the northern subspecies or the threatened southern species and for the purpose of this assessment, a precautionary approach assumed that the species observed is the threatened southern sub-species.

The main impact on the black-throated finch is potentially the removal or degradation of riparian habitat. While the black-throated finch inhabits open woodlands and forest with a grassy understorey, almost all recent records, south of the tropics, have been in riparian habitat (BTF Recovery Team, 2007). The foraging habitat of the black-throated finches requires access to water and grass seeds while breeding habitat is variable. Nesting may occur in a fork of a tree, shrub,

sapling or hollow of a native or non-native species in remnant or non-remnant vegetation (DSEWPaC, 2012d). The relatively broad breeding microhabitat suggests that distance to a suitable water source may be a limiting habitat factor. The dams located at H2 and H13 within the footprint of West Pit 1 and South Pit 1, respectively, is expected to have the largest effect on black-throated finch in terms of habitat loss as they sites afford high value wetlands fringed by eucalypt species and Brigalow adjacent to pastoral grasslands. The Suttor River riparian corridor is also considered to afford breeding and foraging habitat for the black-throated finch. Impacts on this species will be mitigated by conducting detailed searches of nesting habitat within proximity to important water sources (i.e. transects along the Suttor River riparian corridor and dam at H2) and replicating suitable habitats where possible.

The overall objective of the National recovery plan for the Black-throated finch southern subspecies (BTF Recovery Team, 2007) is to manage and protect the black-throated finch and its habitat, and to promote the recovery of the southern subspecies. Guidelines for habitat management for the black-throated finch southern subspecies, as outlined in the recovery plan includes:

- management practices aimed at minimising impacts on habitat by domestic stock and rabbits,
- fire management
- weed management strategies to minimise invasion of habitat by exotic weed species, including exotic grasses.

The project will ensure compliance with these management practices by implementing weed and pest management procedures and fire management protocols. Subject to appropriate management of weeds, introduced fauna species and fire regimes, impacts on this species, expected to result from the project will be negligible.

35.8.2.4 Australian Painted Snipe

Impacts and mitigation measures specific to the Australian painted snipe are outlined in the **Section 35.8.3** below.

35.8.3 Migratory Species

Table 35-17 provides a summary of impacts on potential habitat for migratory species known or likely to occur in the project area, based on RE associations (i.e. remnant vegetation) within the project footprint. It should be noted that these calculations provide an estimate of habitat loss based on broadly suitable habitat only. As such, areas of broadly suitable habitat which have been identified may not actually be of significance, or therefore require mitigation, when determining impacts on the species in question.

Table 35-17 Impacts on Potential Habitat for Migratory Species

Species		RE associations within the project area	Area (ha) of remnant vegetation impacted within the project area[a]
Common name	Scientific name		
Eastern great egret	*Ardea modesta*	11.3.2, 11.3.25, 11.3.27	OC – 8.7
White-bellied sea-eagle	*Haliaeetus leucogaster*	11.3.25, 11.3.27,	OC – 8.7
Latham's snipe	*Gallinago hardwickii*	11.3.25, 11.3.27	OC – 8.7

Species		RE associations within the project area	Area (ha) of remnant vegetation impacted within the project area[a]
Common name	Scientific name		
Rainbow bee-eater	*Merops ornatus*	Aerial foraging over all RE types	E – 313.9 OC – 465.2 NC – 1,612.0
Rufous fantail	*Rhipidura rufifrons*	11.3.25, 11.3.27, 11.9.5	OC – 8.7
Australian painted snipe	*Rostratula australis*	11.3.25, 11.3.2, 11.3.27, 11.9.5	OC – 8.7
Cattle egret	*Ardea ibis*	11.3.2, 11.3.25, 11.3.27	OC – 8.7
Fork-tailed swift	*Apus pacificus*	Aerial foraging over all RE types	E – 313.9 OC – 465.2 NC – 1,612.0
White-throated needletail	*Hirundapus caudacutus*	Aerial foraging over all RE types	E – 313.9 OC – 465.2 NC – 1,612.0
Satin flycatcher	*Myiagra cyanoleuca*	Riparian forest adjoining the Suttor River	0

a Area calculation based on RE biodiversity status: E - Endangered, OC - Of concern, NC - No concern at present

The potential impacts to migratory species in the project area are predicted to be minor or negligible as many of the species are highly mobile and capable of relocating with changes in the availability of suitable habitat.

There are no recovery plans in place for those migratory species known or likely to occur in the project area. The project is not expected to substantially interfere with the recovery of migratory species. There are no migratory species where an ecologically important proportion of the population will be impacted.

A description of impacts on migratory species known or likely to occur within the project area and proposed mitigation measures are provided below.

35.8.3.1 Eastern Great Egret

The removal or degradation of permanent and/or ephemeral wetlands is likely to have the largest effect on the eastern great egret. Gilgais, inundated flood plains, dam sites and water courses, particularly those concentrated in the south-western section of the project area, afford foraging habitat for this species. The large wetland associated with the dam at H2 and the dam at H13 are located within the footprints of West Pit 1 and South Pit 1, however the dam at H19 and the riparian areas along the Suttor River are located outside the development footprint and are likely to experience little disturbance. The waste rock pile however, located west of South Pit 1 will be managed to reduce the probability of habitat degradation within the Suttor River riparian areas.

Disturbance to other drainage features such as the creek diversions between South Pit 1 and 2 and the central infrastructure corridor creek crossings approaching the Northern Infrastructure Area are not expected to affect the eastern great egret as this species is highly mobile and capable of relocating with changes in the availability of suitable wetland habitat.

As this species breeds in colonies in the northern parts of Australia, no disturbance to breeding habitat is expected as a result of this project.

35.8.3.2 White-bellied Sea-eagle

The white-bellied sea-eagle is generally associated with coastal environments and large, inland bodies of water or major drainages. It is a highly mobile species that is likely to use suitable habitat in the project area as a flyover resting site or potentially to forage. Project activities are expected to have a minor or negligible effect on the white-bellied sea-eagle.

35.8.3.3 Latham's Snipe and Australian Painted Snipe

The removal or degradation of ephemeral water bodies is likely to have the largest effect on Latham's snipe and the Australian painted snipe. High value habitat includes the large wetland associated with the dam at H2 and the dam at H13 which are both located within the footprints of West Pit 1 and South Pit 1. The creek diversion and crossings between South Pit 1 and South Pit 2 and south of the Northern Infrastructure Area are also likely to affect the habitat for these species. The dam at H19 and the riparian areas along the Suttor River are located outside the development footprint and no impacts on these areas are expected to result from the project. Impacts on the Latham's snipe and Australian painted snipe will be mitigated by having a suitably qualified spotter-catcher available when clearing in habitat areas and the provision of suitable habitat associated with offset benefits for the species as discussed in **Section 35.11.2.3**. These species may also benefit from the generation of foraging opportunities associated with the creation of new dams and cleared areas.

35.8.3.4 Rainbow Bee-eater

The rainbow bee-eater is a common and widespread species across Australia inhabiting a range of habitat types throughout the project area including remnant and non-remnant vegetation. Foraging habitat is varied and includes disturbed and undisturbed areas while breeding habitat involves the excavation of a burrow in soil such as along a river bank, dam wall, gravel pit or soil piles. Sandy banks associated with water courses within the footprint of West Pit 2 and 3 and the Suttor River afford high quality nesting habitat. The excavation of open pits and the stocking of waste rock may increase the availability of nesting sites, while conversely create susceptibly of nest disturbance through ongoing project activities.

This species utilises a broad range of habitats and all remnant vegetation within the project footprint would be considered suitable habitat for this species. Large areas of suitable remnant habitat will remain in areas which would not be disturbed by mining and the impacts presented in **Table 35-17** somewhat overstate the extent of impact. Impacts on this species may be mitigated by timing works in and around watercourses to avoid breeding times (September–February) and to deploy fauna spotter-catchers to search for nest burrows in stream banks when works during this period cannot be avoided.

35.8.3.5 Rufous Fantail

This species utilises the shrub layer sub canopy of woodlands adjacent to riparian areas as breeding and foraging habitat. High value habitat is located at the farm dam at site H2 and the riparian corridor of waterways in the southern section of the project area. The removal of the dam and diversion of the creek located between South Pit 1 and South Pit 2 is likely to impact foraging habitat however, this species typically breeds in moister vegetation types. Impacts on breeding habitat for this species may be mitigated by minimising impacts on the Suttor River riparian corridor as described throughout **Section 35.7** of this chapter.

35.8.3.6 Cattle Egret

The cattle egret inhabits predominately shallow and open wetlands, but unlike the eastern great egret, forages away from wetlands in low lying grasslands and improved pastures. Suitable habitat for this species is more prevalent within the southern half of the project area, largely within the footprint of the West and South pits, within non-remnant vegetation in proximity to water.

As the cattle egret appears tolerant of some level of ground disturbance, the largest effect as a result of project activities is expected to be potential displacement during the construction phase. While noise and vehicle traffic may affect cattle egret activity during the operational phase, new dams and cleared areas may generate foraging opportunities. As this species breeds in colonies in the coastal areas of Australia, no disturbance to breeding habitat is expected as a result of this project.

35.8.3.7 Fork-tailed Swift and White-throated Needletail

The fork-tailed swift and white-throated needletail are highly mobile, aerial species which adapt to many habitat types. Breeding and foraging habitat are considered unlikely to be affected by the project.

35.8.3.8 Satin Flycatcher

Satin Flycatchers inhabit heavily vegetated gullies in eucalypt-dominated forests and taller woodlands, and on migration, occur in coastal forests, woodlands, mangroves and drier woodlands and open forests. The satin flycatcher is considered likely to occur in riparian vegetation adjoining the Suttor River (outside of the project area).

35.8.4 Benefits of Mitigation Measures and Positive Impacts

The positive impacts from the project in relation to MNES values, are derived from the mitigations (and associated direct and indirect benefits of mitigations) proposed for impacts to MNES values. Benefits can be realised for ecology in general (such as offsets) or for specific species.

Positive impacts and benefits would be realised most notably in the mid to long term, post construction and include:

- a net conservation gain for each impacted matter, implemented via an offsets package that consists of an offset which:
  - is protected in perpetuity thus protecting the associated protected value in perpetuity
  - has a management plan which reduces threats to the protected values (e.g. weeds or predators)
  - has land based management techniques to improve the quality of the habitat or ecosystem
  - monitors and reports effectiveness
- generation of foraging opportunities resulting from new dams and cleared areas (such as for the cattle egret)
- increase in the availability of nesting sites for some species resulting from the excavation of open pits and the stocking of waste rock.

35.9 Cumulative Impacts on MNES

Cumulative impacts on MNES were assessed by considering impacts of current and planned projects within the Brigalow Belt North bioregion on TECs associated with these projects. The proponent has

identified 56 projects which have the potential to contribute to cumulative environmental and social impacts, including:

- projects in the Bowen Basin, or within 150 km of the project
- projects in the Isaac Regional Council, Whitsunday Regional Council, or Mackay Regional Council local government areas
- projects for which an EIS process has commenced under the EP Act or *State Development and Public Works Organisation Act 1971*
- projects for which an EIS process has commenced under the EP Act or SDPWO Act
- other projects of which the proponent is aware
- known major infrastructure projects (e.g. power stations or water infrastructure) that are seeking approval or have obtained development approval other than through an EIS.

The majority of planned development in the region relates to coal mining projects and, to a lesser extent, development of infrastructure to support the coal mining industry (rail and pipeline corridors). The most relevant impacts to be considered relate to the area of terrestrial remnant vegetation (which also provides an indication of fauna habitat) and the extent of sensitive vegetation communities.

It is difficult to draw consistent comparisons across all of these projects due to:

i. the varying availability of associated ecological assessment reports
ii. the quality and manner in which impact data is expressed
iii. the fluid nature of development footprints which remain in the planning phase.

For this reason the cumulative impact assessment for MNES adopted the (highly) precautionary approach of assuming that all vegetation within the broader project area of each project (normally a mining lease) will be removed. This clearly results in a significant overestimation of vegetation which is likely to be affected, particularly for TEC's, which proponents preferentially avoid compared to the more common vegetation types. It is very important to keep this approach in mind when considering the following analysis.

The potential impact for each project was based on the project MLs, project boundary or, for linear features, buffered.

The areas covered by Exploration Permits for Coal (EPC), Exploration Permits for Minerals (EPM) and Mineral Development Licences (MDLs) have not been included as their areas are disproportionate to the likely disturbance generated by the project. As a consequence, projects consisting of EPCs, EPMs and MDLs have been excluded from the assessment. These are:

- Anthony Project (EPM)
- Dysart East (MDL)
- Goonyella Riverside Mine (EPC)
- Goonyella Riverside Mine (MDL)
- Integrated Isaac Plains (EPC)
- Moranbah South (MDL)
- Sarum Project (EPC)
- Sonoma Project (EPC)
- Talwood Project (EPC)
- Wilunga Project (EPC)

- Winchester South (MDL).

The Conner's River Dam and Pipeline Projects have also been excluded from this assessment due to the project's cancellation in July 2012 (SunWater, 2012). Projects located outside the Brigalow Belt North bioregion were also excluded from this assessment. In many cases the cumulative impact project areas overlapped. To obtain an accurate account of terrestrial vegetation potentially affected by the projects, overlapping areas were accounted for within one project only (usually within the project of the larger extent). The areas of project overlay are shown in **Appendix 19**.

The area of each value type potentially disturbed was summed across all projects and the contribution of the Byerwen project to the total potential disturbance of TECs calculated. Potential disturbance areas for TECs have been defined in accordance with Commonwealth listing advice as described in **Table 35-18**.

Table 35-18 Definition of TECs for Cumulative Impact Assessment

TEC	Definitions
Brigalow	All brigalow RE types within the Brigalow Belt North bioregion (REs 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)
Semi-evergreen vine thickets (SEVT)	All SEVT RE types within the Brigalow Belt North bioregion (REs 11.2.3, 11.3.11, 11.4.1, 11.5.15, 11.8.3, 11.8.6, 11.8.13, 11.9.4, 11.9.8, 11.11.18)
Natural grasslands	Natural grassland REs (REs 11.3.21, 11.4.4, 11.4.11, 11.8.11, 11.9.3, 11.9.12, 11.11.17) within the following subregions of the Brigalow Belt North bioregion: ▪ BBN6 Northern Bowen Basin ▪ BBN9 Anakie Inlier ▪ BBN10 Basalt Downs ▪ BBN11 Isaac-Comet Downs ▪ BBN12 Nebo-Connors Range ▪ BBN13 South Drummond Basin.

Table 35-19 shows the areas of impact from identified projects on TECs including the Byerwen project and the percentage of Byerwen project impact within the total cumulative impact and the Bioregion.

Table 35-19 Cumulative Impacts on TECs

Projects	Brigalow TEC	Natural grasslands TEC	SEVT TEC
Byerwen Coal Project	316.3	84.4	18.0
Abbot Point Coal Terminal	-	-	41.9
Arrow Bowen Pipeline Project	15.9	13.1	1.1
Bow Energy Gas Pipeline	6.2	0.3	-
Bowen basin Coal Growth Caval Ridge	723.9	148.2	-
Bowen Basin Coal Growth Daunia Mine	111.3	8.6	-

Projects	Brigalow TEC	Natural grasslands	SEVT TEC
Burton Project	65.9	24.9	-
Central Queensland Gas Pipeline	25.8	-	0.3
Central Queensland Integrated Rail	26.2	8.2	5.8
Clermont Coal Mine	186.8	77.6	-
Cows Coal	-		-
Dalrymple Bay Coal Terminal	-	-	-
Drake Coal Project	-	104.5	-
Dudgeon Point Coal terminal	-	-	-
Eagle Downs Coal Terminal	127.6	518.0	2.7
Eaglefield Expansion	34.7	435.1	11.6
Ellensfield Coal Mine	114.3	-	0.7
Goonyella Riverside Mine ML	697.3	1.2	-
Grosvenor Coal	0.8	-	-
Integrated Issac Plains ML	8.5	-	-
Jax Project	11.4	-	-
Jilalan Rail Yard	-	-	-
Millenium Expansion Project	185.5	36.4	-
Moorvale Coal	69.5	-	-
Moranbah CSG Operation	945.5	1886.3	155.3
Nebo Moranbah Power Stations	-	-	-
New Lenton	11.5	776.9	-
Newlands Coal	514.8	636.9	21.2
Newlands Coal Extension	1440.3	90.1	14.7
Northern Missing Link	6.3	4.8	13.7
NQ gas Pipeline	11.2	0.3	4.5
Olive Downs	22.0	-	-
PL224	134.9	88.3	-
Saraji East	336.0	1.4	-
Sarsfield Project	-	-	-
Twin Hills	3.6	-	-
Vermont Coal	98.0	-	-
Wards Well Underground	4.3	1640.6	405.7
Water For Bowen Project	-	-	-
Total cumulative impact of projects	**6,256.3**	**6,586.3**	**697.4**
Total area within Bioregion	**579,883.0**	**35,606.0**	**12,042.0**

Projects	Brigalow TEC	Natural grasslands	SEVT TEC
% of Byerwen Coal Project impact within total cumulative impact	**5.1**	**1.3**	**2.6**
% of Byerwen Coal Project impact within Bioregion	**0.1**	**0.2**	**0.1**
% of cumulative impact of projects within Bioregion	**1.1**	**18.5**	**5.8**

The total cumulative impact of projects on Brigalow TEC is 6,256.3 ha, or 1.1% of the 579,883.0 ha of Brigalow TEC within the Bioregion. The Byerwen project's contribution to cumulative impacts on Brigalow TEC is 316.3 ha, or approximately 5.1% of the impact from all projects and is therefore considered to be a minor contribution to a minor cumulative impact to Brigalow TEC.

The total cumulative impact of projects on natural grasslands TEC is 6,586.3 ha, or 18.5% of the 35,606.0 ha of natural grasslands TEC within the Bioregion. The Byerwen project's contribution to cumulative impacts on natural grasslands TEC is 84.4 ha, or approximately 1.3% of the impact from all projects and is therefore considered to be a minor contribution to a moderate cumulative impact to natural grasslands TEC.

The total cumulative impact of projects on SEVT TEC is 697.4 ha, or 5.8% of the 12,042.0 ha of SEVT TEC within the Bioregion. The Byerwen project's contribution to cumulative impacts on SEVT TEC is 18.0 ha, or approximately 2.6% of the impact from all projects and is therefore considered to be a minor contribution to a minor cumulative impact to Natural Grasslands TEC.

35.10 Significant Impact Assessment for MNES

Impacts on MNES are required to consider the criteria established by the Significant Impact Guidelines – EPBC Act Policy Statement 1.1 (DEWHA, 2009a). An assessment has been undertaken against this guideline for MNES that may be impacted by the project. Results of the assessment are provided in the sections below. Where more prescriptive guidelines have been published for species or groups of species, these are also described below. The assessment of significance takes into account implementation of mitigation measures listed in **Section 35.7** and **Section 35.8**, and also the specific mitigation measures provided in this section.

35.10.1 Threatened Ecological Communities

35.10.1.1 Brigalow TEC

Table 35-20 provides an assessment of the potential impacts associated with the project on brigalow TEC against the EPBC Act significant impact criteria for endangered ecological communities.

Table 35-20 Brigalow TEC Significant Impact Assessment

Significant impact criteria	Response
An action is likely to have a significant impact on an endangered ecological community if there is a real chance or possibility it will:	
Reduce the extent of an ecological community.	The project would require the loss of 316.3 ha of brigalow TEC from the project area. Based on current certified RE mapping (Version 6.1), this represents a reduction in the extent of brigalow TEC within the Brigalow Belt North Bioregion of

Significant impact criteria	Response
	approximately 0.1% (refer **Section 35.9**).
Fragment or increase fragmentation of an ecological community.	Approximately 50% of clearing within the brigalow TEC would result from the loss of small, fragmented patches in the southern part of the project area and clearing along the edge of patches of brigalow vegetation. No increase in fragmentation of the ecological community would occur in these areas. Establishment of the West Pit would fragment a band of terrestrial vegetation in the central part of the project area which contains the brigalow TEC.
Adversely affect habitat critical to the survival of an ecological community.	The project would not adversely affect habitat critical to the survival of this community.
Modify or destroy abiotic 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 project would be expected to result in the altered distribution of brigalow cracking clay soils, which would be removed from open cut mining areas and replaced during rehabilitation. However, this is not expected to impact the long-term survival of the ecological community as a whole.
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.	Subject to appropriate management of fire regimes, no substantial change in species composition in retained areas would be expected to result from the project. Development and implementation of a site-specific fire management plan will address the need to minimise fire risk in areas of fire-sensitive brigalow.
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 ▪ 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.	Subject to appropriate management of the waste rock dump within the Suttor River floodplain, the project would not be expected to result in a substantial reduction in the quality or integrity of an occurrence of brigalow TEC.
Interfere with the recovery of the ecological community.	The project would result in clearing of approximately 0.1% of the remaining brigalow TEC in the Brigalow Belt North Bioregion. As such, the project is not expected to interfere with the recovery of the ecological community.

35.10.1.2 Natural Grasslands TEC

Table 35-21 provides an assessment of the potential impacts associated with the project on natural grasslands TEC against the EPBC Act significant impact criteria for endangered ecological communities.

Table 35-21 Natural Grasslands TEC Significant Impact Assessment

Significant impact criteria	Response
An action is likely to have a significant impact on an endangered ecological community if there is a real chance or possibility it will:	
Reduce the extent of an ecological community.	The project would require the loss of 84.4 ha of natural grasslands TEC from the project area. Based on current certified RE mapping (Version 6.1), this represents a reduction in the extent of natural grasslands TEC within the Brigalow Belt North Bioregion of approximately 0.2% (refer **Section 35.9**).
Fragment or increase fragmentation of an ecological community.	Establishment of the East Pit 2 would result in clearing the western-most extent of two patches of natural grasslands TEC. Clearing in the northern occurrence would reduce the patch size and result in a very small area becoming isolated from the remaining patch. While not directly located in the impact footprint, the remaining area is unlikely to remain a viable remnant. Clearing in the southern occurrence would expose a new edge to this community but this patch would be expected to remain viable
Adversely affect habitat critical to the survival of an ecological community.	The project would not adversely affect habitat critical to the survival of this community.
Modify or destroy abiotic 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 project would not modify or destroy abiotic factors necessary for the survival of the natural grasslands TEC beyond areas of direct impact.
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.	Parthenium (*Parthenium hysterophorus*) was recorded at a number of locations in proximity to occurrences of natural grasslands TEC in the south-east of the project area. Establishment of the East Pit 2 would disturb intact areas of native grassland with limited incursion of exotic species. Disturbance would create a new edge which has the potential to allow parthenium to establish within adjacent areas of natural grasslands. Appropriate measures will be taken to prevent parthenium becoming established in retained areas of natural grassland to the east of the disturbance. Management measures will include: ▪ development of a weed management plan which specifically addresses measures to prevent spread of parthenium into intact areas of natural grasslands TEC ▪ implementation of appropriate weed management protocols, including the provision of vehicle wash down facilities as described **Section 35.7.14** ▪ monitoring in grasslands adjacent to the disturbance area and undertaking appropriate weed eradication programs as required.

Significant impact criteria	Response
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 ▪ 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.	If not appropriately managed, the establishment of parthenium weed in intact areas of natural grasslands TEC would cause a substantial reduction in their quality and integrity. Management measures will be undertaken to prevent the spread of parthenium across the site as described above.
Interfere with the recovery of the ecological community.	The project would result in clearing of approximately 0.2% of the remaining natural grasslands TEC in the Brigalow Belt North Bioregion. As such, the project is not expected to interfere with the recovery of the ecological community.

35.10.1.3 Semi-evergreen Vine Thicket TEC

Table 35-22 provides an assessment of the potential impacts associated with the project on SEVT TEC against the EPBC Act significant impact criteria for endangered ecological communities.

Table 35-22 SEVT TEC Significant Impact Assessment

Significant impact criteria	Response
An action is likely to have a significant impact on an endangered ecological community if there is a real chance or possibility it will:	
Reduce the extent of an ecological community.	The project would result in the loss of 18.0 ha of SEVT TEC from the project area. Based on current certified RE mapping (Version 6.1), this represents a reduction in the extent of SEVT TEC within the Brigalow Belt North Bioregion of approximately 0.1% (refer **Section 35.9**).
Fragment or increase fragmentation of an ecological community.	Disturbance associated with the central infrastructure corridor and the haul road linking the North Pit with the Northern Infrastructure Area would bisect two small patches of SEVT TEC. This would result in the creation of smaller patches with a larger edge area, exposing the remaining vegetation to edge effects associated with dust deposition from haul roads, exposure to weeds and increased fire risk. Management measures to minimise adverse impacts on this patch will include: ▪ ongoing management of weeds, particularly those which pose a threat in terms of increased fire risk ▪ undertaking dust suppression on haul roads adjacent to new edges.
Adversely affect habitat critical to the	The project would not adversely affect habitat critical to the

Significant impact criteria	Response
survival of an ecological community.	survival of this community.
Modify or destroy abiotic 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.	SEVT TEC is generally regarded as a fire-sensitive community and remnants are typically (but not always) located in areas protected from fire by topography and/or substrate (Fensham, 1995). The greatest fire risk to this community is associated with the rail loop associated with the Northern Infrastructure Area where sparking from train traffic is a potential ignition source. Incursion of exotic pasture grass species such as buffel grass and parthenium will further increase fire risk (Fensham, 1995). This risk will be managed through weed management practices which will address the edge effects in the areas of SEVT TEC affected by the rail loop. Vegetation retained on site will also be managed for fuel load and appropriate fire regimes put in place to maintain biodiversity values while minimising the risk of bushfire.
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.	Fragmentation and associated edge effects and inappropriate fire regimes have the potential to alter species composition of the impacted areas of SEVT through the establishment of weed species and the ultimate loss of fire-sensitive species which comprise the TEC. Impacts on species composition will be avoided through appropriate management of these factors as described above.
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 ▪ 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.	Given the small patch size of the affected areas, the haul road and central infrastructure corridor would be expected to cause a substantial reduction in the quality and integrity of these occurrences of the TEC. This will be avoided by: ▪ undertaking dust suppression on haul roads ▪ ongoing management of weeds in adjacent areas, particularly those weed species which pose a threat in terms of increased fire risk.
Interfere with the recovery of the ecological community.	The project would result in clearing of approximately 0.1% of the remaining SEVT TEC in the Brigalow Belt North Bioregion. As such, the project is not expected to interfere with the recovery of the ecological community.

35.10.2 Threatened Fauna Species

35.10.2.1 Ornamental Snake

DSEWPaC provides Draft Referral Guidelines for the nine MNES-listed reptile species in the Brigalow Belt Bioregion, including the ornamental snake (DSEWPaC, 2011).

When assessing whether an action is likely to have a significant impact on a species listed as vulnerable under the EPBC Act, DSEWPaC considers nine significant impact criteria (see page 11 of EPBC Act Policy Statement 1.1 Significant Impact Guidelines (DEWHA, 2009a)). Four of these criteria relate to impacts on **important populations** of the listed vulnerable species.

However, given that the listed Brigalow Belt reptiles are difficult to detect and population information is limited, DSEWPaC regards **important habitat** as a surrogate for **important populations** in the assessment of whether an action is likely to have a significant impact on one or more of these species.

Suitable habitat for any one of the listed Brigalow Belt reptiles is considered **important** if it is:

- habitat where the species has been identified during a survey
- near the limit of the species' known range
- large patches of contiguous, suitable habitat and viable landscape corridors (necessary for the purposes of breeding, dispersal or maintaining the genetic diversity of the species over successive generations)
- a habitat type where the species is identified during a survey, but which was previously thought not to support the species.

Table 35-23 provides an assessment of the potential impacts associated with the project on the ornamental snake against the EPBC Act significant impact criteria for vulnerable species. The assessment has used important habitat as a surrogate for important population as recommended in the Draft Referral Guidelines (DSEWPaC, 2011) and discussed above.

Table 35-23 Ornamental Snake Significant Impact Assessment

Significant impact criteria	Response
An action is likely to have a significant impact on vulnerable species if there is a real chance or possibility it will:	
Lead to a long-term decrease in the size of an important population of a species.	The project site is known to support the ornamental snake, and as such, the habitat is considered to be important habitat for the species as per Draft Referral Guidelines for the nine MNES-listed reptile species in the Brigalow Belt Bioregion which explicitly define important habitat for this group. As discussed above, important habitat is used as a surrogate for "important populations" in the case of the listed Brigalow Belt Reptiles. This species is strongly associated with brigalow woodland (RE 11.4.9 and 11.3.1 in particular) and riparian woodlands, particularly in association with cracking clay soils. South Pit 1 and 2 will in particular impact on these habitat types. The habitat condition for the ornamental snake in the project area is poor relative to pre-clearing vegetation types; however, the habitat quality for this species in the project area is moderate to high. This species is known to persist in cleared areas which support gilgai micro-relief. The loss of these habitat areas is likely to lead to a decrease in the size of an important population of the ornamental snake. Subject to re-instatement of the pre-disturbance landform, it is likely that the ornamental snake will recolonise disturbed areas from habitat patches which remain undisturbed as the mine progresses.
Reduce the area of the occupancy of an important population.	The area of occupancy for the ornamental snake population will be reduced. As discussed above, the population is considered to be an important population because the habitat is known to be occupied and considered to be important habitat.
Fragment an existing important	The ornamental snake is strongly associated with creeks, floodplains and associated clay plains and occupies a more or less

Significant impact criteria	Response
population into two or more populations.	continuous distribution from Collinsville in the north to Moura in the south and east to Rockhampton. The population is considered to be a single continuous population. Loss of habitat on the project site is not likely to fragment this population.
Adversely affect habitat critical to the survival of a species	The habitat on the project site is not critical to the survival of the species, which is locally common and abundant in many parts of the Brigalow Belt North Bioregion in particular.
Disrupt the breeding cycle of an important population.	The proposed action will reduce the area of occupancy of the population and impact on the breeding cycle of those individuals which occur in those habitats. There will however, be substantial areas of suitable habitat retained adjacent to Suttor Creek and to the south of South Pit 2. Breeding is likely to continue unabated in these areas.
Modify, destroy, remove or isolate or decrease the availability or quality habitat to the extent that the species is likely to decline.	The species remains widespread and abundant in the Brigalow Belt and is known to utilise completely cleared land and degraded sites which contain areas of gilgai microrelief. The loss of habitat associated with this project is very unlikely to result in the decline of the species.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.	A range of exotic flora and six introduced pest fauna species were recorded during the field surveys. Of these, the cane toad is the species which presents the greatest threat to the ornamental snake. Field surveys found the cane toad to be a widespread and common species in the project area. The project will establish additional areas of ponded water, which could be used as breeding sites by the cane toad. However, as the cane toad is already widespread and common in the project area it is unlikely to gain significant additional benefit from the establishment of these dams. No further invasive species are likely to be introduced to the project site.
Introduce disease that may cause the species to decline.	This species is not known to be susceptible to any disease which may be transferred or introduced to the project area as a result of the proposed action.
Interfere substantially with the recovery of the species.	The Queensland Brigalow Belt Reptile Recovery Plan (Richardson, 2006) lists a range of actions relevant to the ornamental snake, focussing on research, education and protection of habitat. The proposed action is considered inconsistent with the recovery objectives insomuch as habitat for the species will be lost in the short term. Provided that appropriate habitat can be secured elsewhere and managed to the conservation benefit of this species, this interference is considered unlikely to result in a substantial impact on the species.

35.10.2.2 Squatter Pigeon

Table 35-24 provides an assessment of the potential impacts associated with the project on the squatter pigeon against the EPBC Act significant impact criteria for vulnerable species.

Table 35-24 Squatter Pigeon Significant Impact Assessment

Significant impact criteria	Response
An action is likely to have a significant impact on vulnerable species if there is a real chance or possibility it will:	
Lead to a long-term decrease in the size of an important population of a species.	The population of squatter pigeon within the project area not considered to be an important population. The population is not likely to be a key source population, necessary for maintaining genetic diversity or near to the geographic limits of its range. This species is one of the most frequently recorded pigeon species in the northern Brigalow Belt and is ubiquitous in relation to the range of habitats it occurs in and its capacity to cope with disturbance.
Reduce the area of the occupancy of an important population.	The population is not considered to be an important population.
Fragment an existing important population into two or more populations.	The population is not considered to be an important population.
Adversely affect habitat critical to the survival of a species.	The habitat on the project site is considered unlikely to be critical to the survival of the species, which is widespread in the sub-region and broader region and persists in many disturbed areas.
Disrupt the breeding cycle of an important population.	The population is not considered to be an important population.
Modify, destroy, remove or isolate or decrease the availability or quality habitat to the extent that the species is likely to decline.	The squatter pigeon typically occurs in proximity to water. Clearing in proximity to water would result in a localised reduction of breeding and foraging habitat in the southern part of the project area however, this habitat type is widespread in the region and impacts on the species as a whole would not be significant.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.	A range of exotic flora and six introduced pest fauna species were recorded during the field surveys. No further invasive species are likely to be introduced to the project site as a result of the proposed action.
Introduce disease that may cause the species to decline.	This species is not known to be susceptible to any disease which may be transferred or introduced to the project area as a result of the proposed action.
Interfere substantially with the recovery of the species.	There is no recovery plan in place for this species. The proposed action is not expected to substantially interfere with the recovery of the species.

35.10.2.3 Black-throated finch (southern)

The impact assessment for the black-throated finch has been completed in accordance with EPBC Act Policy Statement 3.13 - Significant impact guidelines for the endangered black-throated finch (southern) (*Poephila cincta cincta*) and EPBC Significant impact guidelines 1.1 - Matters of National Environmental Significance.

35.10.2.3.1Impact Assessment in Accordance with Policy Statement 3.13

In accordance with the guidelines, significant impact judgements must be made on a case by case basis and with consideration for the context of the action. The potential for a significant impact on a listed threatened species depend on the:

- intensity, duration, magnitude and geographic extent of the impact
- sensitivity, value and quality of the environment on and around the site
- cumulative effect of on-site, off-site, direct and indirect impacts
- presence of this and other matters of national environment significance.

A significant impact on the black-throated finch (southern) is likely if an action threatens to disrupt access to or availability of one or more of the three key resources (water, seeding grasses and nesting trees).

It is thought that the black-throated finch (southern) continues to persist in the Townsville hinterland because the historic land use has preserved the mosaic of grassland and woodland critical to the survival of the species. The main land use in the area surrounding Townsville is low intensity agriculture (mainly beef production), however there is increasing pressure for low density residential development.

As a guide, the character and quality of the habitat may be significantly diminished if an action results in:

- net loss or degradation of water sources (either permanent or seasonal) in the locality
- widespread or indiscriminate loss of trees, including known nest trees within 1 km of a water source
- a decrease in tree recruitment capacity which limits the area's ability to be self-sustaining
- the degradation of foraging habitat (grassland) where black-throated finch (southern) records exist, including the intensification of biomass reduction or stocking rates.

Actions that may lead to the loss, degradation and/or fragmentation of black-throated finch (southern) habitat and may have a significant impact on the subspecies, could include, but are not limited to:

- clearing of grassland and/or grassy woodland
- damming or disrupting the natural flows of creeks and rivers
- earthworks or excavation
- pasture improvement (to previously unimproved grassland)
- changes in management regimes, such as burning, slashing and grazing
- construction of roads, structures and/or hard surfaces
- construction of temporary or permanent structures for storage and accommodation
- the introduction of domestic and agricultural animals
- the introduction of exotic plants, particularly exotic grasses
- substantial increases in human traffic and/or recreational activities (e.g. trail bike riding, dog walking etc).

Measures to mitigate such impacts will be incorporated into the design of the action at the conceptual and planning stage(s) to:

- reduce the level of the impact to below the significant impact thresholds
- monitor the performance of the mitigation measures (e.g. by using performance indicators measured at seasonally/annually nominated times)
- incorporate feedback into an adaptive management plan, to quickly react to any changes in performance.

Mitigation and management actions will:

- prioritise impact avoidance over impact reduction measures
- avoid negative impacts on other MNES
- be consistent with relevant recovery, conservation or action plans.

Impacts on the black-throated finch (southern) can be minimised by:

- Retaining remnant woodland within 1 km of water sources (nesting habitat).
- Maintaining all foraging habitat within 400 m of known nesting habitat, and within 3 km of water sources.
- Maintaining connectivity between important habitat, or areas known or likely to contain the black-throated finch (southern), with corridors of at least 100 m in width. (Note: when planning corridors and buffers, priority should be given to riparian areas and alluvial plains, where early flowering perennial grasses are likely to occur. Land uses adjoining corridors should be planned and conditioned so as to not impact the ecological integrity of the corridor. Also, the effectiveness of habitat corridors diminishes with increasing length).
- Building structures (e.g. Buildings, roads etc.) at least 1 km from key water sources and nesting trees.
- Enhancing the availability of water in the landscape through management and construction of water sources.
- Limiting livestock grazing to ensure that the herbaceous layer (particularly perennial grasses) is maintained in a healthy condition. Care should be taken to plan a grazing regime that will achieve this.
- Enhancing the availability of seeding grasses in the landscape through the incorporation of conservative stocking rates and wet season spelling into any grazing regime.

35.10.2.3.2Impact Assessment in Accordance with Significant Impact Guidelines 1.1

Table 35-25 provides an assessment of the potential impacts associated with the project on the black-throated finch against the EPBC Act significant impact criteria for endangered species.

Table 35-25 Black-throated Finch Significant Impact Assessment

Significant impact criteria	Response
An action is likely to have a significant impact on an endangered species if there is a real chance or possibility it will:	
Lead to a long-term decrease in the size of a population.	The southern subspecies of the black-throated finch is thought to occur as a single, contiguous population, but this estimate is considered to be of low reliability, due to uncertainty about the number of subpopulations and/or the extent of genetic separation

Significant impact criteria	Response
	(Garnett & Crowley, 2000). Any birds which occur on the project site would be considered to be a part of the overall population, estimated to comprise some 20,000 individuals. The lack of records of the species from the broader locality suggests that the occurrence of this species on the project site is likely to be transitory, as semi-permanent water bodies during wetter seasons is thought to allow the black-throated finch (southern) to expand its range over a greater area of the landscape (Natural Resource Assessment Environmental Consultants, 2005). The lack of confirmed records from baseline surveys and the absence of historical records suggests a lack of a resident population within the project area. Loss of habitat may impact on a small number of individuals, however, a long-term decline in the overall population as a result of the proposed action is considered unlikely.
Reduce the area of occupancy of the species.	The area of occupancy is estimated to be 5,000 km², based on the number of 1 km² grid squares that the subspecies is thought to occur in at the time when the population is most constrained. This estimate is considered to be of low reliability (Garnett & Crowley, 2000). The proposed action will contribute to habitat loss and modification within the area of occupancy of the species. The area of habitat to be disturbed is relatively small and supported what was potentially a pair of black-throated finches at the time of survey, although the identification of this species has not been confirmed. Loss of habitat is therefore considered unlikely to reduce the area of occupancy of the species.
Fragment an existing population into two or more populations.	The subspecies is thought to occur as a single, contiguous population. As such, the two birds potentially recorded from the project site are considered to be a part of the overall population, estimated to comprise some 20,000 individuals. There are many gaps which occur in the distribution of the subspecies resulting in widely separated sub-populations. However, these sub-populations are not considered to be genetically distinct and are considered to be part of one population. Displacement of this species and its habitat from the project site are not likely to fragment the overall population into two or more populations.
Adversely affect habitat critical to the survival of a species.	All areas of habitat within 5 km of a post 1995 sighting of the subspecies are considered to be important habitat. However, the project site and broader locality are not known to support a resident population of black-throated finches. Areas which support large numbers of birds over many years are considered to contain habitat critical to the survival of the subspecies. Other areas, such as the project site, are considered to be important habitat but not likely to be critical to the survival of the species.
Disrupt the breeding cycle of a population.	The subspecies is thought to occur as a single, contiguous population, estimated to comprise some 20,000 individuals. It is not known whether the black-throated finch breeds in the locality. Black-throated finches (southern) breed in colonies, mainly in non-remnant native vegetation associated with solodic soils and alluvial plains (Natural Resource Assessment Environmental Consultants,

Significant impact criteria	Response
	2005), with the dispersion of nests within colonies varying. As there was no evidence of nesting by the subspecies on the project site and no breeding colony recorded, the proposed action is considered unlikely to disrupt the breeding cycle of the population.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	The most important area of habitat for the black-throated finch is likely to be the riparian woodlands associated with the Suttor River and its tributaries. Almost all recent records of the finch from south of the tropics have been in riparian habitat (Baldwin, 1976; BTF Recovery Team, 2007; Ley & Cook, 2001). These habitats will be largely avoided by the proposed action. There will be removal of permanent, yet artificial, water sources associated with two dams. These dams are the only sources of permanent water in the southern part of the project area and are potentially important refuges for the black-throated finch. Other potentially permanent water sources identified using aerial photography are located approximately 6.5 km to the north-west (adjacent to the Suttor River) and 6 km to the south-west. It is likely that water storages will be constructed within the project area and these will offset the removal of the two existing dams. Vegetation clearing (and habitat) loss associated with the project are skewed away from the preferred riparian and floodplain habitats of the black-throated finch. The avoidance of these broad habitats has minimised impacts on potential habitat for the black-throated finch. The loss of habitat associated with the proposed action is not considered likely to result in the decline of the species.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat.	A range of exotic flora and six introduced pest fauna species were recorded during the field surveys including the feral cat, which represents the greatest threat to the black-throated finch. No further invasive species are likely to be introduced to the project site as a result of the proposed action.
Introduce disease that may cause the species to decline.	This species is not known to be susceptible to any disease which may be transferred or introduced to the project area as a result of the proposed action.
Interfere with the recovery of the species.	The overall objective of the National recovery plan for the Black-throated finch southern subspecies (*Poephila cincta cincta*) (BTF Recovery Team, 2007) is to manage and protect the species and its habitat, and to promote the recovery of the southern subspecies. The proposed action is considered inconsistent with the recovery objectives insomuch as potential habitat for the species will be lost (albeit introduced dams). This interference will not result in a substantial impact on the species.

35.10.2.4 Australian Painted Snipe

Table 35-26 provides an assessment of the potential impacts associated with the project on the Australian painted snipe against the EPBC Act significant impact criteria for vulnerable species.

Table 35-26 Australian Painted Snipe* Significant *Impact Assessment

Significant impact criteria	Response
An action is likely to have a significant impact on vulnerable species if there is a real chance or possibility it will:	
Lead to a long-term decrease in the size of an important population of a species.	The concept of an 'important population' is central to assessing the potential for an action to have a significant impact on a vulnerable species. The Significant Impact Guidelines define an important population as "…a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are: ▪ key source populations either for breeding or dispersal ▪ populations that are necessary for maintaining genetic diversity ▪ populations that are near the limit of the species range. The Australian painted snipe has not been recorded from the project site. Should this species actually occur, the population is likely to be small and transitory, which is typical of the Bowen Basin (pers. Obs. J. Richard). The population could not be considered a key population for breeding or dispersal, necessary for maintaining genetic diversity or near the limits of the species range. An important population of the Australian painted snipe is therefore not known to occur on the project site.
Reduce the area of the occupancy of an important population.	The species is not known from the project site. Should the Australian painted snipe be present, the population would not be classified as an important population when considered against the relevant criteria.
Fragment an existing important population into two or more populations.	The species is not known from the project site. Should the Australian painted snipe be present, the population would not be classified as an important population when considered against the relevant criteria.
Adversely affect habitat critical to the survival of a species.	The removal or degradation of ephemeral water bodies may impact the Australian painted snipe. The highest value habitat in the project area is the ephemeral wetland (Aquatic Survey Site S3) on the western boundary of the project area and outside the impact area. The wetland habitat on the project site is considered unlikely to be critical to the survival of the species, which is widespread in the sub-region and broader region and persists in many disturbed areas.
Disrupt the breeding cycle of an important population.	The species is not known from the project site. Should the Australian painted snipe be present, the population would not be classified as an important population when considered against the relevant criteria.
Modify, destroy, remove or isolate or decrease the availability or quality habitat to the extent that the species is likely to decline.	The extent of occurrence of the Australian painted snipe is estimated, with low reliability, to be 4,500,000 km² (Garnett & Crowley, 2000). The Australian painted snipe is considered to occur in a single, contiguous breeding population (Garnett & Crowley,

Significant impact criteria	Response
	2000). The loss of small areas of habitat which is not known habitat, and not high quality habitat, is very unlikely to result in the further decline of the species.
Result in invasive species that are harmful to a vulnerable species becoming established in the venerable species' habitat.	A range of exotic flora and six introduced pest fauna species were recorded during the field surveys. No further invasive species are likely to be introduced to the project site as a result of the proposed action.
Introduce disease that may cause the species to decline.	This species is not known to be susceptible to any disease which may be transferred or introduced to the project area as a result of the proposed action.
Interfere substantially with the recovery of the species.	There is no recovery plan in place for this species. The proposed action is considered inconsistent with recovery objectives insomuch as habitat for the species will be lost. This interference will not result in a substantial impact on the species.

35.10.3 Migratory Species

Central to the assessment of impacts on listed migratory species are the concepts of "important habitat" and "ecologically significant proportion of the population". Should a project site support neither of these values in relation to a particular migratory species, then project impacts cannot be considered significant.

An area of 'important habitat' for a migratory species is:

- habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species
- habitat that is of critical importance to the species at particular life-cycle stages
- habitat utilised by a migratory species which is at the limit of the species range
- habitat within an area where the species is declining.

Listed migratory species cover a broad range of species with different life cycles and population sizes. Therefore, what is an 'ecologically significant proportion' of the population varies with the species (each circumstance will need to be evaluated). Some factors that should be considered include the species' population status, genetic distinctiveness and species specific behavioural patterns (for example, site fidelity and dispersal rates).

Specific impact assessment guidelines have been published for 36 migratory shorebirds in Australia (DEWHA, 2009a). The widely accepted and applied approach to identifying internationally important shorebird habitat throughout the world has been through the use of criteria adopted under the Ramsar Convention on Wetlands. According to this approach, a wetland should be considered internationally important if it regularly supports:

- one per cent of the individuals in a population of one species or subspecies of waterbird
- a total abundance of at least 20,000 waterbirds.

35.10.3.1 Eastern Great Egret

Table 35-27 provides an assessment of the potential impacts associated with the project on the eastern great egret against the EPBC Act significant impact criteria for migratory species.

Table 35-27 Eastern Great Egret Significant Impact Assessment

Significant impact criteria	Response
An action is likely to have a significant impact on a migratory species if there is a real chance or possibility it will:	
Substantially modify (including by fragmentation, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species.	The study region is not known to support an ecologically significant proportion of the population of this species. The habitat present is not known or likely to be of critical importance to this species, nor is the species at limits of its range or known to be in decline in the region. As such, the project will not substantially modify, destroy or isolate an area of important habitat.
Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species.	The project area does not support an area of important habitat for this species for the reasons set out above.
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.	There has been no systematic survey of the Australian population of the Eastern Great Egret. A preliminary estimate of 60,000 individuals was derived from data on breeding colonies (Jaensch, 2003) and supports the current published estimate of 25,000–100,000 individuals (Wetlands International, 2006). The small number of birds observed in the project area does not constitute an ecologically significant proportion of this population.

35.10.3.2 White-bellied Sea-eagle

Table 35-28 provides an assessment of the potential impacts associated with the project on the white-bellied sea-eagle against the EPBC Act significant impact criteria for migratory species.

Table 35-28 White-bellied Sea-eagle Significant Impact Assessment

Significant impact criteria	Response
An action is likely to have a significant impact on a migratory species if there is a real chance or possibility it will:	
Substantially modify (including by fragmentation, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species.	The study region is not known to support an ecologically significant proportion of the population of this species. The habitat present is not known or likely to be of critical importance to this species, nor is the species at limits of its range or known to be in decline in the region. As such, the project will not substantially modify, destroy or isolate an area of important habitat.
Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species.	The project area does not support an area of important habitat for this species for the reasons set out above.
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion	By applying a population density of one pair per 40 km to the entire length of the Australian coastline (approximately 20,000 km), and taking into account the various inland river systems occupied by the species, the total population size of the

Significant impact criteria	Response
of the population of a migratory species.	white-bellied sea-eagle in Australia is estimated at more than 500 pairs. This estimate is likely to be of low reliability, and may significantly underestimate the size of the population (Ferguson-Lees & Christie, 2001). In any case, the small number of birds observed in the project area does not constitute an ecologically significant proportion of this population.

35.10.3.3 Latham's Snipe

Table 35-29 provides an assessment of the potential impacts associated with the project on Latham's snipe against the EPBC Act significant impact criteria for migratory species.

Table 35-29 Latham's Snipe Significant Impact Assessment

Significant impact criteria	Response
An action is likely to have a significant impact on a migratory species if there is a real chance or possibility it will:	
Substantially modify (including by fragmentation, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species.	Important habitat for Latham's snipe occurs at those sites that are identified as internationally important for the species, or those sites: ▪ that support at least 18 individuals of the species ▪ that have the following characteristics: a naturally occurring freshwater wetland with vegetation cover nearby (for example tussock grasslands, sedges, lignum and reeds). The project site is not known to support at least 18 individuals of Latham's snipe and is not considered important habitat.
Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species.	The project area does not meet published criteria for consideration as important habitat for Latham's snipe.
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.	There are no published guidelines for determining what constitutes an ecologically significant proportion of the population of this species. However, the small number of individuals observed in the project area is not considered to represent an ecologically significant proportion of the population. The proposed action will not seriously disrupt the lifecycle of a significant proportion of a population of a migratory species.

35.10.3.4 Rainbow Bee-eater

The rainbow bee-eater (*Merops ornatus)* was detected numerous times during the fauna surveys. Stream banks in the project area are expected to provide burrow sites for this species.

Table 35-30 provides an assessment of the potential impacts associated with the project on the Rainbow bee-eater against the EPBC Act significant impact criteria for migratory species.

Table 35-30 Rainbow bee-eater Significant Impact Assessment

Significant impact criteria	Response
An action is likely to have a significant impact on a migratory species if there is a real chance or possibility it will:	
Substantially modify (including by fragmentation, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species.	The study region is not known to support an ecologically significant proportion of the population of this species. The habitat present is not known or likely to be of critical importance to this species, nor is the species at limits of its range or known to be in decline in the region. As such, the project will not substantially modify, destroy or isolate an area of important habitat.
Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species.	The project area does not support an area of important habitat for this species for the reasons set out above.
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.	The total population size of the rainbow bee-eater in Australia has not been estimated. However, the population size is assumed to be reasonably large based on reporting rates for the species (i.e. the Atlas of Australian Birds has received more than 30,000 records of the Rainbow Bee-eater since 1998). The small number of birds observed in the project area does not constitute an ecologically significant proportion of this population.

35.10.3.5 Rufous Fantail

Table 35-31 provides an assessment of the potential impacts associated with the project on rufous faintail against the EPBC Act significant impact criteria for migratory species.

Table 35-31 Rufous Fantail Significant Impact Assessment

Significant impact criteria	Response
An action is likely to have a significant impact on a migratory species if there is a real chance or possibility it will:	
Substantially modify (including by fragmentation, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species.	The study region is not known to support an ecologically significant proportion of the population of this species. The habitat present is not known or likely to be of critical importance to this species, nor is the species at limits of its range or known to be in decline in the region. As such, the project will not substantially modify, destroy or isolate an area of important habitat.
Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species.	The project area does not support an area of important habitat for this species for the reasons set out above.
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.	The Rufous fantail is a common and secure species (Blakers *et. al*,1984) for which there are no reliable population estimates. Estimates of population density vary from 0.02 birds/ha near Canberra (Bell, 1980) to 2.66 birds/ha at Lower Bucca State Forest in north-east NSW (Huggett, 2000) indicating a potentially

Significant impact criteria	Response
	enormous overall population. The small number of birds observed in the project area does not constitute an ecologically significant proportion of this population.

35.10.3.6 Australian Painted Snipe

Table 35-33 provides an assessment of the potential impacts associated with the project on the Australian painted snipe against the EPBC Act significant impact criteria for migratory species.

Table 35-32 Australian Painted Snipe Significant Impact Assessment

Significant impact criteria	Response
An action is likely to have a significant impact on a migratory species if there is a real chance or possibility it will:	
Substantially modify (including by fragmentation, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species.	The highest value habitat in the project area is the ephemeral wetland (Aquatic Survey Site S3) on the western boundary of the project area and outside the impact area. The wetland habitat on the project site is considered unlikely to be critical to the survival of the species, and is considered unlikely to be important habitat. The project will not substantially modify important habitat for the Australian painted snipe.
Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species.	The project area does not support an area of important habitat for this species for the reasons set out above.
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.	The extent of occurrence of the Australian painted snipe is estimated, with low reliability, to be 4 500 000 km² (Garnett & Crowley, 2000). The Australian painted snipe is considered to occur in a single, contiguous breeding population (Garnett & Crowley, 2000). The highest value habitat in the project area is the ephemeral wetland (Aquatic Survey Site S3) on the western boundary of the project area and outside the impact area. The wetland habitat on the project site is considered unlikely to be critical to the survival of the species, which is widespread in the sub-region and broader region and persists in many disturbed areas. It is considered unlikely that the project area supports an ecologically significant proportion of the species' population.

35.10.3.7 Cattle Egret

Table 35-33 provides an assessment of the potential impacts associated with the project on the cattle egret against the EPBC Act significant impact criteria for migratory species.

Table 35-33 Cattle Egret Significant Impact Assessment

Significant impact criteria	Response
An action is likely to have a significant impact on a migratory species if there is a real chance or possibility it will:	
Substantially modify (including by fragmentation, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species.	The study region is not known to support an ecologically significant proportion of the population of this species. The habitat present is not known or likely to be of critical importance to this species, nor is the species at limits of its range or known to be in decline in the region. As such, the project will not substantially modify, destroy or isolate an area of important habitat.
Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species.	The project area does not support an area of important habitat for this species for the reasons set out above.
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.	The population estimate for Australia, New Guinea and New Zealand is 100,000 birds (Maddock & Geering, 1994). The species has not been recorded from the project area. If it is present, the population would be small and/or transitory as it avoided detection during baseline surveys. It is very unlikely that an ecologically significant proportion of the population of this species is present.

35.10.3.8 Fork-tailed Swift

Table 35-34 provides an assessment of the potential impacts associated with the project on the fork-tailed swift against the EPBC Act significant impact criteria for migratory species.

Table 35-34 Fork-tailed Swift Significant Impact Assessment

Significant impact criteria	Response
An action is likely to have a significant impact on a migratory species if there is a real chance or possibility it will:	
Substantially modify (including by fragmentation, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species.	The study region is not known to support an ecologically significant proportion of the population of this species. The habitat present is not known or likely to be of critical importance to this species, nor is the species at limits of its range or known to be in decline in the region. As such, the project will not substantially modify, destroy or isolate an area of important habitat.
Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species.	The project area does not support an area of important habitat for this species for the reasons set out above.
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour)	There are no measures of abundance in Australia. The largest flocks recorded in Australia were 90,000 near Mildura, Victoria,

Significant impact criteria	Response
of an ecologically significant proportion of the population of a migratory species.	during 1961 (Simpson, 1961); 50,000 at Portland, south-west Victoria, during January 1960 (Anon, 1960); and 50,000 at Ivanhoe, NSW (Anon, 1972). The species has not been recorded from the project area. If it is present, the population would be small and/or transitory as it avoided detection during baseline surveys. It is very unlikely that an ecologically significant proportion of the population of this species is present.

35.10.3.9 White-throated Needletail

Table 35-35 provides an assessment of the potential impacts associated with the project on the white-throated needletail against the EPBC Act significant impact criteria for migratory species.

Table 35-35 White-throated Needletail Significant Impact Assessment

Significant impact criteria	Response
An action is likely to have a significant impact on a migratory species if there is a real chance or possibility it will:	
Substantially modify (including by fragmentation, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species.	The study region is not known to support an ecologically significant proportion of the population of this species. The habitat present is not known or likely to be of critical importance to this species, nor is the species at limits of its range or known to be in decline in the region. As such, the project will not substantially modify, destroy or isolate an area of important habitat.
Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species.	The project area does not support an area of important habitat for this species for the reasons set out above.
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.	The species' total population is unknown. It is described as 'abundant' in some regions of Australia during the non-breeding season (Chantler, 1999). The species has not been recorded from the project area. If it is present, the population would be small and/or transitory as it avoided detection during baseline surveys. It is very unlikely that an ecologically significant proportion of the population of this species is present.

35.10.3.10 Satin Flycatcher

Table 35-36 provides an assessment of the potential impacts associated with the project on the satin flycatcher against the EPBC Act significant impact criteria for migratory species.

Table 35-36 Satin Flycatcher Significant Impact Assessment

Significant impact criteria	Response
An action is likely to have a significant impact on a migratory species if there is a real chance or possibility it will:	

Substantially modify (including by fragmentation, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species.	The satin flycatcher inhabits heavily vegetated gullies in eucalypt dominated forests and taller woodlands, often near wetlands and watercourses. This species was recorded at locations outside the project area and is considered likely to occur in riparian environs along the Suttor River. The riparian habitats of the Suttor River will not be directly affected by the project, but may be subject to indirect impacts associated with development in the catchment and encroachment of a waste rock dump onto the Suttor River floodplain.
Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species.	The project area does not support an area of important habitat for this species for the reasons set out above.
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.	The satin flycatcher is found along the east coast of Australia from far northern Queensland to Tasmania, including south-eastern South Australia. It is also found in New Guinea. The project area does not contain significant habitat for this species, and the adjoining areas of the Suttor River which do provide potential habitat are unlikely to be significantly affected by the project. It is considered unlikely that the project will affect an ecologically significant proportion of the species' population.

35.10.4 Summary

Based on the assessment of impacts on MNES against the Significant Impact Guidelines – EPBC Act Policy Statement 1.1, as provided in the sections above, it is considered that the project has the potential to result in significant residual (post avoidance and mitigation) impacts on one threatened species (the vulnerable ornamental snake) and three TECs (brigalow, native grassland and SEVT ecological communities) listed under the EPBC Act. Residual impacts on these MNES are addressed in the offset strategy outlined in **Section 35.11**. There are unlikely to be significant residual impacts on other listed threatened species and communities or listed migratory species.

35.11 Offset Requirements

35.11.1 Regulatory Framework for Offsetting MNES

The EPBC Act Environmental Offsets Policy (EOP) (DSEWPaC, 2012e) outlines the Australian Government's approach to the use of environmental offsets ('offsets'). EOP defines offsets as measures that compensate for any residual adverse impacts of an action on the environment. This policy relates to all matters protected under the EPBC Act, including MNES.

35.11.2 MNES Proposed to be Offset

Under EOP, offsets must be provided if significant adverse residual impacts (i.e. impacts after avoidance and mitigation measures) are likely on MNES. **Section 35.10.4** describes that significant residual impacts are likely for the following MNES:

- Threatened ecological communities (TECs)
  - Brigalow (*Acacia harpophylla*) dominant and co-dominant (Brigalow)
  - Semi-evergreen vine thickets of the Brigalow Belt (north and south) and Nandewar Bioregions (SEVT)

- Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin (Natural grasslands)

- Threatened species
  - Ornamental snake *(Denisonia maculata)*.

35.11.2.1 Threatened Ecology Communities

The proponent proposes to offset areas of TECs within the project footprint. **Table 35-37** summarises these areas, as represented by RE classification.

Table 35-37 Area of Clearing for Listed TECs

TEC	REs represented	Impact area (ha)
Brigalow (*Acacia harpophylla*) dominant and co-dominant*	11.3.1	8.7
	HVR 11.3.1	11
	11.4.8	34.6
	11.4.9	62.2
	HVR 11.4.9	7.6
	11.5.16	190.4
	HVR 11.9.5	1.8
Total Brigalow		**316.3**
Natural grasslands	11.8.11	84.4
Semi-evergreen vine thicket	11.8.13	18.0

* Estimated areas for Brigalow TEC take into account the regrowth vegetation more than 15 years old which meets the listing requirements for the TEC (refer Environment Australia, 2001b)

35.11.2.2 Threatened Species

The proponent proposes to offset an area of potential habitat for the ornamental snake (*Denisonia maculata*), listed as vulnerable under the EPBC Act, that may be impacted by the project. The area of potential habitat which is proposed to be offset corresponds to endangered and of concern REs associated with habitat requirements for the species which will be impacted within the project area. These impact areas proposed for offsets relating to the ornamental snake are presented in **Table 35-38**.

Table 35-38 Impacts on Potential Habitat for the Ornamental Snake and Proposed Offsets

REs associated with habitat requirements within the project area	RE biodiversity status	Proposed offset area (ha)
11.3.1	Endangered	8.7
HVR 11.3.1	Endangered	11.0
11.3.4	Of Concern	1.6
11.3.25	Of Concern	8.7
11.4.2	Of Concern	156.4
11.4.8	Endangered	34.6

REs associated with habitat requirements within the project area	RE biodiversity status	Proposed offset area (ha)
11.4.9	Engendered	62.2
HVR 11.4.9	Engendered	7.6
11.8.11	Of Concern	84.4
11.8.13	Endangered	18.0
HVR 11.9.5	Endangered	1.8
	Total	**395.0**

35.11.2.3 Offset Benefits for other MNES

There are unlikely to be significant residual impacts on listed threatened or migratory species, other than the ornamental snake, which have been addressed according by offsets proposed in **Section 35.11.2**. These offsets will however result in offset benefits for other known or likely to occur threatened and migratory species under the EPBC Act that will be impacted by the project. The area of offset for these species is presented in **Table 35-39**.

Table 35-39 Offset Benefits for Species

Common Name	Species	EPBC Act status	Offset area (ha)
Squatter pigeon	*Geophaps scripta scripta*	Vulnerable	10.3
Black-throated finch (southern)	*Poephila cincta cincta*	Endangered	583.6
Australian painted snipe	*Rostratula australis*	Vulnerable, Migratory	10.5
Eastern great egret	*Ardea modesta*	Migratory	8.7
White-bellied sea-eagle	*Haliaeetus leucogaster*	Migratory	8.7
Latham's snipe	*Gallinago hardwickii*	Migratory	8.7
Rainbow bee-eater	*Merops ornatus*	Migratory	585.4
Rufous fantail	*Rhipidura rufifrons*	Migratory	8.7
Cattle egret	*Ardea ibis*	Migratory	9.7
Fork-tailed swift	*Apus pacificus*	Migratory	585.4
White-throated needletail	*Hirundapus caudacutus*	Migratory	585.4

35.11.3 Proposed Offset Approach

It is noted that land-based offsets proposed for the project under the EOP can only be legally secured through mechanisms available under Queensland law. Offsets are therefore limited by the nature of the legal protection mechanisms available in Queensland, and the ability to reach an agreement with the Queensland Government.

The proposed offset approach is to initially locate offsets within parts of the project area (i.e. the mining leases (MLs) comprising the project) that are not identified for development. The proponent,

and related companies, own several pastoral properties in the Brigalow Belt Bioregion and these have been assessed at the desktop level for biodiversity values. These properties will be used subsequent to the project area. Any MNES that cannot be offset within the project area or other proponent related properties will be located on third party properties, away from the project.

This method is considered to be the most effective, reliable and efficient approach available to achieve the offsets required whilst maintaining consistency with the applicable offset principles and policies.

35.11.3.1 Methodology for Identifying Potential Offsets

The identification of offsets for the impact areas listed in **Table 35-37** and **Table 35-38** was assessed at three scales (shown in **Figure 35-17**):

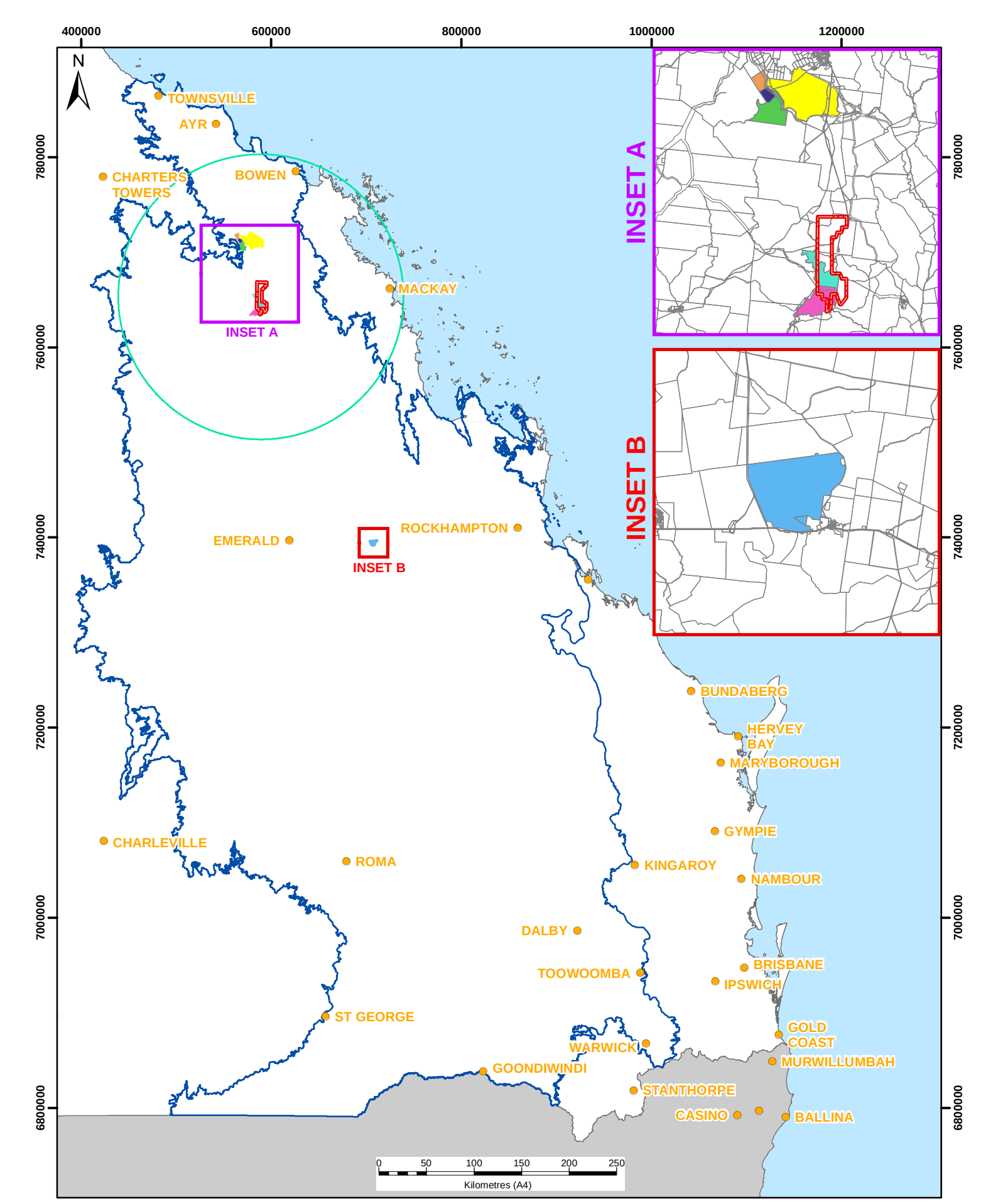
- on proponent related tenements and properties, particularly the Byerwen project tenements
- within 150 km of the project
- within the Brigalow Belt Bioregion.

The EOP contains the flexibility to allow offset obligations to be met with similar but not identical composition. For example, the Brigalow TEC contains 16 of the Queensland mapped REs that are dominated by *Acacia harpophylla* (Brigalow). The offset proposed may be for an identical RE to what is impacted or one of the other 15 REs which have been identified as Brigalow.

In the interest of securing good environmental outcomes, searches for potential offset areas focused on finding all obligations for each MNES in **Table 35-37** and **Table 35-38**, at the highest value impacted. For example, the analysis for the Brigalow TEC centred on only the equivalent REs as mapped by the Queensland Herbarium that have an endangered-dominant status under the VMA. The analysis then filtered the potential areas that would also satisfy the habitat requirement for the ornamental snake (i.e. those potential Brigalow TECs that were on deep cracking clay soils). This exercise was repeated for each of the MNES identified in **Table 35-37**and **Table 35-38**.

The Queensland RE mapping was utilised as a surrogate for the MNES during this process. At each of the above scales data was assessed and interrogated to evaluate potential offset areas. RE, HVR and pre-clear area datasets were intersected by Property Map Assessable Vegetation (PMAV) category X areas (being areas where the landowner has the existing right to clear the vegetation under the VMA). In addition, the analysis was designed to exclude all mining lease or protected areas, to find the first level of potential offset areas. These results were then further refined to show the areas that fell within either special features (e.g. biodiversity corridors as per the Biodiversity Planning Assessment) or within stream order (SO) buffers (e.g. a 100 m buffer of SO 3 – 4 and a 200 m buffer of SO5+) or a combination of both. At the 150 km and proponent related property scales the results from the pre-cleared area data were further analysed to find areas that fell within areas where the foliage predictive cover was greater than 11% (defined as the minimum coverage required for a functioning vegetation community).

A further calculation at the 150 km buffer and the proponent related property scale used searches for the dominant vegetation group within mixed polygons to locate further potential areas for analysis if the need arose.



Legend

- Project Area
- Brigalow Belt Bioregion Boundary
- Project Area 150km Buffer

Proponent Related Properties

- 1CP905226
- 1DK4
- 3DK114
- 3HT616
- 4DK114
- 618PH2106
- 689SP251696

Scales used for Identifying Potential Offsets	
Figure 35-17	Byerwen Coal Project
Date: 5/03/2013	Author: samuel.ferguson
	Map Scale: 1:5,000,000
Revision: R1	Coordinate System: GDA 1994 MGA Zone 55
G:\CLIENT\SA-TO-D\BYEGEN - Byerwen EIS\GIS\Maps\EIS Chapters\EIS_Chpt_35_MNES\BYEGEN_offsetproperties.mxd	

35.11.4 Delivery of Offsets

35.11.4.1 Process to Finalise and Secure Offsets

A process to finalise and deliver the offsets required for the project is illustrated below (**Figure 35-18**). The impacts of the project will be confirmed and refined during the final design phase of the project.

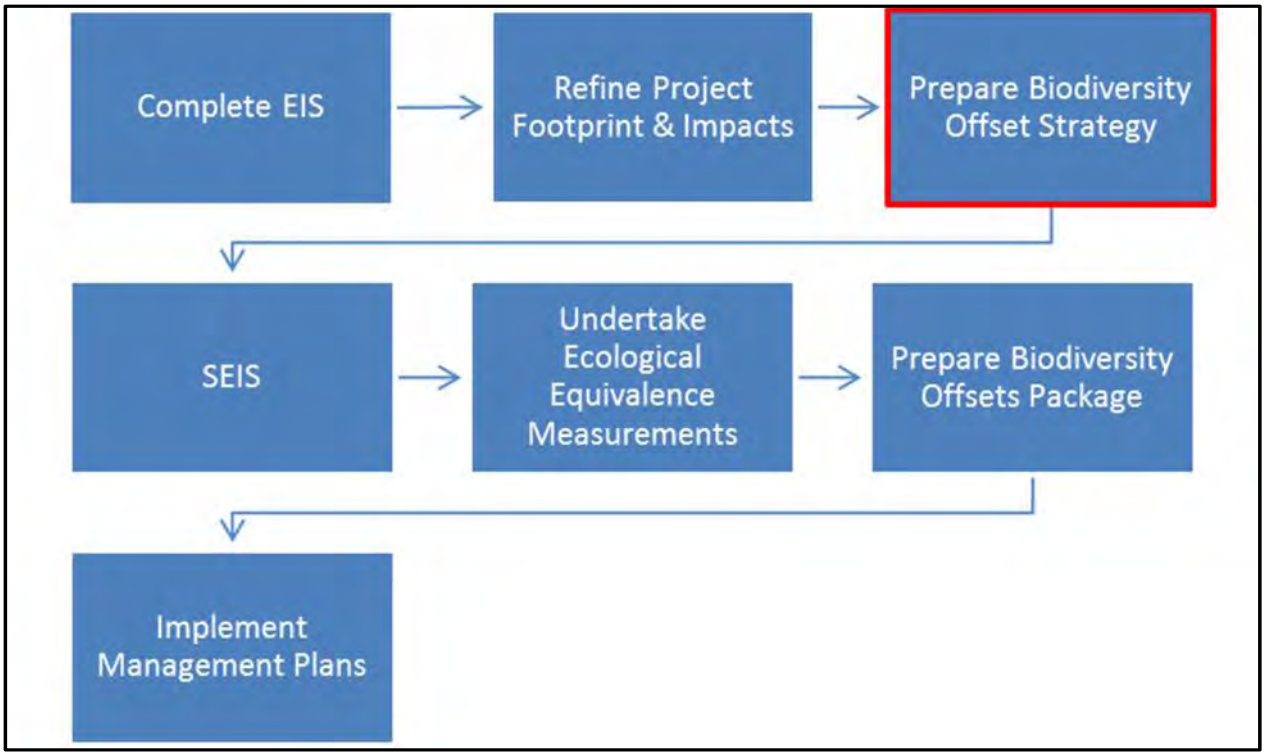


Figure 35-18 Process to Finalise Offset Requirements and Secure Offsets

A biodiversity offset package will then be prepared that will:

- address the requirements of the EOP for a land based offset
- identify the ecological score of the impact site
- identify the ecological score of the proposed offset site
- address the relevant approval conditions
- address any criteria required by the Queensland Government for the offset management plan
- develop an Offset Area Management Plan/s which will be as per the requirements of the EOP and the Voluntary Declaration
- secure a legally binding mechanism on Title.

35.11.4.2 Offset Availability on Proponent Related and Third Party Properties

After final impact and ecological equivalence methodology (EEM) calculations of the impact sites, non-development areas on proponent related tenements and properties will be assessed and utilised initially for offset supply. Subsequent to this, approaches will be made to landholders with potential offset sites to participate in the offset package. The approach to sourcing the offsets on the

proponent related and third party properties will be to amalgamate areas of TECs and offset these areas into larger patch sizes wherever possible. Additionally, offsets for MNES that can be co-located and/or where superior outcomes can be achieved, will be sourced wherever possible.

35.11.4.3 Securing Offsets

The next phase of the process post issue of the Environmental Authority (EA) for the project will be to undertake EEM assessments. Once the final obligation is determined, the next step will be to initiate discussions with the owners of each potential property to verify their willingness to participate in the provision of offsets and to field verify the RE and pre-clear mapping.

The principal management actions required in the Offset Area Management Plan will be negotiated with the regulator and landholders at this stage.

The preferred legally binding mechanism to secure the offsets is the Voluntary Declaration process as facilitated by the *Vegetation Management Act 1999* (VM Act).

35.11.4.4 Proposed Timeframes

It is proposed that the proponent will enter into a Deed of Agreement (DOA) for the life of the project with EHP. Within twelve months (12 months) from the date that the DOA is signed by both parties, the proponent will submit, for approval, the offset package for the first 10 years of impact, which includes signed mechanisms to legally secure the offsets for the disturbance incurred, in a manner that meets the requirements set out in the EOP.

35.11.4.5 Ratios to be applied to the Offsets

The EOP does not specify ratios for calculating offset areas. Ratios are determined on a case-by-case basis, with consideration of several factors including the results of BioCondition and ecological equivalency assessments (Eyre *et al* 2011). These ecological measurements are conducted on the impact as well as the offset sites to establish the final area required for the offset.

35.11.5 Available Offset Options

This assessment has been undertaken via desktop GIS analysis of the Queensland RE mapping version 6.1 as a surrogate for the TEC. Additionally the pre-clear, HVR v 2.1 and Biodiversity Planning Assessment (BPA) layers were added to the analysis. The target area for offsets was determined as the project with a buffer of 150 km applied around the development footprint.

The results of this assessment are displayed in **Table 35-40** for those potential offset areas available on the proponent related properties. In summary, there is excess suitable land available for use as offsets within a 150 km radius of the project. Depending on outcomes of detailed ecological equivalence assessment, if required, additional offset supply will be sourced outside of the 150 km radius.

35.11.5.1 Balance of Mining Lease outside the Impact Area

Options are likely to exist for at least five of the six RE based TEC offset targets to be located on the project area. Potential offset areas for habitat for the ornamental snake also occur on the balance of the project area in substantial quantities and additionally there are 9,700 ha of non-remnant areas that could be assessed for their offset potential if required for habitat.

Opportunities to offset the TECs of endangered SEVT (Broad Vegetation Group (BVG) 7a), Brigalow (BVG 25a) and Natural Grasslands (BVG 30b) on the project mining lease are particularly significant, because there are few opportunities to locate endangered communities in a secure location under the control of the project proponent that are of a significant scale and exist outside of areas covered by mining lease applications.

35.11.5.2 Proponent Related Properties

Options are likely to exist for a number of offset targets to be located on the proponent related properties, as shown in **Table 35-40**.

Table 35-40 Potential Offset Opportunities on Proponent Related Properties

Value to be Offset		BVG	Impact Area (ha)	Potential for offsets (ha)	Potential offsets by BVG
RE	TEC				
11.3.1	Brigalow	25a	8.7	538.37	
HVR 11.3.1	Brigalow	25a	11.0		
11.4.8	Brigalow	25a	34.6	150.60	
11.4.9	Brigalow	25a	62.2	6,070.60	
HVR 11.4.9	Brigalow	25a	7.6		
11.5.16	Brigalow	25a	190.4	565.70	
HVR 11.9.5	Brigalow	25a	1.80	241.10	
		Total	**316.3**		**15,114**
11.8.11	Natural Grasslands	30b	84.4	499.00	1,128
11.8.13	SEVT	7a	18	2,731.20	3,171
11.4.2	-	17a	156.40	386.80	2,945
11.3.4	-	16c	1.6	104	104
11.3.25	-	16a	8.7	36	36

35.11.5.3 Within 150 km of the Project

Only areas of HVR mapped as PMAV category X were included in assessment. There are large areas available within the 150 km radius assessed to secure offsets for the RE and TEC based offsets.

A summary of potential offsets by BVG available within 150 km, on the project area and on proponent related properties, including candidate properties with sufficient potential offset to supply 3 times the impact area, is provided in **Table 35-41**.

Table 35-41 Potential Offsets Opportunities by BVG

Value to be Offset		BVG	Potential offsets by BVG within 150 km		Potential offsets by BVG on the project area	Potential offsets by BVG on proponent related properties
RE	TEC		Area (ha)	Candidate properties	Area (ha)	Area (ha)
11.3.1 HVR 11.3.1 11.4.8 11.4.9 HVR 11.4.9 11.5.16 HVR 11.9.5	Brigalow	25a	348,247	271	1,895	15,114
11.8.13	SEVT	7a	10,443	147	1,766	3,171
11.8.11	Natural Grasslands	30b	62,873	145	1,769	1,128
11.4.2	-	17a	205,449	247	348	2,945
11.3.4	-	16c	14,829	153	3.6	97
11.3.25	-	16a	16,167	207	13.6	22

35.11.5.4 Third Party Properties within the Brigalow Belt Bioregion

The assessment of the Brigalow Belt Bioregion offers many opportunities to offset the impact. At this scale of area, only the potential offsets available via remnant or HVR vegetation were assessed. Again, all potential impacts were able to be accommodated within the Bioregion.

The further refinements of adding the filter of special features and stream orders greater than 3 were also added to the filter, and again all potential impacts were accommodated.

35.11.6 The Means by which the Offsets will be Secured and Managed

Provided below are details relating to the mechanisms to be used to secure offset sites for the project. Details are also provided regarding the preparation of Offset Area Management Plans (OAMPs), which will outline the ongoing management actions required at each site.

35.11.6.1 Legally Secured Offsets

All direct offset sites will be secured using one of the legally binding mechanisms on Title that are available to ensure the protection of the offset and implementation of the OAMPs. These legally binding mechanisms are:

- gazettal as a protected area (e.g. a nature refuge) under the *Nature Conservation Act 1992*
- declaration of an area of high nature conservation value under the *VM Act*
- use of a covenant under the *Land Title Act 1994* or *Land Act 1994*.

The mechanisms adopted to secure offsets will ultimately depend upon the mechanisms available and agreed to by the relevant parties.

35.11.6.2 Management of Offset Sites

OAMPs will be prepared for each offset site in accordance with the specific requirements contained within the EOP and the requirements for using a Voluntary Declaration. The OAMPs will include, but are not limited to, information on the threats and the management actions required on each offset site to abate those threats. Each OAMP will contain an estimate of the costs of management and the reporting and monitoring program that will extend until the management outcomes are achieved or the expiration of the Environmental Authority, whichever occurs first.

Management actions recommended could include:

- management of grazing
- weed management
- feral pest management
- management of fire
- if applicable, active revegetation.

The length of active management will be influenced by the condition of vegetation, type of habitat and vegetation on site, as well as existing management issues.

35.11.6.3 Monitoring and Reporting on Progress of Legally Secured Offsets

Regular monitoring and reporting on the progress of the offset will be provided to the regulator with biennial photo point monitoring to be conducted and, every seven years, BioCondition assessment(s) to be conducted at the same location(s) as the photo points. These monitoring actions will provide a record of comparability over the term of the offset and the overall progress of the offset in returning to remnant vegetation status.

Weed monitoring will be conducted annually by the land manager and recorded. These records will be incorporated into reports to the regulator as per the above schedule of monitoring and reporting.

35.11.7 Cost of Offsets

The primary cost of mitigation for impacts to terrestrial ecology will be securing and delivering offsets. Costs of offsets will not be able to be determined until such time as a biodiversity offset package is developed.

35.12 Conclusion

The project was determined to be a controlled action with the relevant controlling provisions being 'listed threatened species and communities' (sections 18 and 18(a)) and 'listed migratory species' (sections 20 and 20(a)). A combination of desktop assessments and field surveys were conducted to determine the potential for listed threatened species, migratory species and communities to be impacted by the project.

Three of the EPBC Act listed threatened ecological communities (TECs) identified by the desktop assessment as potentially occurring were confirmed as present within the project area: brigalow (*Acacia harpophylla*) dominant and co-dominant, natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin and semi-evergreen vine thickets of the Brigalow Belt (north and south) and Nandewar Bioregions.

Desktop assessments identified eleven flora species listed as threatened under the EPBC Act with the potential to occur in the project area. However no threatened flora species were recorded during field surveys or are considered likely to occur in the project area.

Fifteen fauna species listed as threatened under the EPBC Act were identified by desktop assessment as having potential to occur in the project area. Of these threatened species, four are known or considered likely to occur in the project area and as such may be impacted by the project. These species are the ornamental snake, squatter pigeon, black-throated finch (southern) and Australian painted snipe. The Australian painted snipe is also listed as a migratory species. A further nine migratory species were recorded or are considered likely to occur in the project area and as such may be impacted by the project.

Land clearance and habitat loss associated with the establishment of open cut pits and supporting infrastructure are the main impacts on threatened species and communities in the project area. Removal of permanent water sources associated with farm dams may also result in the loss of a habitat resource for some threatened and migratory species. Measures to minimise impacts through avoidance or mitigation have been proposed, however there will be residual impacts on MNES.

The assessment considered the potential impacts of the project on MNES against the Significant Impact Guidelines. Based on this assessment, it is considered that the project has the potential to result in significant residual (post avoidance and mitigation) impacts on one threatened species (the vulnerable ornamental snake) and three threatened ecological communities (brigalow, native grassland and SEVT ecological communities) listed under the EPBC Act. The project will therefore need to consider the EPBC Act Environmental Offsets Policy.

There are unlikely to be significant residual impacts on other listed threatened species and communities or listed migratory species.

Under the EPBC Act EOP, offsets must be provided if significant adverse residual impacts (i.e. impacts after avoidance and mitigation measures) are likely on MNES.

The proponent proposes to offset areas of TECs within the project footprint and an area of potential habitat for the ornamental snake corresponding to endangered and of concern REs associated with habitat requirements for the species which will be impacted by the project.

The proposed offset approach is to initially locate offset areas within parts of the project area (i.e. the mining leases (MLs) comprising the project) that are not identified for development. Proponent related companies own several pastoral properties in the Brigalow Belt Bioregion and these have been assessed at the desktop level for biodiversity values and these properties will be used for offsets subsequent to the project area. Any values that cannot be offset within the project area or other proponent related properties will be located on third party properties, away from significant mine development areas.

An assessment of available offset options revealed there is excess suitable land available for use as offsets within a 150 km radius of the project. Depending on outcomes of detailed ecological equivalence assessment, if required, additional offset supply will be sourced outside of the 150 km radius.

All direct offset sites will be secured using one of the legally binding mechanisms on Title that are available to ensure the protection of the offset and implementation of the OAMP.

Regular monitoring and reporting on the progress of the offset will be provided to the regulator and will provide a record of comparability over the term of the offset and the overall progress of the offset in returning to remnant vegetation status.