C EPBC Report

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Appendix C EPBC Report

C.1 Executive Summary

C.1.1 Overview

Hancock Prospecting Pty Ltd (HPPL) (the Proponent) is proposing to develop the Alpha Coal Project (the Project), a 30 million tonnes per annum (Mtpa) product open cut thermal coal mine to target the seams in the Upper Permian coal measures of the Galilee Basin, Queensland, Australia. The Project will be supported by the development of a standard gauge, single track, non-electrified, 495 kilometers (km) long railway line for the purposes of transporting processed coal from the Alpha coal mine to the Port of Abbot Point in Bowen for export.

This report has been developed to fulfill the Terms of Reference (TOR) for the Project This report discusses the Matters of National Environmental Significance (MNES) that relate to the Alpha Coal Project EIS and are listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The TOR describes the Project as the mine, rail and port facilities, plus supply water and power supply utilities. The Alpha Coal EIS, and consequently this report, address only the mine and rail components as the remaining aspects will be subject to separate environmental approvals are not included. Furthermore, the port environmental process is being managed by North Queensland Bulk Ports Corporation and, as such, the EPBC referral submitted by Hancock in November 2008 has not been included as part of the EIS or this report.

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

C.1.1.1 Mine

Review of database searches indicated the potential presence of 21 flora species of conservation significance listed under the EPBC Act. Of these none were considered to have a medium or high likelihood of being present within the mine study area.

No EPBC Act listed threatened flora species or threatened ecological communities (TECs) were identified from the field surveys of the mine study area.

Review of database searches indicated the potential presence of 26 fauna species of conservation significance listed under the EPBC Act. Of these, six were considered to have a moderate likelihood of being present within the mine study area.

One EPBC Act listed threatened fauna species was recorded from the field surveys of the mine study area (southern squatter pigeon, *Geophaps scripta scripta*). This species is listed as Vulnerable under the EPBC Act. Ten Migratory and/or Marine species listed under the EPBC Act were observed within the mine study area during the field surveys.

C.1.1.2 Rail

One EPBC Act listed threatened flora species was detected during the field surveys – *Eucalyptus raveretiana* (black ironbox), which is listed as vulnerable under the EPBC Act. Another species, *Dichanthium queenslandicum* (king bluegrass), is considered to be likely to occur within the rail study area. King bluegrass is listed as vulnerable under the EPBC Act.

Three TECs were recorded within the rail study area. The area to be cleared has been minimised in the design phase by locating the Project footprint in areas that have been previously cleared or degraded by past land use practices.

One EPBC Act listed conservation significant fauna species was recorded from field surveys within the rail study area - *Geophaps scripta scripta* (squatter pigeon). An additional eight EPBC Act listed fauna species of conservation significance may occur as suitable habitat may exist within the rail study area.

A total of 26 migratory species protected under the EPBC Act were present within the study area.

C.1.1.3 Mitigation Measures

Proposed avoidance and mitigation measures to reduce the impact to MNES include the implementation of Weed and Pest Management Strategies and Erosion and Sediment Management Plans.

An Offsets Package for the Project will be developed in consultation with DERM, DEEDI and DSEWPC, giving consideration to relevant state and Commonwealth policies relating to offsets. This package will include environmental offsetting for the three TECs listed under the EPBC Act that were identified within the rail study area and potentially for the 'Of Concern' vegetation communities present within the mine study area.

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

C.2 Introduction

C.2.1 Project Description

C.2.1.1 Project Overview

Hancock Prospecting Pty Ltd (HPPL) (the Proponent) is proposing to develop the Alpha Coal Project (the Project), a 30 Mtpa product open cut thermal coal mine to target the C and D Seams in the Upper Permian coal measures of the Galilee Basin, Queensland, Australia. The coal mine will be supported by privately owned and operated rail and port infrastructure facilities. At the Project site the coal will be mined, washed and conveyed to a train load-out facility where it will be transported approximately 495 kilometers (km) to the east coast of Australia to the port facility of Abbot Point for export. Two options for port locations were evaluated and the Port of Abbot Point selected due to a number of environmental, design and economic reasons.

This report has been developed to fulfil the Terms of Reference (TOR) for the Project as per the EPBC Referral submitted in 2008 for Alpha Coal Project Mine and Rail Development (EPBC 2008/4648). This report discusses the Matters of National Environmental Significance (MNES) that relate to the

Alpha Coal Project EIS and are listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The TOR describes the Project as the mine, rail and port facilities, plus supply water and power supply utilities. The Alpha Coal EIS, and consequently this report, address only the mine and rail components as the remaining aspects will be subject to separate environmental approvals are not included. Specifically, they are (1) the port onshore stockpiling and offshore ship loading facilities by North Queensland Bulk Ports Corporation, (2) the water supply pipeline that will service the mine site and other Galilee Basin projects by Sunwater, and (3) the high voltage power transmission system that will service the mine site and other Galilee Basin projects by Powerlink. Furthermore, the port environmental process is being managed by North Queensland Bulk Ports Corporation and, as such, the EPBC referral submitted by Hancock in November 2008 has not been included as part of the EIS or this report.

C.2.1.1.1 Project Components

The Project has been assessed as two main components. Firstly, the Alpha Coal Project (Mine) and associated infrastructure which incorporates two Run of Mine (ROM) facilities as well as the Coal Handling and Preparation Plant (CHPP); and secondly the Alpha Coal Project (Rail) which incorporates 495 km of single line track. These components are described below.

C.2.1.1.2 Coal Mine and Associated Infrastructure

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

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

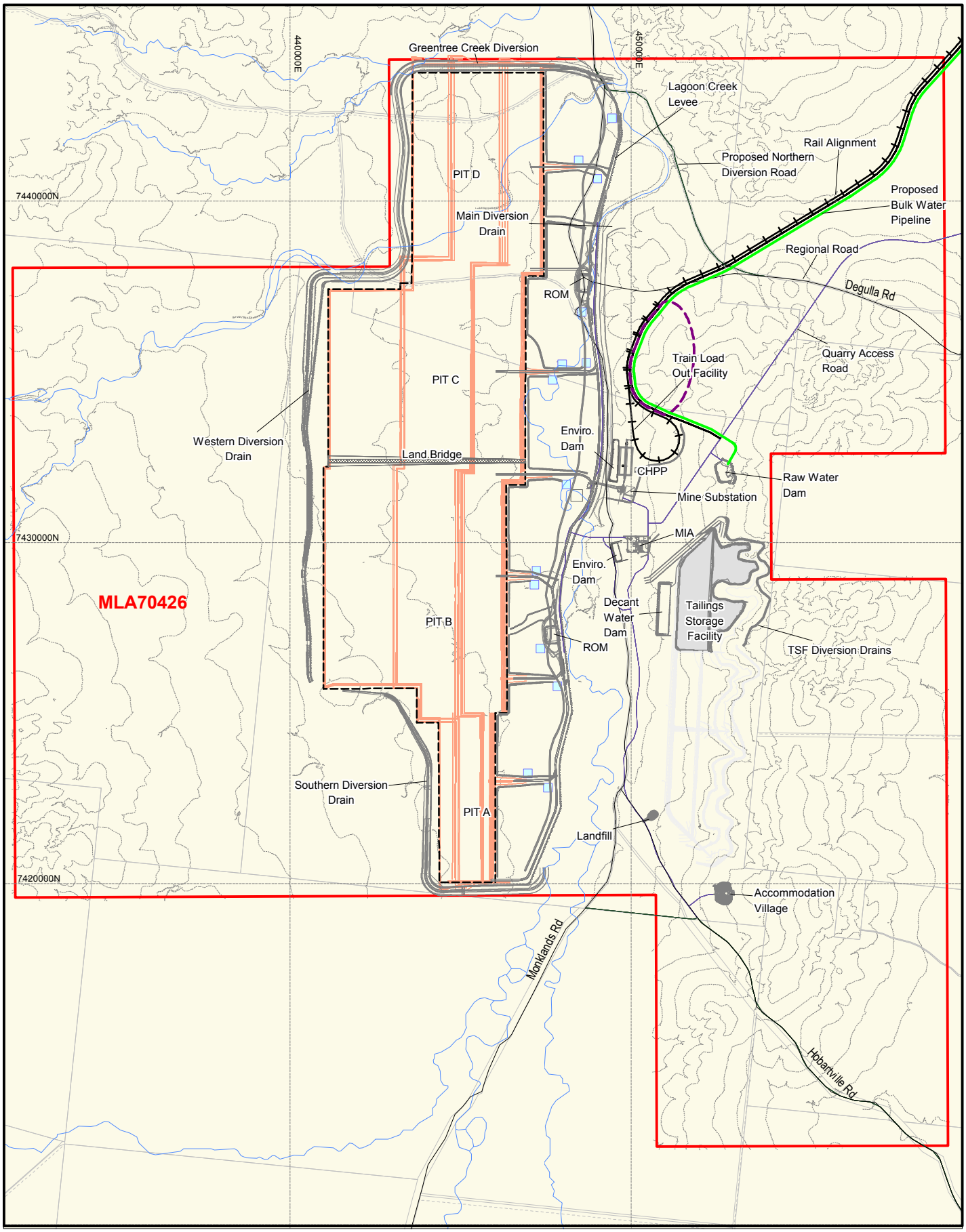
Sized raw coal will be transferred from the ROM facilities via conveyors to the multi-module CPP, where it will be washed. All of the coal resource mined will be processed to produce an 9.5 % ash export thermal product. A tailings dam, known as a tailings storage facility (TSF), is required for the fine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

The mine infrastructure will include:

- Main workshop, warehouse, administration buildings, training and emergency services building, tyre bay, light vehicle workshop, and bucket repair shop;
- Train load out (TLO) facility and rail loop;
- Raw water dams and environment dams;
- Construction camp and main accommodation camp;

- Mine access road;
- Landfill;
- Quarry/borrow pits;
- Fuel, oil, and explosives storage facilities;
- Creek diversions, drainage channels and levee bunds;
- Water and wastewater systems;
- Water treatment plant and sewerage treatment plant;
- Electrical systems; and
- Communication systems.

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



Source: See Copyright Details below and for full disclosure Please Refer to the EIS ***Volume 4 - References***

0 2 4Km

Scale 1:150,000 (A4)

Datum: GDA94, MGA Zone55

N W E S

HANCOCK PROSPECTING PTY LTD

Alpha Coal Project
Environmental Impact Statement

PROJECT SITE
MINE STUDY AREA

Job Number 4262 6580
Revision A
Date 24-09-2010

Figure: C-1

File No: 42626580-g-4002.wor

C.2.1.1.3 Rail

HPPL is proposing to construct a standard gauge, single track, non-electrified, 495 km long railway line for the purposes of transporting processed coal from the Alpha coal mine to the Port of Abbot Point near Bowen.

The proposed railway line connects the Galilee Basin in Central Queensland to the coastal Port of Abbot Point. The Galilee Basin spans over 247,000 km^2 of land and holds over 14 billion tonnes of JORC compliant coal that has been identified by several proponents. As such, the proposed rail corridor will be an essential part of opening up the Galilee Basin for export of thermal coal and other products. As a result, the proposed railway line will benefit the Central Queensland region, State of Queensland and the nation.

The proposed railway line will enable export of 30 Mtpa of quality thermal coal for a lifespan of approximately 30 years. With construction of additional passing loops to the single line track and selective partial duplication, there is potential to further increase the tonnage and thus service other potential mines from the Galilee Basin. HPPL has undertaken to make the track available to third party users under a Voluntary Undertaking pursuant to the *Trade Practices Act 1974* (TP Act).

In addition to the main railway line from the Alpha coal mine to the Port of Abbot Point, the Project also involves development of the following infrastructure:

- Two balloon loops, one at the Alpha coal mine and one at the Port of Abbot Point for loading and unloading;
- Eight passing loops each approximately five km long;
- Maintenance sidings along the railway line;
- Marshalling yard at the entry to the Port of Abbot Point; and
- Five workers' camps accommodating for 700 to 800 personnel per camp including two permanent camps and three temporary camps.

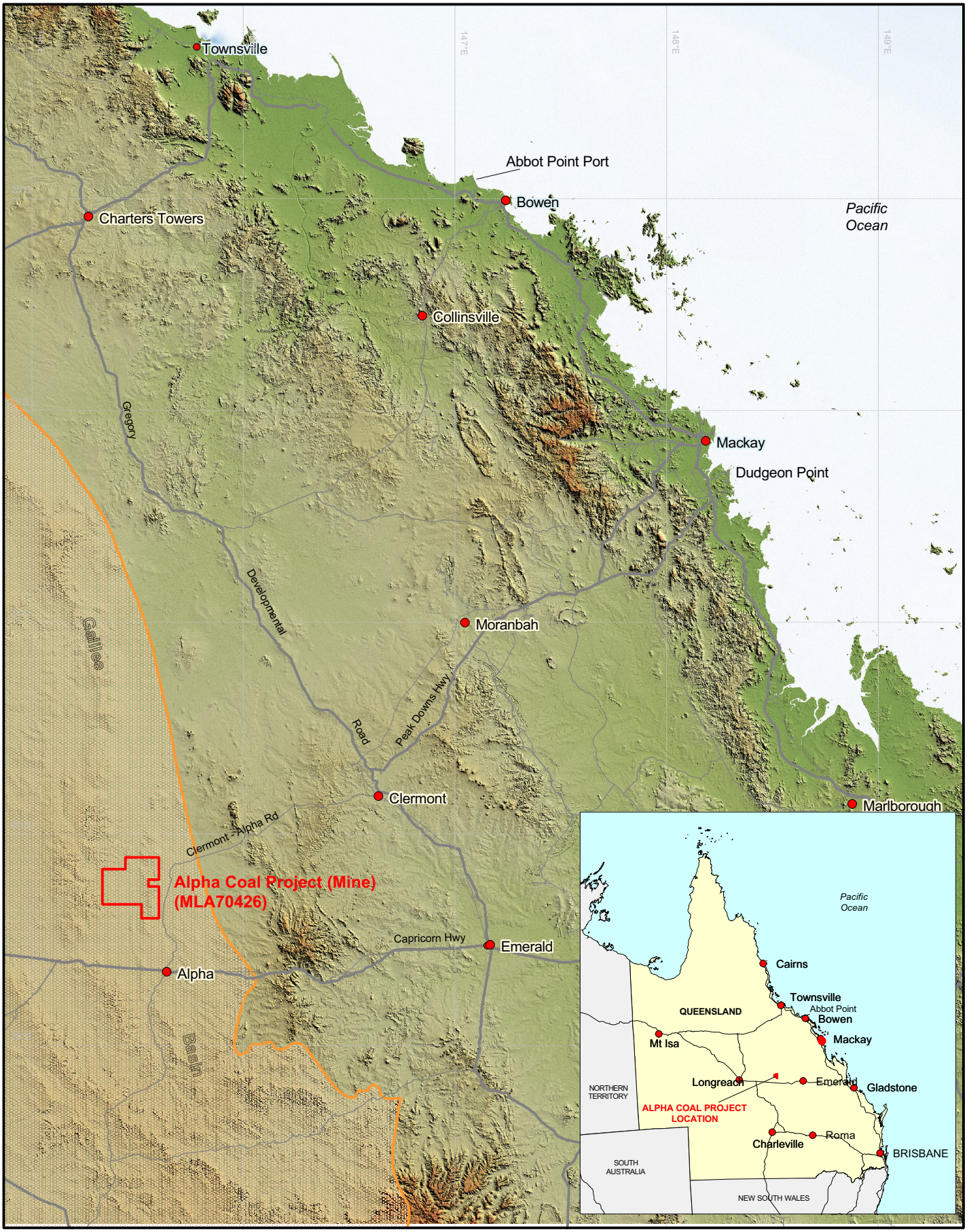
C.2.1.2 Location

The location of the mine and alignment of the railway have been selected on the basis of several factors, primarily environmental, economic and geotechnical grounds.

C.2.1.3 Mine and Associated Infrastructure

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

Refer to Figure C-2 for the Project regional location.



Mining Lease Application (MLA70426) Boundary

Source: See Copyright Details below and for full disclosure Please Refer to the EIS ***Volume 4 - References***

0 25 50km
Scale 1:2 000 000 (A4)

Datum: GDA94, MGA Zone55

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Alpha Coal Project
Environmental Impact Statement

PROJECT LOCATION
MINE STUDY AREA

Job Number	4262 6580
Revision	A
Date	24-09-2010

Figure: C-2

File No: 42626580-g-4003.wor

C.2.1.4 Rail

The Railway is located between the Alpha coal mine, 50 km north of the Alpha township and the Port of Abbot Point coal export terminal, 25 km north of Bowen. The rail corridor proceeds in a generally north-easterly direction from the Alpha mine (Figure C-3).

The railway crosses generally relatively flat lowlands before commencing a gentle climb from near Eaglefield adjacent to the Suttor River, to a point near the existing Newlands mine. This is the highest point on the railway at approximately 300 m above sea level. In the vicinity of the Newlands mine, the railway runs parallel to the Queensland Rail (QR) Northern Missing Link railway for approximately 70 km through a pass in the Leichhardt Range and parallel to the Newlands Railway to a point near the Bowen River. The railway then travels in a north westerly direction on crossing the Bowen River before heading down the Bowen River valley through mostly grazing land toward Mt Herbert. The railway passes to the west of Mt Herbert through a pass in the Clarke Range. From this point, the railway travels north-easterly crossing the Bogie River at about 436 km from the mine, then finally in an easterly direction entering the Abbot Point area on its western boundary at 495 km from the Alpha Coal Mine.

The Alpha Coal Project (Rail) lies mostly within the Whitsunday Hinterland and Mackay (WHAM) region, with a small component lying within the Central West Region. The proposed railway loop and corridor traverses the following Local Government Areas (LGA), within these regions:

- Barcaldine Regional Council from chainage 0 to chainage 45 km;
- Isaac Regional Council from chainage 45 km to chainage 282 km; and
- Whitsunday Regional Council from chainage 282.5 km to chainage 490 km.

Town
Camp
Marshalling Yards
Depot

Proposed Alignment (Aug 2010)
Major Road
Existing Railway

Local Government Area

Source: See Copyright Details below and for full disclosure Please Refer to the EIS ***Volume 4 - References.*** Satellite Imagery Sourced from Geoscience Australia Landsat7 2005.

0 10 20 40 60 Km

Scale 1:2,000,000 (A4)
Datum: GDA94

N W E S

HANCOCK PROSPECTING PTY LTD

Alpha Coal Project
Environmental Impact Statement

LOCATION OF RAIL STUDY AREA

Job Number	4262 6580
Revision	A
Date	24-09-2010

Figure: C-3

File No: 42626580-g-4004.mxd

C.2.1.5 Construction

Construction stage activities will occur once the Mining Lease (ML) has been granted. The construction activities to be undertaken include the following:

C.2.1.5.1 Mine and Associated Infrastructure

The construction period is approximately 24 months. Within this timeframe the following activities are proposed:

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

Coal mining activities are detailed in Volume 2 Section 2.4.1. Throughout the LOM, infrastructure construction, maintenance, demobilization or decommissioning activities will be undertaken. As mining advances, infrastructure such as internal roads and additional water management infrastructure will be constructed, relocated or upgraded as required in order to fulfil operational requirements.

The construction stage has three components:

- Site preparation;
- Civil works; and
- MIA building and CHPP construction.

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

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

Due to the close vicinity to Lagoon Creek all critical infrastructure are to be located at least 0.5 m above the predicted 1 in 3000 year flood inundation level. This is in excess of the general requirement for immunity from the Q100 flood inundation level.

C.2.1.5.2 Rail

Construction of the proposed railway will consist of the following components:

- An easement of approximately 495 km long and 60 m wide;
- A series of laydown areas and construction nodes;
- Local construction access tracks (that will be used during construction only); and

- Local maintenance access tracks (that will be used and maintained through the operational phase).

C.2.1.6 Site Clearance

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

C.2.1.7 Project Operations

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

C.2.1.7.1 Mine

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

- A staged build-up to a target production rate of 30 Mtpa;
- 100% export thermal coal product from the C and D coal seams (refer to Figure C-4);
- A LOM of 30 years;
- 80% of scheduled reserves to be in the proven or probable JORC Reserves category; and
- An owner-operator mining scenario.

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

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

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

C.2.1.7.2 Coal Resource Base and Mine Life

The Alpha coal deposit and the adjacent Kevin's Corner deposit are situated within the Galilee Basin in Central Queensland, Australia. The Galilee Basin is of Palaeozoic to Triassic age and overlays the

older Drummond Basin (early to middle Palaeozoic age). The basin is approximately 480 km long and extends from the town of Tambo in the south to Pentland in the north. There are five recognised coal seams in the Alpha lease areas designated (in descending stratigraphical order) as A, B, C, D and E (Figure C-4). Seams A through D are considered to be economically recoverable via open-cut mining. The seams dip slightly to the west by approximately 0.5° and are believed to be relatively free of faults.

In general, seams include numerous thin parting bands, particularly Seam B. Seam thicknesses vary in multiple directions but range from less than one metre (Seam C at sub-crop) to up to eight metres thick (Seam B). Overburden depth varies from a minimum of 50 m upwards.

The Alpha deposit has been separated into two distinct development areas. Each provides access to a pair of seams. Seams A and B sub-crop in the western area, while the deeper Seams C and D sub-crop in the eastern area. The primary use for this coal is expected to be in export thermal applications.

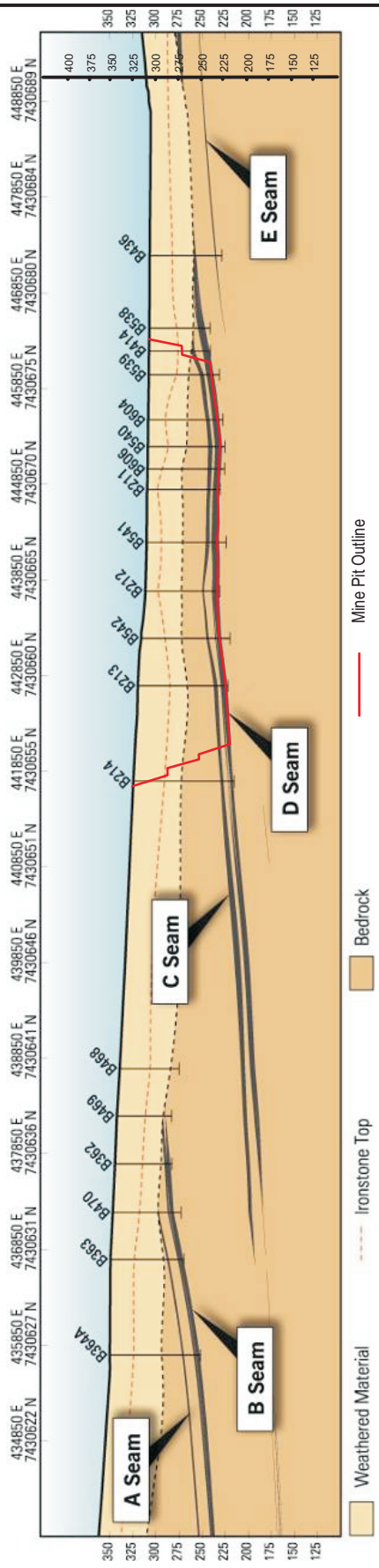
The mine is anticipated to be in full production by year 5 (2017) of operations.

C.2.1.7.3 Rail

The Project's rail operations plan will provide a rail safe working system that allows for capacity growth and technical innovation. These criteria would be developed during the detailed design phase, once the operational parameters of the alignment and infrastructure are further defined.

Based on the criteria, a plan would be developed to manage operations during the ramp up from the first year to the final tonnages over the first five years of operation. This staged approach will cater for other rail operators and regulatory involvement in the delivery of the operating railway.

The railway is designed to accommodate 60 Mtpa which is equivalent to the product from the Alpha Coal mine and the proposed Kevin's Corner Coal mine.



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Datum: GDA94, MGA Zone55

HANCOCK PROSPECTING PTY LTD

Alpha Coal Project
Environmental Impact Statement

GEOLOGICAL WEST TO EAST CROSS-SECTION THROUGH THE ALPHA COAL MLA

Job Number	4262 6580
Revision	A
Date	24-09-2010

Figures: C-4

File No: 42626580-g-4011.cdr

C.3 Description of the Existing Environment

C.3.1 Methodology for assessment of Matters of National Environmental Significance

To describe the existing environmental values of the study area in terms of terrestrial flora and fauna, amphibians, reptiles, birds and mammals of the mine and rail study area for the Project, a combination of desktop assessments and seasonal field surveys were conducted. The desktop assessment comprised a review of relevant literature and database searches. Flora and fauna surveys were conducted to obtain ecological information relevant to the Project and to ground-truth results from desktop assessments.

This report is based upon the findings of the following documents:

- AARC (2010a). Alpha Coal Project, Flora and Fauna Assessment. Prepared for Hancock Prospecting Pty Ltd. September 2010.
- AARC (2010b). Alpha Coal Project, Aquatic Ecology Assessment. Prepared for Hancock Prospecting Pty Ltd. September 2010.
- PB (2010). Alpha Coal Project Site water management system and water balance technical report. Prepared for Hancock Prospecting Pty Ltd. Parsons Brinckerhoff August 2010.
- GHD (2010a). Report for Proposed Alpha Rail EIS, Terrestrial Ecology Report. Prepared for Hancock Prospecting Pty Ltd August 2010.
- GHD (2010b). Alpha Coal Project (Rail) Freshwater Aquatic Flora and Fauna. Prepared for Hancock Prospecting Pty Ltd. August 2010.
- GHD (2010b). Report for Alpha Rail EIS, Surface Water. Prepared for Hancock Prospecting Pty Ltd. August 2010.

C.3.1.1 Coal Mine and Associated Infrastructure

C.3.1.1.1 Desktop Review

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

- EPBC Act Protected Matters Search Tool: This database provides general guidance on MNES and other matters protected by the EPBC Act for a nominated area.
- HERBREC Searches: This database provides information including taxon names and specimen data.
- Wildlife Online Database - Department of Environment and Resource Management (DERM): This database uses records collected from previous surveys, including the Queensland Museum surveys as well as records from the public. While screening of data occurs, some mis-identifications are possible.

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

- EPBC Act Protected Matters Search Tool: This database provides general guidance on MNES and other matters protected by the EPBC Act for a nominated area.
- Birdata Atlas of Australian Birds: This database documents the distribution and relative abundance of birds throughout Australia.
- Wildlife Online Database (DERM): This database uses records collected from previous surveys, including the Queensland Museum surveys as well as records from the public. While screening of data occurs, some mis-identifications are possible.

C.3.1.1.2 Flora Field Survey

Eight site visits to conduct flora assessments across the mine study area and surrounding areas were undertaken between June 2008 and June 2010.

C.3.1.1.3 Overall Approach

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

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

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

Field data collected using this methodology is compatible with the Queensland Herbarium CORVEG database. The level of assessment used in this study is discussed below in C.3.1.1.4and C.3.1.1.5.

C.3.1.1.4 Regional Ecosystem Mapping

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

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

- The preparation of RE maps was undertaken through the use of aerial photographs, geological maps and groundtruthing.

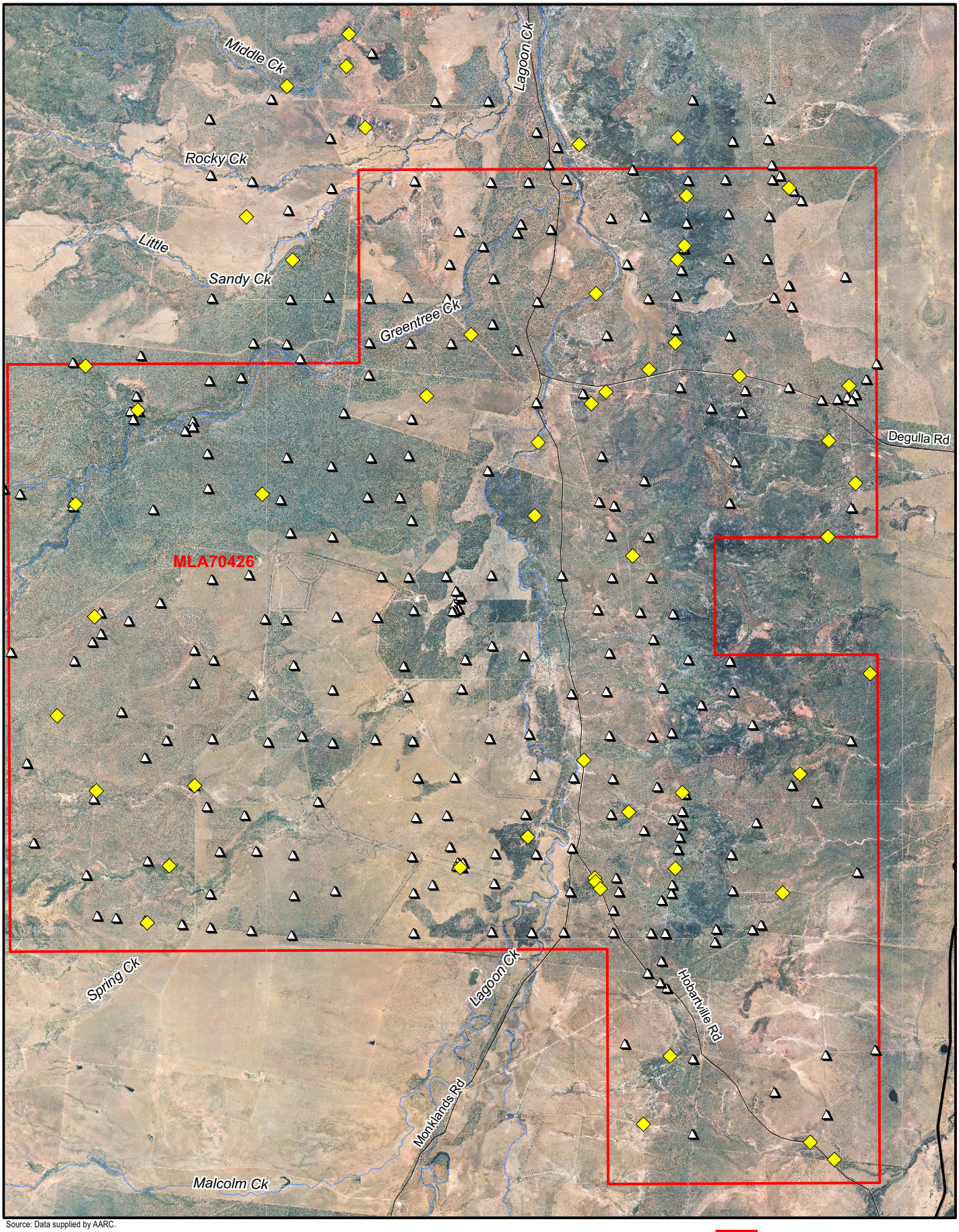
C.3.1.1.5 Survey for Species of Conservation Significance

Targeted searches during field surveys for species of conservation significance were undertaken upon identification of suitable habitat. This specific search involved the use of methods discussed in the draft New South Wales Threatened Species Survey and Assessment Guidelines (New South Wales National Parks and Wildlife Service 2001).

The method outlined in the guidelines above that was used in this survey was the Random Meander Technique. As its name suggests, this technique involves traversing areas of suitable habitat in no set pattern whilst searching for the particular plant species. If there was any uncertainty in identifying the species, a voucher specimen was collected for confirmation by the Queensland Herbarium.

C.3.1.1.6 Flora Transects Surveyed

A total of 51 Secondary transects were conducted as shown in Figure C-5 below.



Source: Data supplied by AARC.

Mining Lease Application (MLA70426) Boundary

Secondary Flora Transect

Quaternary Flora Transect

Source: See Copyright Details below and for full disclosure Please Refer to the EIS ***Volume 4 - References***

0 2 4Km

Scale 1:160 000 (A4)

Datum: GDA94, MGA Zone55

N W E S

HANCOCK PROSPECTING PTY LTD

Alpha Coal Project
Environmental Impact Statement

DISTRIBUTION OF FLORA TRANSECT LOCATIONS MINE STUDY AREA

Job Number	4262 6580
Revision	A
Date	24-09-2010

Figure: C-5

File No: 42626580-g-4005.wor

C.3.1.2 Fauna Field Survey

Eight site visits to conduct fauna assessments across the mine study area and surrounding areas were undertaken between June 2008 and June 2010.

A total of 36 fauna transect sites were established on and surrounding the mine study area. Each site was subject to trapping regimes of up to four consecutive nights for pitfall traps and five consecutive nights for all other traps. Locations of these fauna transects are shown in Figure C-6 below.

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

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

C.3.1.2.1 Elliott trapping

Type A Elliott traps were used to target small ground-dwelling mammals inhabiting the mine study area and surrounding areas. Traps were baited with a mixture of rolled oats, honey, peanut butter and vanilla essence. Elliott traps were positioned in two rows at each transect, approximately 100 m apart, with each trap separated by approximately ten metres. The overall survey effort (combining each field survey) was 1709 Elliot trap nights.

C.3.1.2.2 Pitfall trapping

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

C.3.1.2.3 Funnel trapping

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

C.3.1.2.4 Cage trapping

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

C.3.1.2.5 Micro-bat surveying

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

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

C.3.1.2.6 Bird surveying

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

C.3.1.2.7 Spotlighting

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

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

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

C.3.1.2.8 Habitat searching

To further enhance the likelihood of detecting small cryptic species, opportunistic diurnal searches of likely micro-habitats were conducted at each transect and in other selected areas surrounding the mine study area. Searches involved the rolling of rocks and logs, rustling through leaf litter, and the

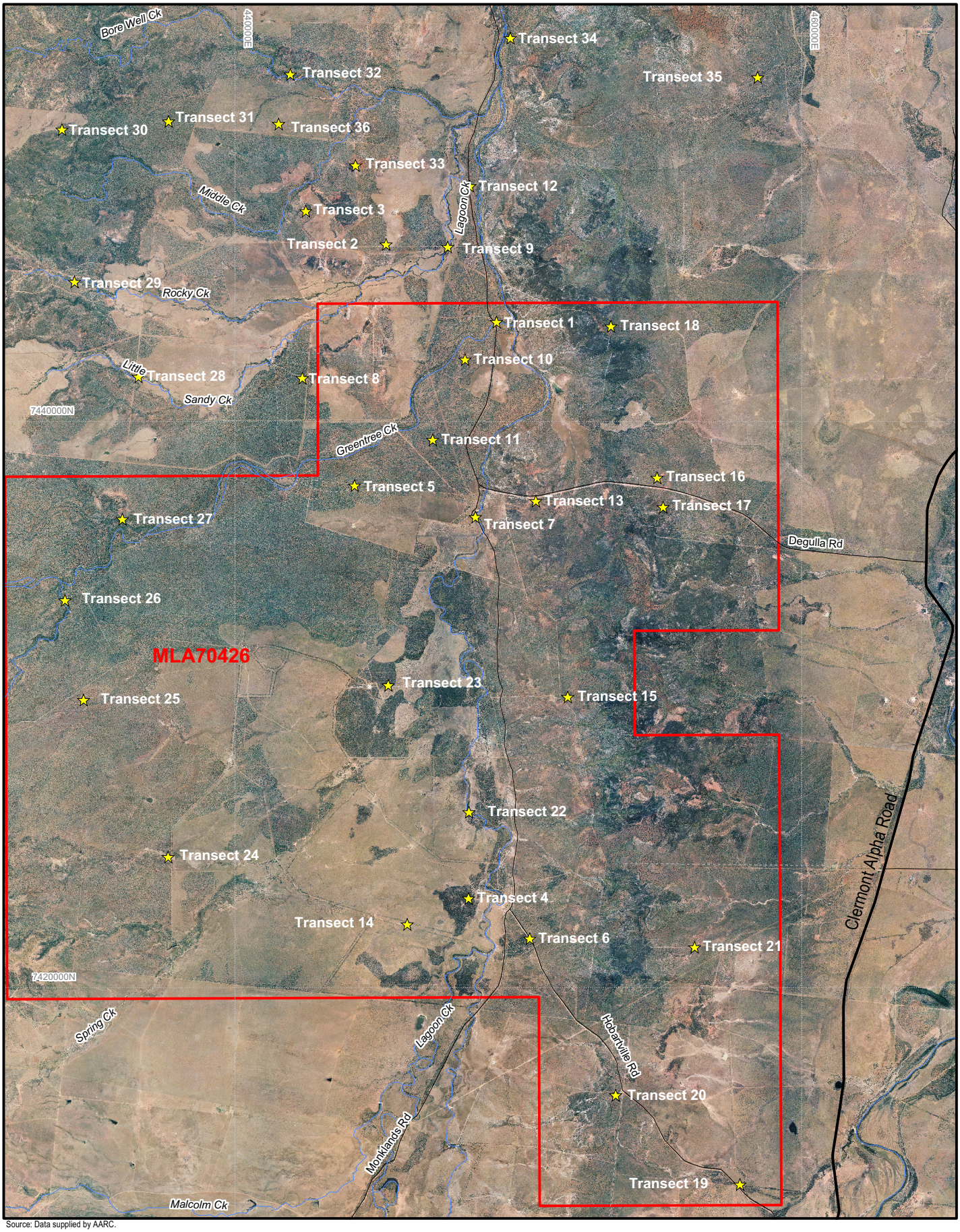
peeling back of exfoliating bark from standing trees. Observed animals were caught where possible to aid positive species identification.

C.3.1.2.9 Scat/Track searching

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

C.3.1.2.10 Incidental recordings

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



Source: Data supplied by AARC.

Mining Lease Application (MLA70426) Boundary

Fauna Transect Sites

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0 2 4Km

Scale 1:180 000 (A4)

Datum: GDA94, MGA Zone55

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Environmental Impact Statement

DISTRIBUTION OF FAUNA TRANSECT LOCATIONS - MINE STUDY AREA

Job Number	4262 6580
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Figure: C-6

File No: 42626580-g-4006.wor

C.3.2 Aquatic Flora and Fauna

To assess the ecological values of the watercourses within the mine study area, the following scope of works was undertaken:

- A literature and database review to identify species of conservation significance known from the region. This enabled these species to be targeted during the field survey component of the study; and
- A field survey employing standard methodologies to determine the composition of aquatic flora and fauna species inhabiting the mine study area, particularly species of conservation significance.

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

- EPBC Act Online Database: This database provides general guidance on MNES and other matters protected by the EPBC Act for a nominated area; and
- Wildlife Online Database (DERM): This database uses records collected from previous surveys, including the Queensland Museum surveys as well as records from the public.

C.3.2.1 Field Survey Methodology

The level of assessment undertaken at each site is described below. Refer to Figure C-7 for the distribution of aquatic sampling locations.

C.3.2.1.1 Initial Site Scoping

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

Secondly, accessible areas of the mine study area were broadly surveyed from a vehicle. This allowed for the targeting of upstream, midstream, and downstream locations, as well as habitats potentially occupied by species of conservation significance.

C.3.2.1.2 Aquatic and Riparian Vegetation Identification

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

C.3.2.1.3 Macro-invertebrate Sampling

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

C.3.2.1.4 Aquatic Vertebrate Fauna Sampling

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

C.3.2.1.5 Drag Netting

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

C.3.2.1.6 Baited Traps

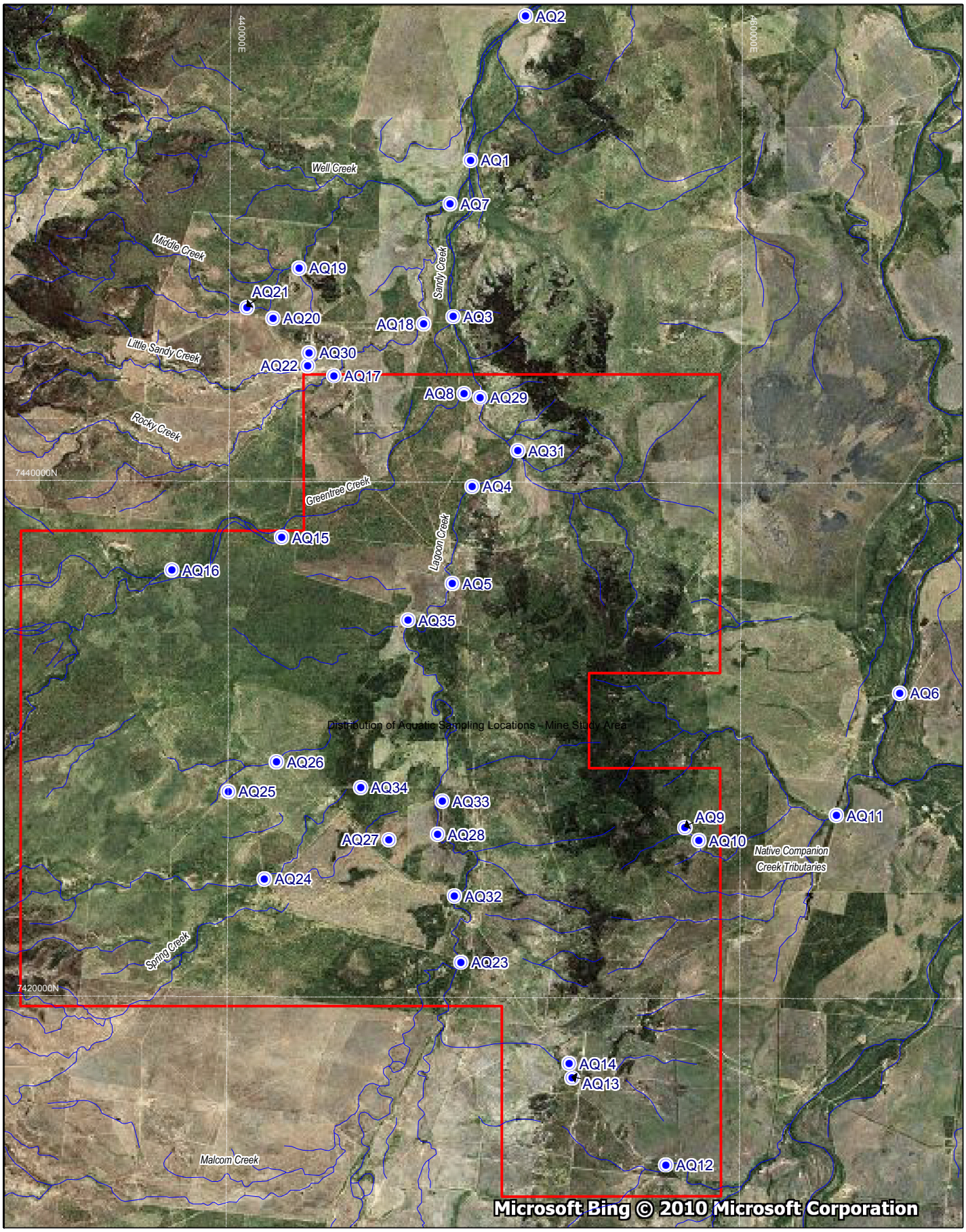
Opera-house and box traps were used at each site where trapping was to be undertaken to target carnivorous species. Traps were baited with either dry dog biscuits or bones to lure fish and other vertebrates into the traps. At each site where trapping was undertaken, four traps were left out for three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

C.3.2.1.7 Spotlighting

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

C.3.2.1.8 Habitat Assessment

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



Mining Lease Application (MLA70426) Boundary

Aquatic Sample Location (2009)

Aquatic Sample Location (2010)

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Scale 1:200 000 (A4)

Datum: GDA94, MGA Zone55

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DISTRIBUTION OF AQUATIC SAMPLING LOCATIONS - MINE STUDY AREA

Job Number	4262 6580
Revision	A
Date	24-09-2010

Figure: C-7

File No: 42626580-g-4007.wor

C.3.3 Rail

C.3.3.1 Desktop Review

Prior to the field surveys, a desktop review was conducted to document the existing environment within the rail study area and identify any listed flora and fauna species that have been historically recorded or have potential to occur on or adjacent to the alignment. Given the length of the alignment, three separate areas were used in desktop searches:

- Area 1 (Latitude: -19.9 to -21.73, Longitude: 146.98 to 148.28);
- Area 2 Latitude: (-21.52 to -22.60; Longitude: 146.50 to 147.77); and
- Area 3 (Latitude: -22.40 to -23.62; Longitude: 146.50 to 147.30).

The desktop assessment included searches of:

- The DSEWPC Protected Matters Search Tool to identify species listed under the EPBC Act that are predicted to occur in the rail study area;
- The DERM Wildlife Online database to identify flora and fauna species that have been historically recorded in or surrounding the rail study area, including species listed under the *Nature Conservation Act 1992* (the NC Act) and the EPBC Act;
- Queensland Herbarium's (DERM) HERBRECS specimen database to identify any flora species previously collected from within the rail study area;
- The Queensland DERM RE (Version 6.0, 2009) and Essential Habitat (Version 3.0, 2009) mapping to determine the distribution of protected remnant vegetation as well as areas recognised as essential habitat for NC Act listed fauna and flora within the rail study area;
- The DERM on-line regrowth mapping facility was queried to determine if any areas on or within the rail study area contained regrowth vegetation protected under the *Vegetation Management and Other Legislation Amendment Act 2009*;
- The DERM Biodiversity Planning and Assessment (BPA) mapping to identify habitats and bioregional wildlife corridors that are significant at state or regional level;
- The DERM Referable Areas mapping to determine if the rail study area was located in or within 100 m of a referable wetland, a conservation estate, or heritage registered place;
- DSEWPC's Directory of Important Wetlands database in Australia; and
- Birds Australia Atlas database which lists all bird species previously recorded from the rail study area during official Birds Australia censuses.

C.3.3.2 Field Surveys

In general, the scope of the assessment was to describe the environment within the rail study area including flora, fauna and vegetation communities and to identify any threatened species, habitats or environmentally sensitive areas that may be impacted by the Project. Information was obtained from desktop sources and field survey investigations, including seasonal surveys.

Terrestrial ecology field surveys included both dry (November/December 2009) and wet (April 2010) season surveys to document seasonal changes in terrestrial flora and fauna assemblages, habitat

condition and utilisation. The survey methodology and site selection was developed in consultation with DERM[1]. The final sites were selected based on consideration of the following criteria:

- Sampling representative REs, vegetation communities and habitats along the rail study area;
- Surveying across the geographical range of the rail study area (to detect regional variation in species assemblages);
- Targeting areas expected to have high flora and fauna species diversity (based on the size, connectivity and structural complexity of vegetation remnants);
- Targeting areas expected to have unique ecological value for listed species (based on the habitat requirements of listed species historically recorded or expected to occur in desktops);
- Sampling within the Project footprint; and
- Sample sites are accessible by vehicle (to maximise survey effort without compromising animal welfare).

C.3.3.3 Terrestrial Flora

Floristic surveys were conducted using CORVEG methodologies defined by the Queensland Herbarium (Neldner *et al*., 2005). Flora surveys were conducted in areas of remnant vegetation including mapped REs. Flora sampling methods included:

- Quadrat sampling;
- Site species lists;
- Random meander techniques;
- Verification of REs using quaternary site assessments; and
- Site descriptions.

Refer to Figure C-8 for the distribution of flora survey sites across the rail study area.

C.3.3.3.1 Quadrat Sampling

Quadrat assessments were conducted primarily at sites identified as requiring comprehensive data collection. At these sites, a 10 x 50 m quadrat was investigated to a secondary CORVEG level, with the only exception to standard Herbarium methodology being that cover was estimated using the Braun-Blanquet scale (to facilitate faster processing of each site). One quadrat was investigated at each site, positioned in a location considered to be most representative of the site vegetation.

Within each quadrat, the following information was recorded:

- Site observations such as soils, geology, apparent disturbance including clearing/fire/flood history, landform, slope, aspect, weed cover and presence of grazing;
- Vegetation community details including overall canopy cover, strata present, and stratum height and cover;

[1] [In October 2009, GHD met with representatives of DERM to review the methodology. On November 12, 2009 DERM provided coordinates for 35 recommended survey sites, specifying 16 for comprehensive surveys and 19 for rapid assessment. These sites formed the foundation of survey effort.]

- All vascular plant species present (voucher specimens were sent to the Queensland Herbarium for identification where necessary), with abundance data collected by measuring the basal area (with a Bitterlich stick), stem count (for trees and shrubs only) and abundance (recorded by stratum);
- Vegetation condition was recorded using the VAST (Vegetation Assets, States and Transitions) methodology (Thackway and Lesslie, 2005); and
- Six photographs were taken at each transect – three looking along each long axis, with two each end facing diagonally across the quadrat.

C.3.3.3.2 Site Species Lists

At each of the sampling sites, a species inventory of the main vascular plant species located outside of each transect was prepared together with any ecologically significant characteristics, including the presence of threatened species or vegetation communities (or potential habitats) and threatening processes (such as weed infestations).

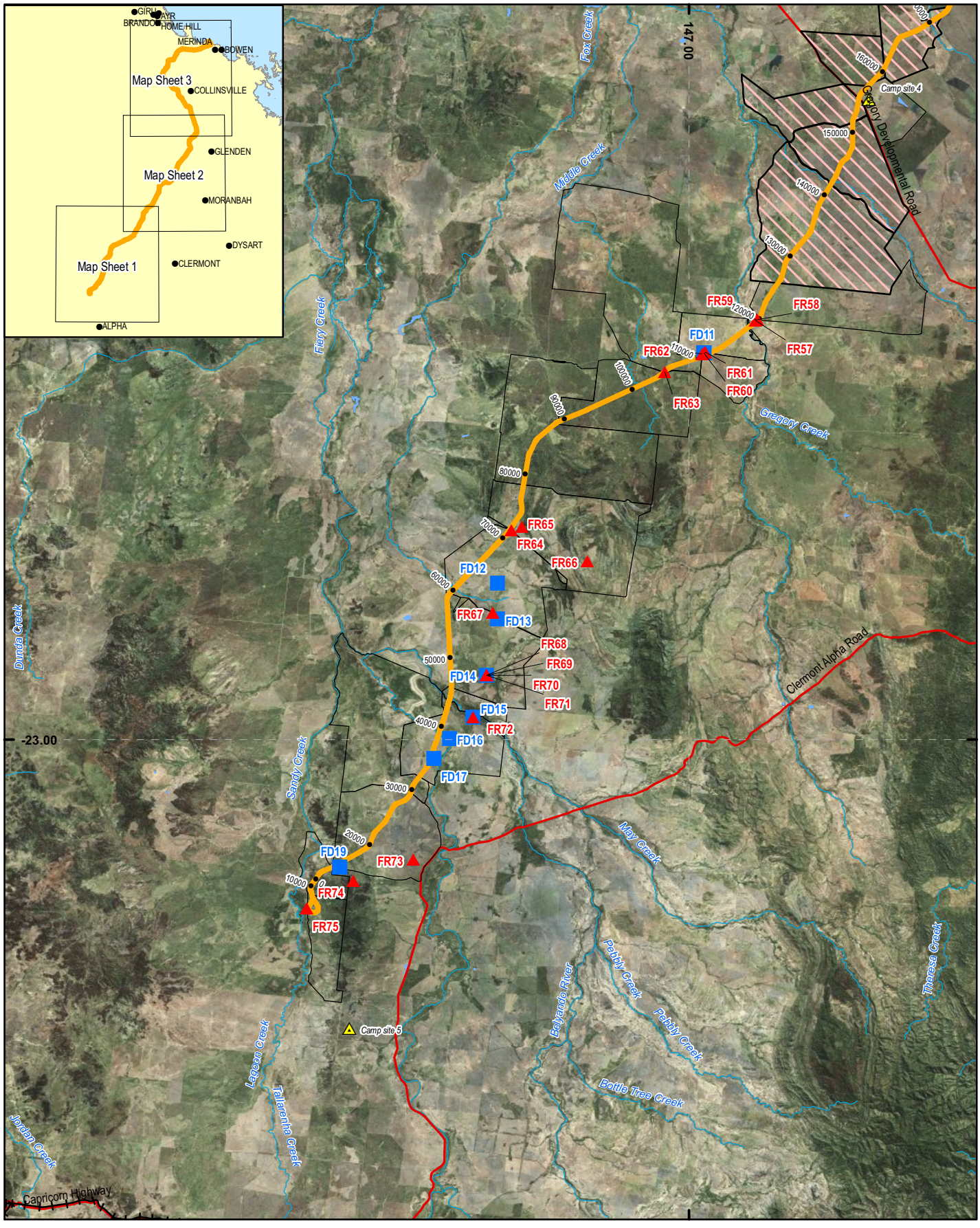
Plant species were either identified in situ or collected for later identification. For species for which identification or confirmation was required, a vouchered specimen was sent to the Queensland Herbarium. A list of all species collected, including all vouchered identifications, will be included at a later date when the information has been processed by the Queensland Herbarium.

C.3.3.3.3 Random Meander Technique

The random meander technique (Cropper, 1993) is a widely accepted method to survey for rare or threatened plant species or other species of interest that may not occur in surveyed quadrats or sample sites. It involves traversing sections of the study area at random searching for flora species that may not have been located using more structured search methods. This technique is particularly suitable for locating species that typically occur at very low densities, or that may be grouped in isolated clumps, as is often the case with many plants listed as rare or threatened.

C.3.3.3.4 Verification of Mapped Regional Ecosystems

REs that appear on the certified mapping for the mine study area were verified at approximately 69 quaternary level sites within the Project footprint or adjacent to it (often necessary due to the limited access). Quaternary site assessments are used primarily as a record of field traverses and to verify RE/vegetation mapping. A quaternary level site assessment involves a plotless sampling strategy with data recorded from a 360° arc to approximately 25 m radius. At the quaternary level of assessment, up to seven strata can be assessed (Emergent, Tree 1, Tree 2, Tree 3, Shrub 1, Shrub 2, Ground). Most non-rainforest native plant communities only have between one (i.e. grasslands) and five strata present. The dominant species were recorded for each strata present at a sampling site in order of dominance with their height and cover/abundance measured. Quaternary sites were collected wherever possible where vegetation patterns changed.



Town
Camp
Marshalling Yards
Depot

Flora Rapid Survey
Flora Detailed Survey

Proposed Alignment (Aug 2010)
Major Road
Existing Railway
Watercourse

Cadastre
Waterbody

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DISTRIBUTION OF FLORA SURVEY SITES

Job Number 4262 6580
Revision A
Date 24-09-2010

Figure: C-8
Sheet: 1 of 3

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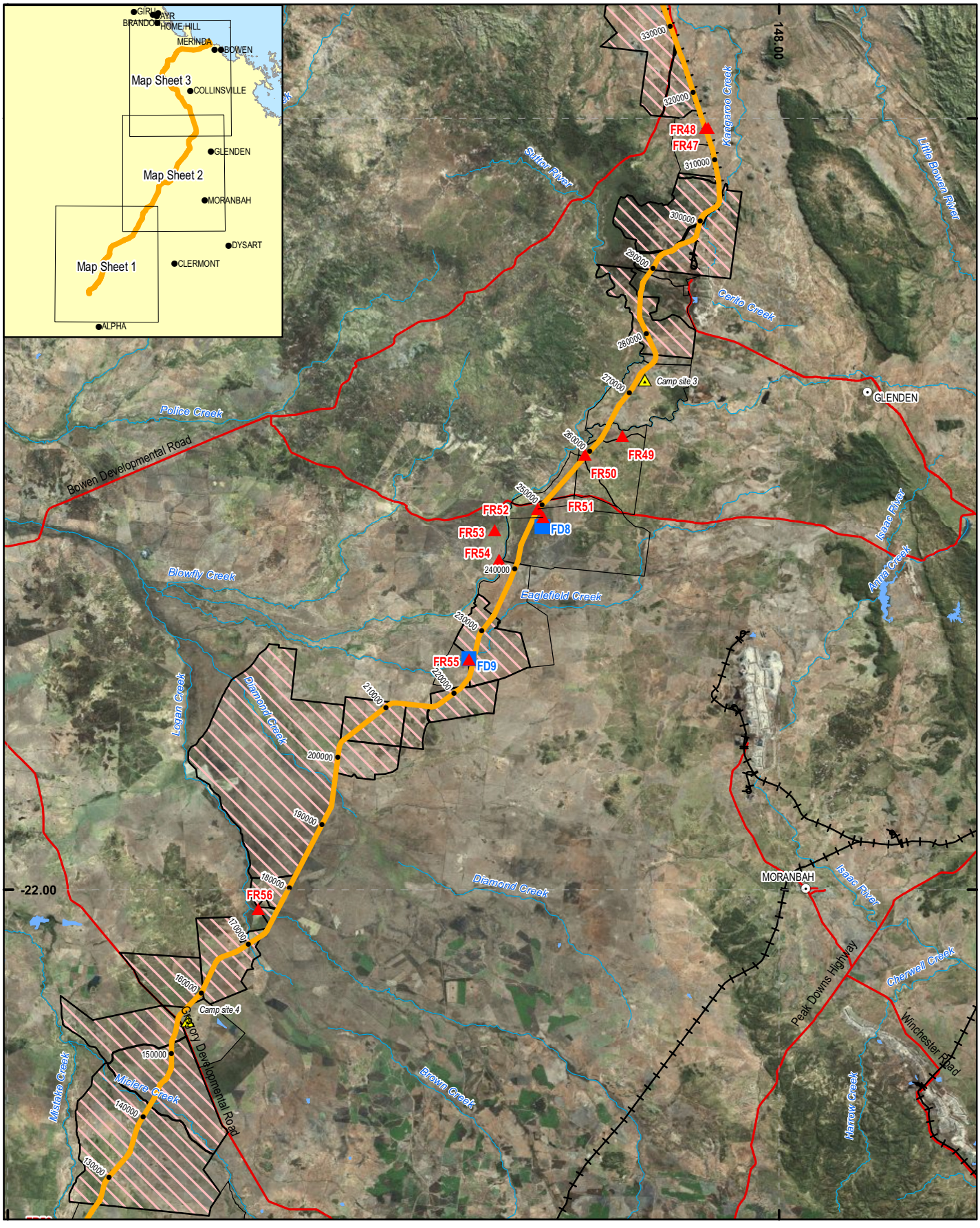

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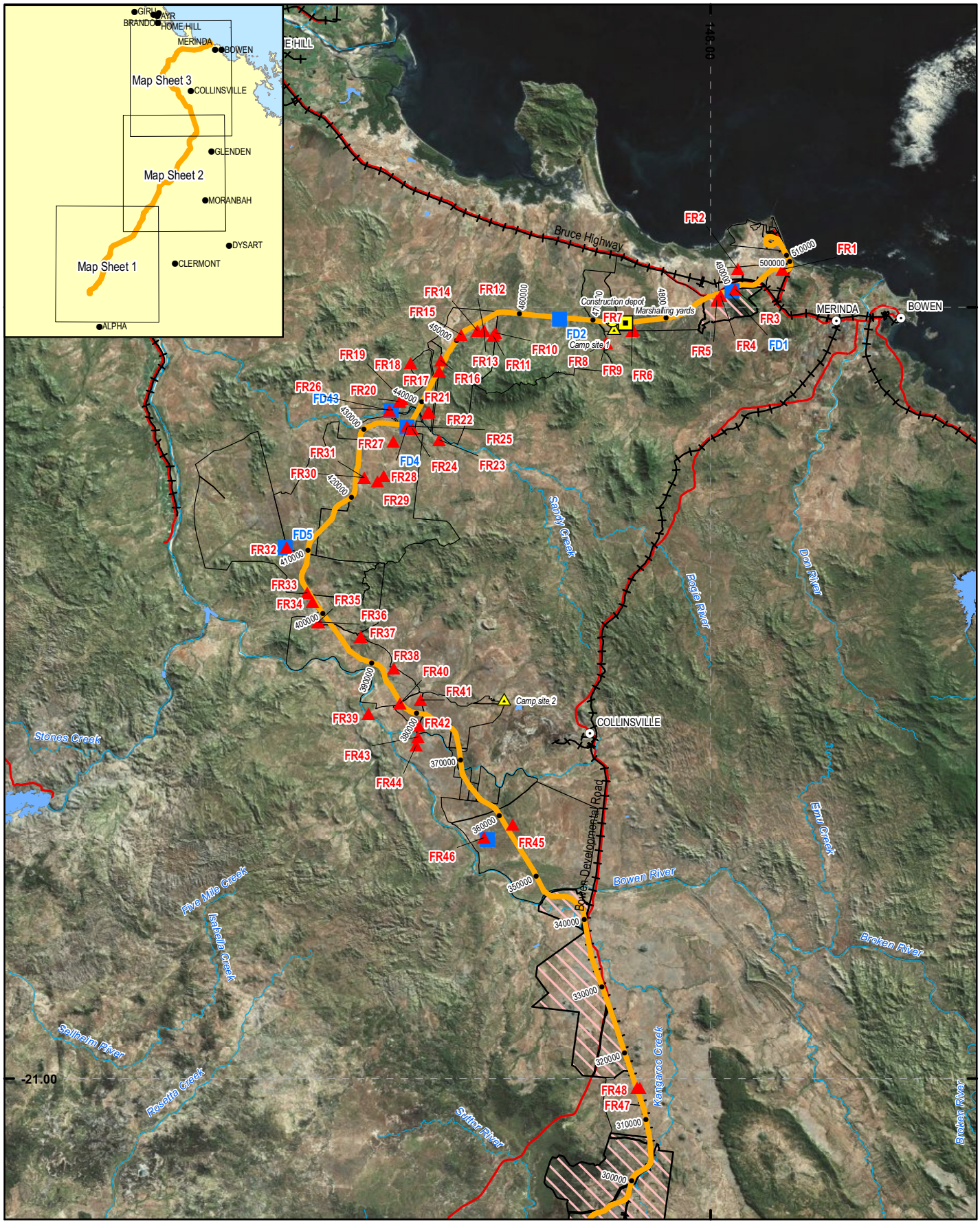

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C.3.3.4 Terrestrial Fauna

Terrestrial fauna surveys were undertaken at 16 comprehensive trapping sites and 43 rapid assessment sites across the rail study area (refer to Figure C-9). For the purposes of this assessment, terrestrial fauna are defined as animals that only spend only limited periods of time in aquatic environments. This includes amphibians and semi-aquatic species such as water birds.

C.3.3.4.1 Terrestrial Habitat Assessment

Terrestrial habitat assessments were undertaken at each fauna survey site and at additional areas throughout the wider study area. The following parameters were recorded during habitat assessments:

- Landscape context (size, shape, connectivity or relative isolation of habitat remnants);
- Structural and floristic complexity of vegetation (i.e. tree density, canopy cover, vertical structural complexity of vegetation strata – canopy, shrub and understorey layers, ground cover);
- Structural complexity and relative heterogeneity of ground-level microhabitats (i.e. substrate type, vegetation cover, leaf litter, woody debris, presence of rocks, logs or boulders);
- Habitat features (i.e. hollows, fallen logs, rock outcrops, nests, burrows, water bodies, gilgais);
- Relative abundance of hollows and hollow-bearing (habitat) trees; and
- Sources of disturbance (i.e. adjacent land-uses, feral animals, predation, weed infestation).

C.3.3.4.2 Systematic Trapping Surveys

Systematic trapping was undertaken at each of the 16 comprehensive survey sites. This involved a five day, four night survey of each site using cage, Elliott A traps, hair traps and funnel and drift fences.

At each site, traps were set in a single linear transect of 20 Elliott's, 19 hair tubes and 10 cage traps set within optimal microhabitats. Four drift fence and funnel complexes (each with three funnels) were placed at each site, set in areas with suitable microhabitat adjacent to the linear transects. Traps were set and checked each morning for four consecutive nights. The trap configuration comprised:

- Funnel traps and drift fence: Twelve funnel traps were established at each site. Each funnel trap complex consisted of a 6 m long (30 cm high) aluminium flywire drift fence with three nylon mesh funnels set along the centre of the fence line. Wet sponges were placed in each funnel. These were covered with vegetation to provide shade and protection;
- Elliot box traps: each site comprised 20 Elliot A traps baited with universal bait (a mixture of peanut butter, rolled oats and sardines and/or honey). Traps were located in shady areas or covered with vegetation to minimise heat exposure to animals;
- Cage traps: 10 cage traps were set at each site. These were interspersed with Elliott traps along linear transects. Cages were baited with universal bait or a single raw chicken neck and covered with hessian sacks to shade from the elements; and
- Hair tubes: 19 hair tubes were placed at each site and baited with universal bait. Hair tubes were positioned approximately 10 m parallel to the Elliot traps. Half the hair tubes were set at ground level and half on tree trunks to target both ground and arboreal mammals.

C.3.3.4.3 Opportunistic Surveys for Wildlife Traces

At each site, a minimum of one person hour was spent searching for wildlife traces (i.e. bones, hair traces, tracks, scats, diggings, burrows, nests, skins) that could indicate the presence of additional fauna species. All scats and hairs were sent to a specialist sub-consultant (Scatsabout) for identification.

C.3.3.4.4 Standardised Bird Surveys

Standardised bird surveys were undertaken at each survey site using the methods described by Loyn (1986) and recommended for surveys by Birds Australia. This involved a timed 20-minute survey of a 2 ha search area, recording the number of birds seen or heard calling. Birds observed flying overhead or outside the search area were recorded as incidental observations to allow their exclusion if precise statistical comparison of sampling units was required later. Bird surveys were undertaken in early morning or afternoon in clear conditions. Standardised bird surveys were undertaken once at each of the rapid assessment sites and a minimum of three times at the comprehensive survey sites.

C.3.3.4.5 Diurnal Active Searches for Reptiles and Amphibians

Active searches were undertaken for reptiles and amphibians at each site. This involved searching beneath rocks, logs, bark, corrugated iron and among soil and leaf litter. Vegetation at the edges of local waterbodies was also searched for frogs and aquatic reptiles. Diurnal active searches were standardized by time, each diurnal active search event lasting one person hour. This was undertaken once at each rapid survey site and repeated four times at each comprehensive survey site.

C.3.3.4.6 Nocturnal Spotlighting and Call Playback

Nocturnal spotlighting surveys were undertaken at each of the detailed survey sites. Two person hours were spent at each site, using a combination of high-powered spotlights and head torches. Visual surveys were undertaken in a 2 ha area, searching trees, shrubs and understorey habitats for arboreal mammals, ground mammals, reptiles, frogs and nocturnal birds.

Call playback was then used at each comprehensive site to detect owls and frogs. Call playback surveys involved broadcasting the call of individual target species for two minutes. This was followed by a listening period of two minutes. Species featured in call-playback included the Australian owlet nightjar, large-tailed nightjar, spotted nightjar, white-throated nightjar, powerful owl, barn owl, grass owl, masked owl, barking owl, rufous owl, southern boobook and tawny frogmouth. An additional 50 person hours were spent spotlighting on foot and from vehicles on roads within the study area. These surveys targeted nocturnal ground-dwelling reptiles, owls, frogs and mammals.

C.3.3.4.7 Microchiropteran Bats

Anabat II Bat Detectors were used to survey micro-chiropteran (insectivorous) bats by recording and analysing their echolocation calls. Detectors were placed at each of the comprehensive trapping sites for a minimum of one night. Anabat units were placed in potential bat ‘flyways’ just before dusk and left to record calls overnight. Detectors were positioned on the ground with the microphone orientated upwards at a 45° angle from the ground. All bat calls recorded were sent to a qualified bat-call analyst (Greg Ford) for identification. Bat calls can be identified to species. However there can be overlap between species with similar calls. An indication of the level of certainty was provided for the identification of each species:

- Definite – one or more calls with absolutely no doubt associated with the species identification;
- Probable – most likely the species named. There is a low probability of confusion with species that have similar calls;
- Possible – the call is comparable with the species named. However, there is a moderate to high possibility of confusion with species that have similar calls. Only bat calls with definite or probable call identification were included in the results.

C.3.3.4.8 Targeted Surveys for Listed Species

Targeted surveys were undertaken for listed species at specific locations where the likelihood of occurrence was considered high based on historical records or the presence of suitable habitat.

Poephila cincta cincta (black-throated finch), and *Neochmia ruficauda* (star finch)

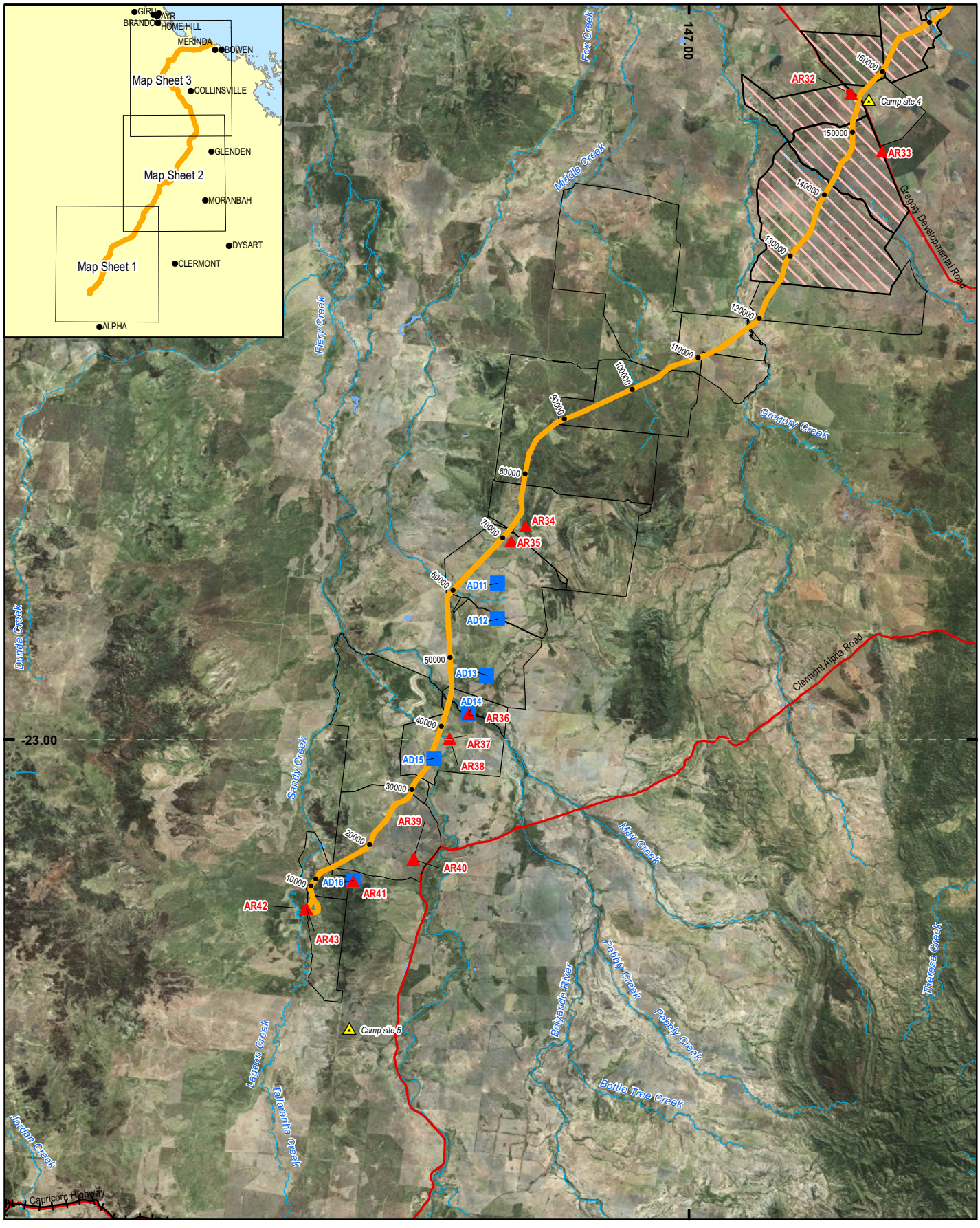
Two listed finches were considered to have the potential to occur at the northern end of the rail study area. The black-throated finch has been historically recorded near Strathalbyn, several kilometres from Abbot Point (BTF Recovery Team, 2007). The star finch is predicted to occur in the rail study area according to the Protected Matters database but was considered less likely, based on the lack of historical records and its current known distribution. Targeted surveys were undertaken to detect both finch species. Tall grasses and vegetated creeks at the northern end of the rail study area were searched for nests and individuals. A number of stock dams and creeks were considered potential drinking resources for these species. Timed (30-minute) dusk surveys were undertaken at each waterbody, recording all birds that were observed visiting the waterbody.

Dasyurus hallucatus (northern quoll)

The northern quoll has been historically recorded in the vicinity of the rail study area (Wildlife Online database) and is predicted to occur (Protected Matters). Habitats along the alignment, particularly rocky woodland areas at the northern end of the rail project footprint (Site AD 5) and rocky creeks (Site AR 21) were considered suitable habitat. At these locations traps were baited with universal bait to target that species. A series of remote infrared cameras were set at three additional locations (outside the trapping network). The cameras were trained on bait positioned on the ground. Cameras were left for a week at each location. Targeted searches for quoll scats and distinctive communal latrines were also undertaken in all suitable habitats.

Paradelma orientalis (brigalow scaly-foot), *Denisonia maculata* (ornamental snake), *Furina dunmalli* (Dunmall's snake), and *Egernia rugosa* (yakka skink)

A number of listed reptile species were considered likely to occur in the study area. The brigalow scalyfoot, ornamental snake, Dunmall's snake and yakka skink occur in vegetation communities that have been heavily impacted by historical land clearing (eg. brigalow, *Acacia harpophylla*) and are listed for this reason. Specific microhabitats were targeted (i.e. brigalow-gilgai formations, grass tussocks, sandstone slabs and cracking black clays). Targeted searches were also undertaken for the distinctive communal scat piles of the yakka skink.



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Fauna Detailed Survey
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Watercourse
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Waterbody
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Job Number 4262 6580
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Figure: C-9
Sheet: 1 of 3

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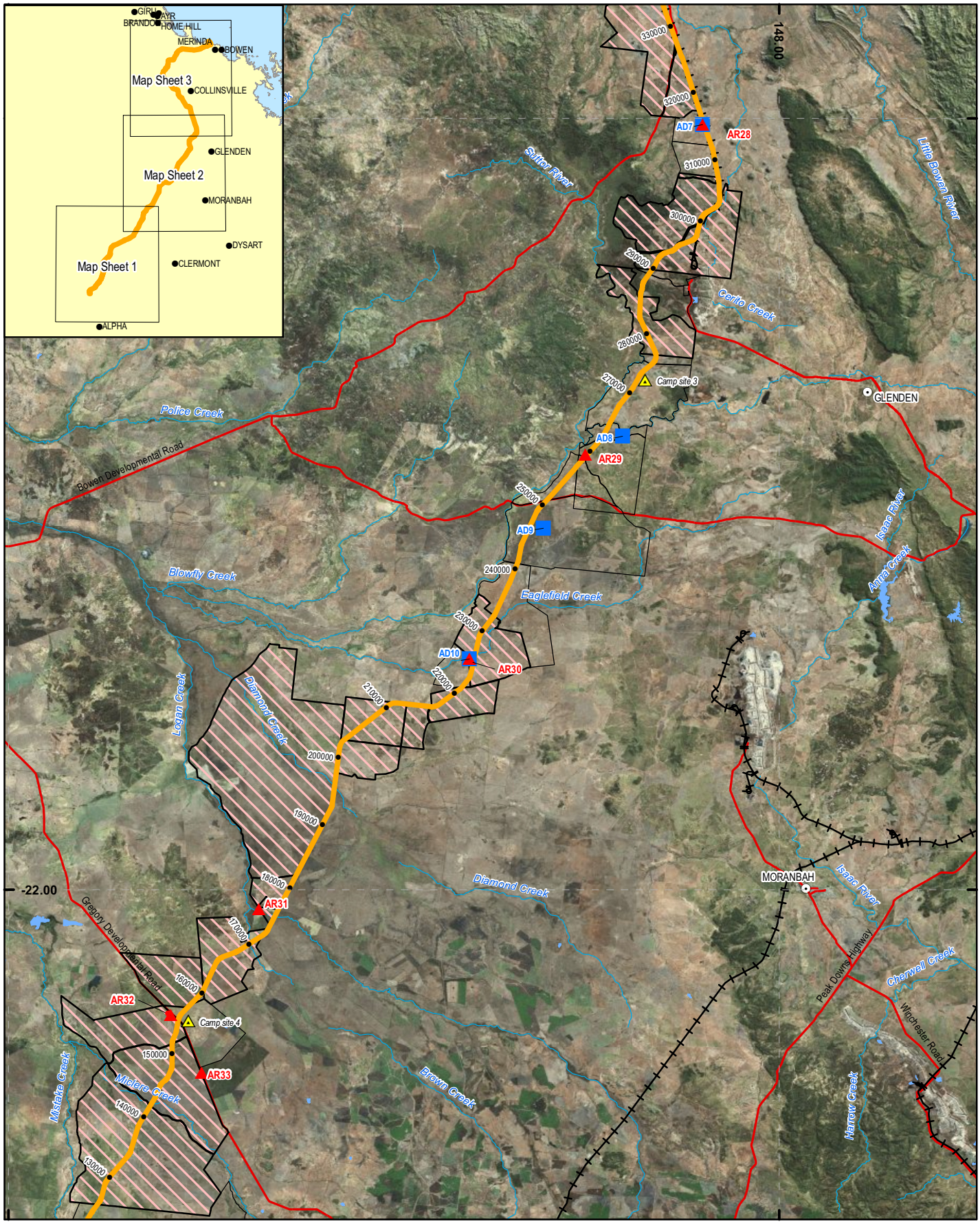

Town
Camp
Marshalling Yards
Depot

Fauna Rapid Survey
Fauna Detailed Survey

Proposed Alignment (Aug 2010)
Major Road
Existing Railway
Watercourse

Cadastre
Waterbody

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Alpha Coal Project
Environmental Impact Statement

DISTRIBUTION OF FAUNA SURVEY SITES

Job Number 4262 6580
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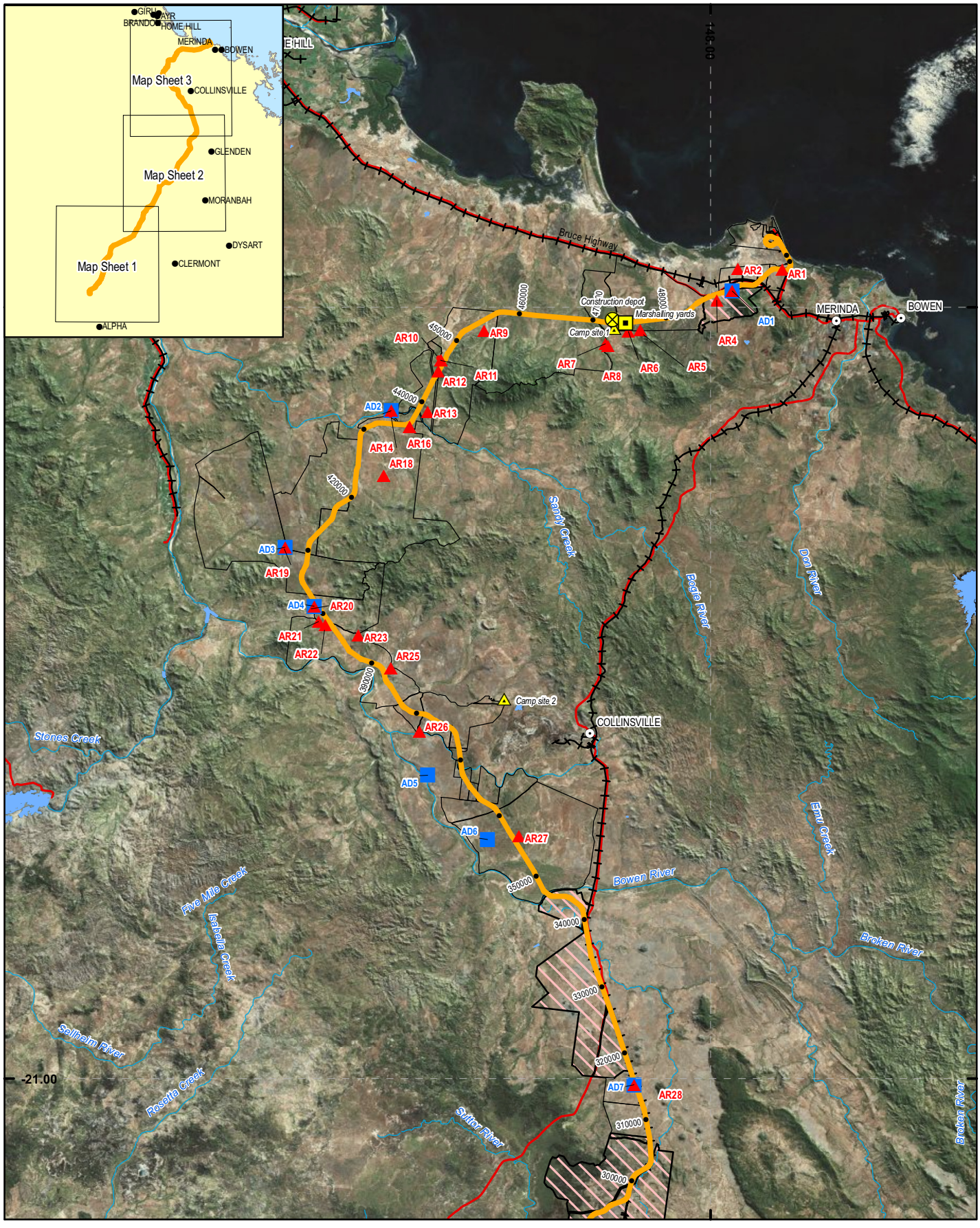

Town
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Fauna Rapid Survey
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C.3.3.5 Aquatic Flora and Fauna

The aim of the aquatic flora and fauna assessment was to provide a sufficient amount of baseline information to enable identification and assessment of the potential impacts of the Alpha Coal (Rail) Project on the existing environmental values of the rail study area. To achieve this objective, the following tasks were undertaken:

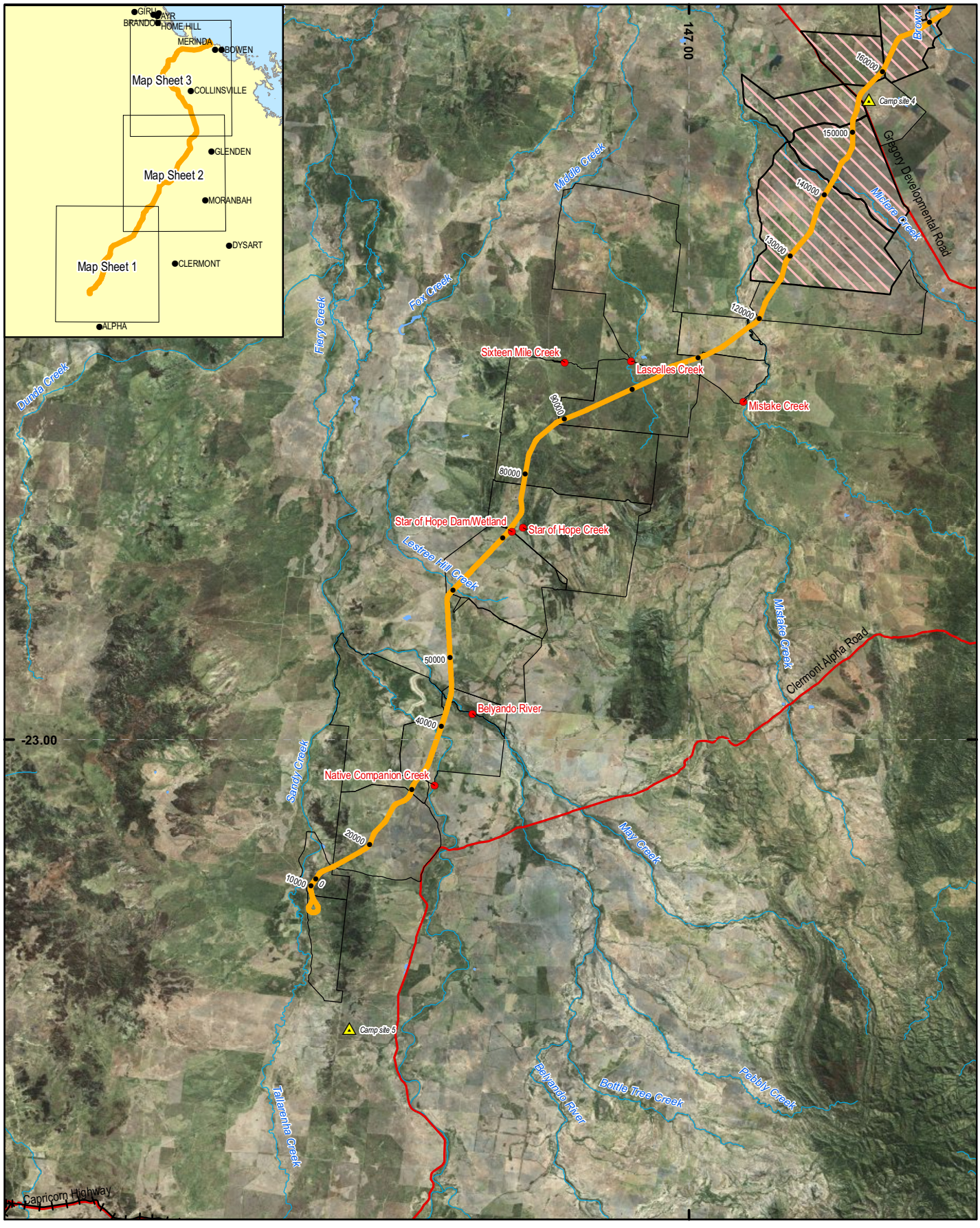
- Literature review: the literature review included a review of relevant scientific and grey literature, database searches and previously prepared technical reports. This assessment was conducted to document the known aquatic environmental values within the rail study area including a list of aquatic flora and fauna species that have been historically recorded or have the potential to occur within the area; and
- Field assessment: a field survey was conducted at proposed major watercourse crossings during the wet season to characterise and document the freshwater ecosystems of the rail study area. This assessment included detailed habitat assessments and in situ water quality assessments.

While the literature was used to make a general assessment across the rail study area, specific observations made at habitat assessment sites during the field assessment phase were used for more detailed descriptions of habitat and for the impact assessment phase.

Field assessments were conducted to determine the site-specific habitat characteristics of aquatic ecosystems within the rail study area and to assess surface water quality. Twenty-two field assessment sites were selected following a review of aerial photography and GIS watercourse mapping and a reconnaissance of the rail study area. These sites were selected to provide adequate coverage of the range of aquatic ecosystems for assessment and were selected on the basis of being:

- Representative of major aquatic habitats within the rail study area;
- Covered a geographical range of aquatic habitats;
- Corresponded with proposed disturbance footprints of alignment crossings (based on preliminary alignment);
- Prioritised larger watercourses that are more likely to provide aquatic habitat for much of the year; and
- Were accessible (including landowner permissions).

The field assessments were conducted between 15 – 21 April 2010 and are considered to represent post wet season conditions. This survey period was selected to coincide as close as possible to the wet season when the aquatic ecosystems within the rail study area are at their highest ecological productivity. Due to the extended wet season in 2010, access difficulties (i.e. as a result of high water levels and poor road access) hindered field assessments during the typical wet season summer period. The location of the field assessment sites are illustrated in Figure C-10.



Town
Camp
Marshalling Yards
Depot
Aquatic Assessment Sites
Proposed Alignment (Aug 2010)
Major Road
Existing Railway
Watercourse
Cadastre
Waterbody
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Job Number 4262 6580
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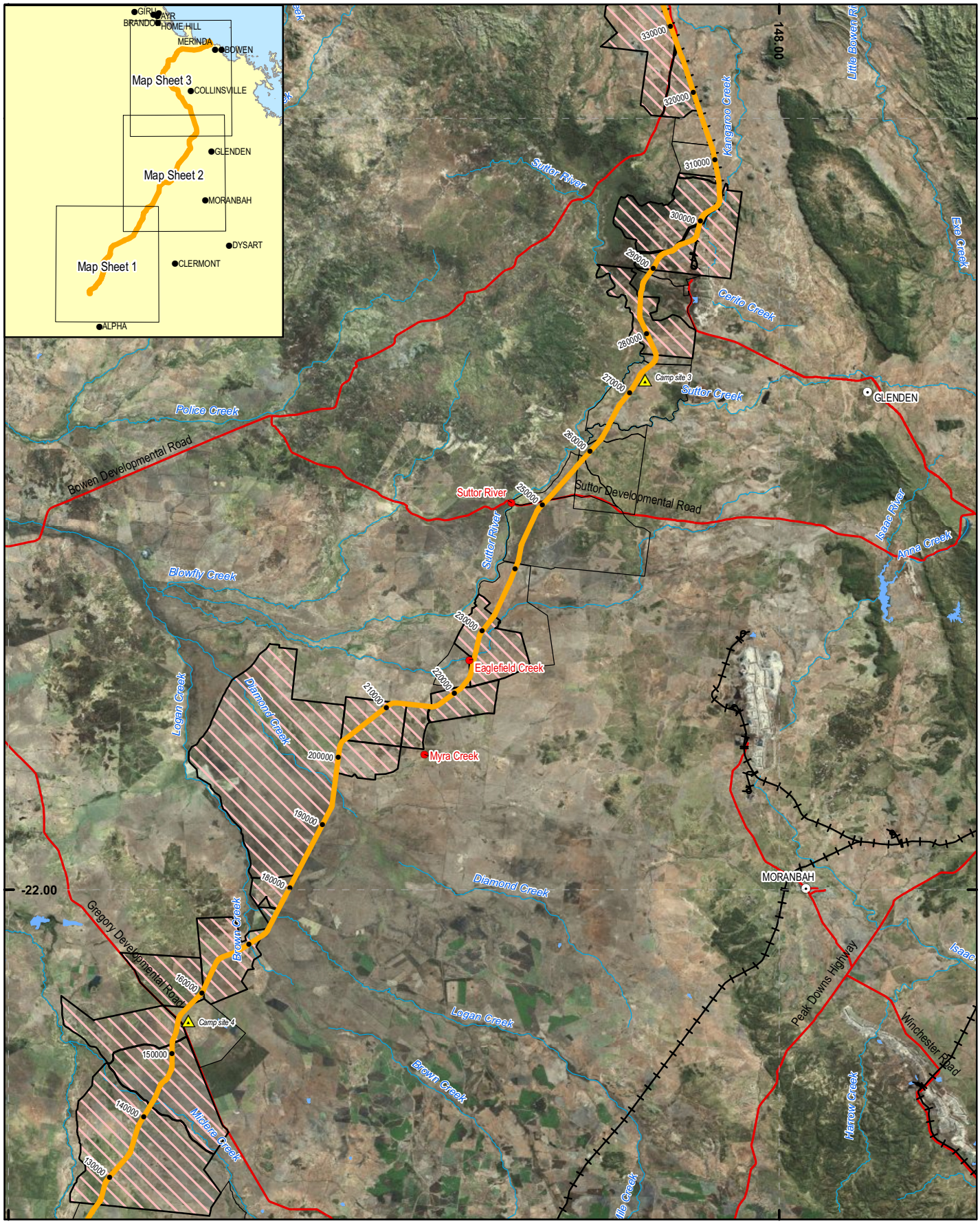

Town
Camp
Marshalling Yards
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Aquatic Assessment Sites
Proposed Alignment (Aug 2010)
Major Road
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Waterbody
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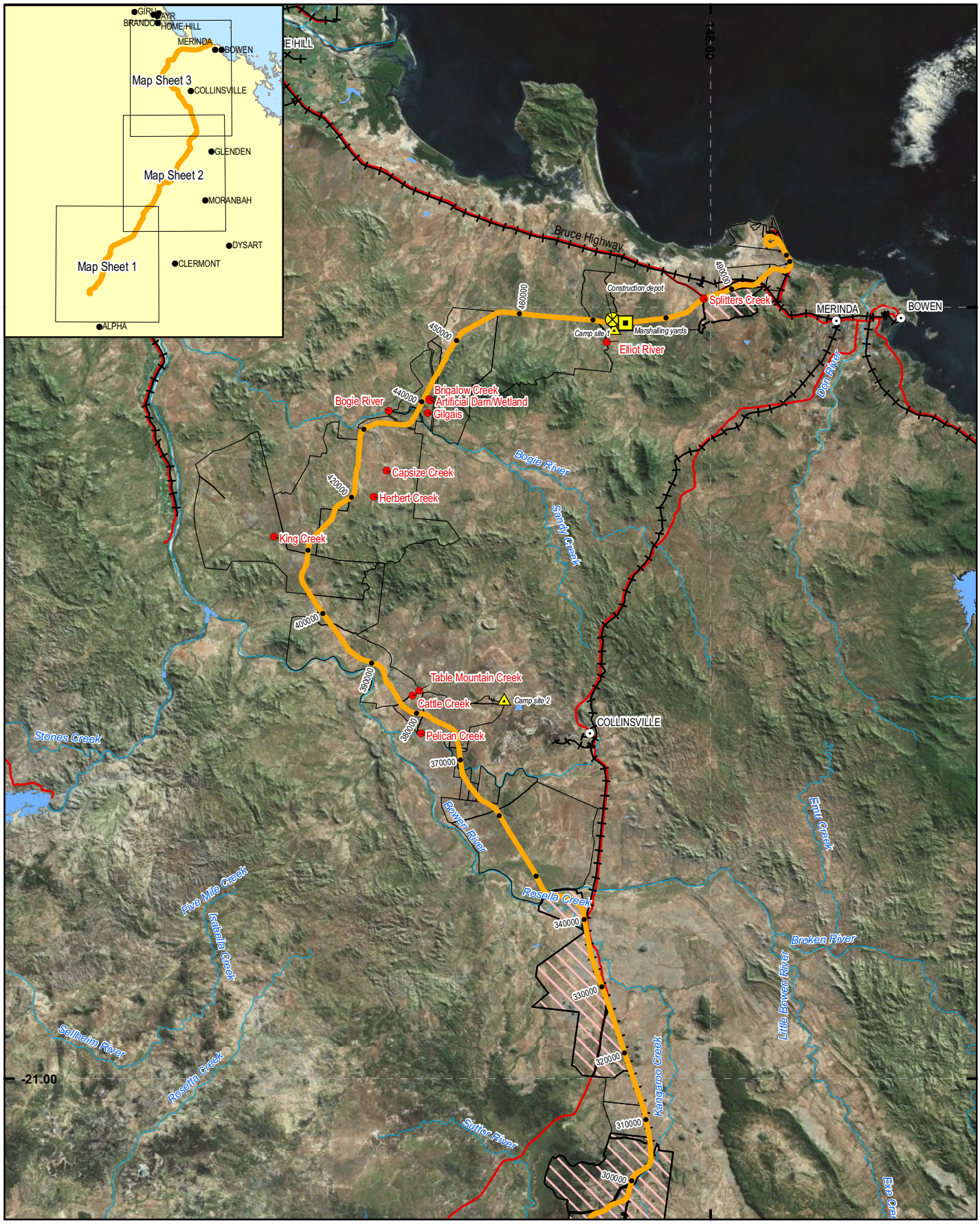

Town
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C.4 Description of Affected Matters of National Environmental Significance (MNES)

This section outlines the affected environment and values relevant to the MNES. Terrestrial and freshwater environments and MNES listed species are discussed.

C.4.1 Coal Mine and Associated Infrastructure

C.4.1.1 EPBC Matter of National Environmental Significance

Table C-3 EPBC Act Matters of National Environmental Significance for Rail Study Area.

Table C-1 EPBC Act Matters of National Environmental Significance for Mine Study Area

Aspect	Values
World Heritage properties	None present
Australian Heritage places	None present
Wetlands of international importance (Ramsar Wetlands)	None present
Threatened species and ecological communities	Threatened ecological communities – none present. Threatened flora species – No species recorded during surveys nor expected to occur. Threatened fauna species – One species was recorded (*Geophaps scripta scripta*); a total of six species have the potential to occur.
Migratory species	24 migratory or marine bird species were found within the rail study area.
Commonwealth marine areas	None present
Nuclear actions	Not applicable to this Project

C.4.1.2 Listed Threatened Species

C.4.1.2.1 Flora

Review of database searches indicated the potential presence of 21 flora species of conservation significance listed under the EPBC Act. Of these none were considered to have a medium or high likelihood of being present within the mine study area.

No EPBC Act listed threatened flora species were identified from the field surveys of the mine study area.

C.4.1.2.2 Fauna

Review of database searches indicated the potential presence of 26 fauna species of conservation significance listed under the EPBC Act. Of these, six were considered to have a moderate likelihood of being present within the mine study area (Table C-2).

Table C-2 Conservation Significant Fauna Species which may occur or are likely to occur in the mine study area

Scientific Name	Common Name	EPBC Status	NC Act Status	Habitat	Likelihood of Occurrence
Anthochaera phrygia	Regent Honeyeater	Endangered	Endangered	Regent Honeyeaters mostly occur in dry box-ironbark eucalypt woodland and dry sclerophyll forest associations. They sometimes use native pine *Callitris* sp woodlands, usually where mixed with eucalypts (Department of the Environment, Water, Heritage and the Arts 2009)	Some suitable habitat occurs on the Project site, however the range of this species is further south, if the species was present; it is considered unlikely that the Project would impact on the species / Unlikely
Bettongia tropica	Northern Bettong	Endangered	Endangered	This species is now restricted to four areas of the north-eastern tropical rainforest zone, although has formerly been identified in the Rockhampton area by a single specimen (Menkhorst and Knight 2001). Their distribution appears to be limited by the availability of hypogenous fungi (truffles) and potentially *Alloteropsis semialata* and *Hypoxix spp*., all of which are critical food resources (Johnson & McIlwee 1997)	As this species has not been identified within the Central Highlands region since 1884 (Pope 1996), it is considered unlikely that there would be any extant populations in the area, and therefore there are not considered to be any impacts possible by the Project on the species / Unlikely
Chalinolobus dwyeri	Large-eared Pied Bat	Vulnerable	Vulnerable	Dry and wet eucalypt forests, and roosts in caves and mines (Menkhorst and Knight 2001)	Suitable habitat for this species exists, but distribution of the Large-eared Pied Bat is east of the Project site / Unlikely
Dasyurus geoffroii geoffroii	Western Quoll	Vulnerable	Extinct in the wild	The last specimens of the Western Quoll in Queensland were collected between 1884 and 1907. The species disappeared from central Australia around the 1940s–1950s. The species is now known only from Western Australia (Department of the Environment, Water, Heritage and the Arts 2009)	The available data indicates that the species is no longer extant within Queensland. It is therefore considered that the Project will not impact on the species / Unlikely
Dasyurus hallucatus	Northern Quoll	Endangered	Not Listed	The Northern Quoll is found in savannahs and rocky eucalypt woodlands, mostly within 200km of the coast (Menkhorst and Knight 2004)	Despite targeted trapping and extensive spotlighting activities within the Project site, this species was not detected. It is considered unlikely that the species is found within the

Scientific Name	Common Name	EPBC Status	NC Act Status	Habitat	Likelihood of Occurrence
					Project site / Unlikely
Dasyurus maculatus maculatus	Spotted-tailed Quoll (southern subspecies)	Endangered	Vulnerable	The Spotted-tailed Quoll is found in many habitats, including rainforest, wet and dry sclerophyll forest, coastal heath and scrub. Dens in tree hollows, hollow logs, and rock crevices (Menkhorst and Knight 2004)	Despite targeted trapping and extensive spotlighting activities within the Project site, this species was not detected. It is considered unlikely that the species is found within the Project site / Unlikely
Delma torquata	collared delma	Vulnerable	Vulnerable	The collared delma favours open rocky terrain, although has been recorded in woodland and brigalow sites (Wilson 2005). It can be found within disturbed habitats (Cogger 2000) and known populations are concentrated around south-east Queensland, with disjunct populations recorded near the mine study area	Despite targeted trapping active searching activities within the mine study area, this species was not detected. Given the availability of similar habitat in the region it is unlikely the Project will have an adverse impact on the species if it does utilise the area / Moderate Potential
Denisonia maculata	ornamental snake	Vulnerable	Vulnerable	This species occurs in brigalow woodlands growing on slay and sandy soils, riverside woodland, and open forest growing on natural levees (Shine 1983), showing a preference for moist areas (Wilson and Knowles 1988)	This species was not trapped or observed despite targeted efforts across the mine study area. Given the availability of similar habitat in the region it is unlikely the Project will have an adverse impact on the species if it does utilise the area / Moderate Potential
Egernia rugosa	yakka skink	Vulnerable	Vulnerable	Usually found in open dry sclerophyll forest or woodland. Fallen timber and ground litter provide cover along with dense ground vegetation (Cogger 2000)	This species was not trapped or observed despite targeted efforts across the mine study area. Given the availability of similar habitat in the region it is unlikely the Project will have an adverse impact on the species if it does utilise the area / Moderate Potential
Erythrotriochis radiatus	Red Goshawk	Vulnerable	Endangered	The Red Goshawk is typically found over wooded and forested land with a mosaic of vegetation types in tropical and warm temperate climates in coastal and subcoastal areas (Marchant and Higgins 1993)	While the Project site offers a mosaic of vegetation types, this species is generally found closer to the coast in areas with permanent water. The Project will not disturbed its favoured habitat and is unlikely have any adverse impacts on this species / Low Potential
Furina dunmalli	Dunmall's snake	Vulnerable	Vulnerable	This species is commonly found in the Brigalow Belt Region, including belah, brigalow and	Extensive habitat searching and trapping for reptiles was undertaken, and no evidence of this species was detected during the survey. It

Scientific Name	Common Name	EPBC Status	NC Act Status	Habitat	Likelihood of Occurrence
				cypress pine communities	is considered unlikely this species inhabits the mine study area / Moderate Potential
Lasiorhinus krefftii	Northern Hairy-nosed Wombat	Endangered	Endangered	The last known colony of Northern Hairy-nosed Wombats is now restricted to 300 ha in Epping Forest National Park in central Queensland. The Northern Hairy-nosed Wombat occurs along an ancient water course in the park where the soil is sandy and dry (DEWHA, 2009)	Despite active searches in areas of likely habitat, this species was not observed. This species is only known to inhabit one centralised location / Unlikely
Lathamus discolor	Swift Parrot	Endangered	Endangered	The Swift Parrot inhabits forests and woodlands with flowering trees (Morcombe 2002). It breeds only in Tasmania, and migrates to mainland Australia in autumn (Higgins 1999). It has been recorded in the Central Highlands region 3 times	This species has not been seen during any of the field surveys conducted by AARC to date. Migratory birds vary their habitat use in response to variations in climatic conditions and the subsequent spatial and temporal patterns of food productivity. It is therefore considered that, even if the species was observed within the Project area, it would be only transiently during migration, and the Project would not have any impact on breeding populations or habitats / Unlikely
Lerista allanae	Allan's Lerista	Endangered	Endangered	Allan's Lerista is endemic to black soils of the Brigalow Belt at Clermont, Logan Downs Station, and Retro Station, with the most recent specimen being collected in 1960 (Wilson 2005). It is possible that cultivation and grazing have lead to their decline	Despite active searches in areas of likely habitat, this species was not observed. This species is poorly known, there have not been any recent sightings of the species, and the area is currently grazed by cattle. It is therefore considered unlikely that the species is present in the Project area / Unlikely
Macronectes giganteus	Southern Giant-petrel	Endangered	Endangered	This species is marine, over open seas and inshore waters. It favours the edge of the continental shelf and edge of ice-packs (Morcombe 2002)	The habitat required by the species is not present within the Project area. Therefore it is considered unlikely that the species would frequent the Project site, and there will be no impact from the Project on the species / Unlikely
Neochmia phaeton and	Crimson Finch	Vulnerable	Endangered	The Crimson Finch is found in waterside vegetation including pandanus, cane grass,	Riparian habitats similar to those occurring on the Project site are commonly represented in

Scientific Name	Common Name	EPBC Status	NC Act Status	Habitat	Likelihood of Occurrence
Neochmia phaeton phaeton				paperbarks, and lush grasses (Simpson and Day 2010)	the wider area. It is considered unlikely that mining activities would result in adverse impacts on this species / Unlikely
Neochmia ruficauda ruficauda	star finch	Endangered (Eastern and Southern)	Endangered (Eastern)	This species occupies grassland or grassy woodland near water (Simpson and Day 2010)	Grassland and grassy woodland habitats similar to those occurring on the mine study area are commonly represented in the wider area. It is considered unlikely that mining activities would result in adverse impacts on this species as a whole / Moderate Potential
Nyctophilus timoriensis	Eastern Long-eared Bat	Vulnerable	Vulnerable	Found in a range of dry woodland and shrubland communities in arid and semi-arid areas (Menkhorst and Knight 2001). It roosts in tree hollows, crevices, and under loose bark	Habitats similar to those occurring on the Project site are commonly represented in the wider area. ANABAT recordings over a range of seasons and in a range of likely habitats did not detect any presence or potential presence of the species. It is considered unlikely that mining activities would result in adverse impacts on this species as a whole / Low Potential
Onychogalea fraenata	Bridled Nailtail Wallaby	Endangered	Endangered	The Bridled Nailtail Wallaby is confined to acacia-dominated woodland and shrubland in Taunton Scientific Reserve near Dingo, and Idalia National Park (Menkhorst and Knight 2001)	This species has shown up in the database searches as the search included the entire Central Highlands region. However, due to the known restricted range of the species, there is not considered to be any impacts of the Project to the wallaby populations in either National Park / Unlikely
Paradelma orientalis	brigalow scaly-foot	Vulnerable	Vulnerable	The brigalow scaly-foot inhabits the Brigalow Belt region on sandstone ridges, dry forests and woodlands (Wilson 2005).	The mine study area was searched extensively for reptiles and the brigalow scaly-foot was not detected. If the species inhabits the mine study area the availability of similar habitat in the surrounding region makes it unlikely the Project will adversely affect it / Moderate Potential
Pedionomus torquatus	Plains-wanderer	Vulnerable	Vulnerable	The Plains-wandered inhabits natural open grasslands, treeless with patches of open ground, may be lightly grazed. Avoids country	This species was not detected during any of the AARC surveys within the Project site. Due to the grazing activities already undertaken on

Scientific Name	Common Name	EPBC Status	NC Act Status	Habitat	Likelihood of Occurrence
				where grass is too tall or dense, or too sparse, low, or heavily grazed. Infrequent records of it being in low shrublands (Simpson and Day 2010)	the Project site, the potential for the species to be inhabiting the area is considered low. If, however, the site was suitable for the species, there is habitat of similar disturbance in the region / Low Potential
Poephila cincta cincta	Black-throated Finch (Southern subspecies)	Endangered	Endangered	The southern subspecies inhabits open woodland, scrubby plains, Pandanus flats with deep cover of grasses, never far from water	Due to the abundance of similar habitat types surrounding the Project site, the Project is unlikely to have impact on the species / Unlikely
Rheodytes leukops	Fitzroy River Turtle	Vulnerable	Vulnerable	This species is known only from the Fitzroy River and its tributaries (Cogger 2000). Requires rivers systems with fast-flowing, permanently water	The Project site is not part of the Fitzroy River drainage area. Additionally, the Project site does not offer any areas of the species preferred habitat (permanent fast-flowing water), therefore it is considered unlikely that the species would inhabit the Project site / Unlikely
Rostratula australis	Australian Painted Snipe	Vulnerable	Vulnerable	This species inhabits shallow inland wetlands, either permanent or temporary (Marchant and Higgins 1993)	Due to the abundance of similar habitat type surrounding the Project site, if the species was present in the region, the Project is unlikely to impact on the species / Low Potential
Sminthopsis douglasi	Julia Creek Dunnart	Endangered	Endangered	This species is restricted to the Mitchell Grass Downs country of northwest Queensland. It gets its name from the fact that until recently, all known individuals had been found within a short radius of Julia Creek and Richmond. During dry conditions, especially when ground cover is sparse, the Dunnart may shelter in cracks in the ground. After rain it likes the protection of low plant communities.	No suitable habitat exists for this species within or adjacent to the Project site / Unlikely
Turnix melangaster	Black-breasted Button-quail	Vulnerable	Vulnerable	This species is usually found in low-canopy, closed rainforest or monsoon forests vine thickets, and drier shrubby scrubs such as Brigalow thickets, where there is a deep leaf-litter (Simpson and Day 2010)	Patches of habitat suitable for the species exists within the Project area; however no individuals of the species were noted during any of the surveys conducted by AARC. Due to the abundance of similar habitat type

Scientific Name	Common Name	EPBC Status	NC Act Status	Habitat	Likelihood of Occurrence
					surrounding the Project site, if the species was present in the region, the Project is unlikely to impact on the species / Unlikely

One EPBC Act listed threatened fauna species was recorded from the field surveys of the mine study area. This species was the southern squatter pigeon (*Geophaps scripta scripta*) which was recorded during the survey within the non-remnant grassland vegetation community. This species is listed as Vulnerable under the EPBC Act.

Extensive areas of habitat suitable for the southern squatter pigeon exist within the mine study area, and within the local region. It is likely some of the available squatter pigeon habitat will be disturbed by mining activities, however it is considered unlikely that there will be a considerable impact on the regional population of the species due to the broad extent of habitat in the local region.

No other EPBC Act listed threatened fauna species were identified from the field surveys of the mine study area.

C.4.1.2.3 Aquatic Flora and Fauna

No additional aquatic flora species listed under the EPBC Act were identified during the survey of the mine study area. A total of 12 bird species listed under the EPBC Act as Migratory or Marine and with habitat requirements linked to aquatic areas were identified on site. These species are listed under Section C.4.1.4.

C.4.1.3 Listed Threatened Ecological Communities

The desktop survey did not identify any EPBC Act listed TECs as potentially being present within the mine study area. Furthermore, no EPBC Act listed TECs were identified from the field surveys of the mine study area.

C.4.1.4 Listed Migratory Species

Ten Migratory and/or Marine species listed under the EPBC Act were observed within the mine study area during both the terrestrial and aquatic field surveys. These included the nankeen kestrel (*Falco cenchroides*), great egret (*Ardea alba*), intermediate egret (*Ardea intermedia*), nankeen night heron (*Nycticorax caledonicus*), whistling kite (*Haliastur sphenurus*), Australian pelican (*Pelecanus conspicillatus*), rainbow bee-eater (*Merops ornatus*), straw-necked ibis (*Threskiornis spinicollis*), black-faced cuckoo-shrike (*Coracina novaehollandiae*) and sacred kingfisher (*Todiramphus sanctus*).

C.4.2 Rail

C.4.2.1 EPBC Act Matters of National Environmental Significance Summary

Table C-3 EPBC Act Matters of National Environmental Significance for Rail Study Area.

Table C-3 EPBC Act Matters of National Environmental Significance for Rail Study Area

Aspect	Values
World Heritage properties	None present
Australian Heritage places	Mazeppa National Park Note: Located 3.2 km from the rail study area Mount Abbot QLD Note: Located 4 km from the rail study area Epping Forest National Park Note: Located 26 km from the rail study area
Wetlands of international importance (Ramsar Wetlands)	None present
Threatened species and ecological communities	Threatened ecological communities –four listed in EPBC search: brigalow, natural grasslands, semi-evergreen vine thicket, and weeping myall woodlands. Only weeping myall woodland TEC was absent. Threatened flora species – One species recorded during surveys (Eucalyptus raveretiana) but four species potentially occur. Threatened fauna species – One species was recorded; a total of eight species have the potential to occur.
Migratory species	23 migratory or marine bird species were found within the rail study area (11 birds and 1 reptile predicted to occur)
Commonwealth marine areas	None present
Nuclear actions	Not applicable to this Project

C.4.2.2 Australian Heritage Places

C.4.2.2.1 Mazeppa National Park

Mazeppa National Park is listed as a natural heritage place in the Australian Heritage Database. Located approximately 72 km north-west of Clermont the National Park has an approximate size of 4,126 ha and contains a large, undisturbed stand of gidgee (*Acacia cambagei*) scrub. The stand is an important remnant of this vegetation type that was once widespread across the region and is significant for its research potential (DEWHA 2008c). Mazeppa National Park is located approximately 3.2 km from the proposed railway alignment.

The DERM's Biodiversity Planning Assessment (BPA) mapping layer was assessed to determine if the proposed railway alignment intersects any possible habitat corridors connecting to the Mazeppa National Park. This layer identifies Bioregional Wildlife Corridors that have ecological significance to wildlife at a regional or state level. The proposed railway alignment does not intersect any mapped bioregional wildlife corridors in the vicinity of Mazeppa National Park. The proposed alignment

intersects a state significant bioregional wildlife corridor 15 km north of Mazeppa National Park. However this corridor does not connect to the National Park. Mazeppa National Park is surrounded by cleared grazing land and is therefore not connected to any substantial wildlife corridor.

C.4.2.2.2 Mount Abbot

Mount Abbot is a prominent, isolated, mountain massif that is regarded as a 'spectacular landscape feature' and is listed as a natural heritage place in the Australian Heritage Database. Located approximately 50 km west-south-west of Bowen, Mount Abbot covers an area of approximately 5,393 ha. Mount Abbot is home to a diversity of vegetation types, flora, vertebrate and insect fauna species including a high proportion of rare or regionally significant vegetation communities and taxa. Three flora species are endemic to the Mount Abbot and many species have been recorded as remote outliers from other populations. Mount Abbot is in its natural condition, with few introduced species, and is remote from road access and settlements. It has a high potential as a research, reference and educational site (DEWHA 2008d). Mount Abbot is located approximately 4 km from the proposed railway alignment. The proposed railway alignment does pass through stands of native vegetation that are mapped as a state significant Bioregional Wildlife Corridor that connects to Mount Abbot (according to the DERM's BPA mapping layer). This corridor extends for approximately 7 km north of the Bogie River.

C.4.2.2.3 Epping Forest National Park

At its closest point (KP 87000), the proposed Alpha rail alignment is 26 km south-east of Epping Forest National Park. This National Park supports the last remaining population of the Northern Hairy-nosed Wombat (*Lasiorhinus krefftii*). Given that the Northern Hairy-nosed Wombat is restricted to Epping Forest National park, the proposed rail alignment will have no direct impact on the species or its habitat.

C.4.2.2.4 Listed Threatened Species

Desktop surveys identified 13 EPBC-listed flora and 15 EPBC-listed fauna species as previously recorded in the region (Wildlife Online, Herbrecs) or predicted to occur based on bioclimatic modeling (EPBC Act Protected Matters Search).

Field surveys identified one species of flora, two bird species and one reptile species listed under the EPBC Act. However, based on the likelihood of occurrence assessment, which analyses the species distribution, habitat preferences and previous records, a number of additional species may occur in the rail study area where suitable habitat has been identified. The likelihood of occurrence assessment is summarised below and is also presented in Table C-4.

- Five EPBC Act listed flora species are predicted to occur in the region: three species may occur, one species is likely to occur, and one species is present – *Eucalyptus raveretiana* (black ironbox), listed as Vulnerable under the EPBC Act;
- Four EPBC Act listed reptiles are predicted to occur in the region – three are considered likely to occur within the rail study area and one species may occur;
- One EPBC Act listed mammal species is predicted to occur in the region - *Dasyurus hallucatus* (northern quoll). This species may occur within the rail study area; and

- Four EPBC Act listed bird species are predicted to occur in the region - three species may occur and one species - *Geophaps scripta scripta* (squatter pigeon) does occur within the rail study area.

Table C-4 Conservation Significant Species which may occur or are likely to occur in the rail study area

Name	EPBC Status	Likelihood of Occurrence
Plants		
Croton magneticus (Magnetic Island croton)	V	**May Occur**: this species was predicted to occur in the region (Protected Matters Database) and has been historically recorded in the region surrounding the rail study area (Wildlife Online and Herbrecs). Suitable habitat is present in vine thicket areas within the rail study area.
Dichanthium queenslandicum (king-blue grass)	V	**Likely to Occur**: this species was predicted to occur in the region (Protected Matters Database) and has been historically recorded in the region surrounding the rail study area (Wildlife Online and Herbrecs). Suitable habitat exists in natural grasslands on black cracking clay soils between Collinsville and Alpha.
Dichanthium setosum (bluegrass)	V	**May Occur**: this species has been historically recorded in the northern and southern thirds of the rail study area (Wildlife Online and Herbrecs). Suitable habitat for this species exists across most of the rail study area particularly on heavy black clay soils or in moderately disturbed areas.
Eucalyptus raveretiana (black ironbox)	V	**Present**: this species was predicted to occur in the region (Protected Matters Database) and has been historically recorded in the northern part of the study area (Wildlife Online and Herbrecs). Suitable habitat exists on river banks and stream lines in the rail study area. This species was recorded along the banks of the Elliot River during the dry season survey and this identification has been confirmed by the Queensland Herbarium (voucher specimen SFDanielsen147).
Ozothamnus eriocephalus	V	**May Occur**: this species was predicted to occur in the region (Protected Matters Database) and has been historically recorded in the region surrounding the rail study area (Wildlife Online and Herbrecs). Suitable habitat may occur within rocky sclerophyll forests in the rail study area.
Reptiles		
Denisonia maculata (ornamental snake)	V	**Likely to occur**: this species has been historically recorded in the region surrounding the rail study area (Wildlife Online). Suitable habitat exists within the rail study area particularly around the Dawson River catchment area.
Egernia rugosa (yakka skink)	V	**Likely to Occur**: this species was predicted to occur in the region (Protected Matters Database) and has been historically recorded in the region surrounding the rail study area (Wildlife Online). Suitable habitat is present in dry sclerophyll forest and open woodlands surrounding the southern half of the rail study area.
Furina dunmalli (Dunmall's snake)	V	**May Occur**: this species was predicted to occur in the region (Protected Matters Database) however, has not been historically recorded in the region surrounding the rail study area. Habitat is present within remnant brigalow woodland vegetation.
Paradelma orientalis (brigalow scaly-foot)	V	**Likely to Occur**: this species was predicted to occur in the region (Protected Matters Database) and has been historically recorded in the region surrounding the rail study area (Wildlife Online). Suitable habitat is present in open forests and remnant brigalow woodlands.

Name	EPBC Status	Likelihood of Occurrence
Mammals		
Dasyurus hallucatus (northern quoll)	E	**May Occur**: this species was predicted to occur in the region (Protected Matters Database) and has been historically recorded in the region surrounding the rail study area (Wildlife Online). Habitat is present within rocky woodland vegetation.
Birds		
Erythrotriorchis radiatus (red goshawk)	V	**May Occur**: this species was predicted to occur in the region (Protected Matters Database) and has been historically recorded in the region surrounding the rail study area (Wildlife Online). Nesting habitat is present in trees taller than 20 m and within one km of water.
Geophaps scripta scripta (squatter pigeon – southern subspecies)	V	**Present**: squatter pigeons were observed at numerous locations along the rail study area during both the wet and dry season surveys. This species has abundant habitat throughout the Brigalow Belt bioregion. It was predicted to occur in the region (Protected Matters Database) and has been historically been recorded in the rail study area (Wildlife Online).
Poephila cincta cincta (black-throated finch – southern subspecies)	E	**May Occur**: this species was predicted to occur in the region (Protected Matters Database), however has not been historically recorded in the region surrounding the rail study area. Suitable habitat exists in the rail study area, particularly along creeks in the northern sections of the rail study area.
Rostratula australis (Australian painted snipe)	V	**May Occur**: this species was predicted to occur in the region (Protected Matters Database), however has not been historically recorded in the region surrounding the rail study area. Suitable habitat exists in the rail study area among a variety of vegetation types and in association with wetlands and dams.

C.4.2.2.5 Aquatic Fauna

Aquatic reptiles inhabiting the Burdekin Catchment include two crocodile and five freshwater turtle species.

Crocodile species known to inhabit the Burdekin Catchment include the estuarine crocodile (*Crocodylus porosus*) and freshwater crocodile (*Crocodylus johnstoni*). The estuarine crocodile is listed as Marine and Migratory under the EPBC Act and Vulnerable under the NC Act. Overall, estuarine crocodile numbers within the Burdekin Catchment are considered low to very low (DERM 2002). Potentially suitable habitat for the estuarine crocodile within the rail study area is likely to be limited to the tidal creeks of Caley Valley Wetland and the large permanent pool habitats in the Bowen and Bogie Rivers.

The freshwater crocodile is listed as Marine under the EPBC Act. In Queensland, this species primarily occurs in the northwest highlands; Gulp of Carpentaria; Einasleigh uplands and the Cape York Peninsula (Wilson 2009). Small populations also occur on the east coast as a result of translocation and introductions from the pet trade. A small breeding population of freshwater crocodiles has established in the Burdekin Catchment as a result of these introductions (DERM 2010b).

C.4.2.3 Listed Threatened Ecological Communities

Ecological communities are naturally occurring biological assemblages that comprise a particular habitat type. TECs are ecological communities that have been assessed under the EPBC Act and

assigned to one of five categories related to the status of the threat to the community, i.e. conservation dependant, vulnerable, endangered, critically endangered and extinct in the wild.

Four TECs listed under the EPBC Act were identified within the rail study area, all of which are classified as endangered. These are:

- Brigalow (Acacia harpophylla dominant and co-dominant);
- Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin;
- Semi-Evergreen Vine Thickets of the Brigalow Belt (North and South) and Nandewar Bioregions; and
- Weeping Myall Woodlands.

These TECs are described in more detail below.

C.4.2.3.1 Brigalow (*Acacia harpophylla* dominant and codominant)

The Brigalow TEC has been nominated because brigalow communities have undergone a severe decline since the 1940s, and now occupy 10% of their former range (DEH 2001). The main threatening process is broadscale clearing, a practice that saw massive swathes of brigalow and other acacia communities on the fertile clay plains of Central Queensland and northern New South Wales cleared over a number of decades in the post-World War Two period (with the arrival of the bulldozer). This was done primarily to create grasslands for grazing, which are now dominated by the exotic pasture grasses buffel grass and creeping bluegrass.

The Brigalow TEC is comprised of vegetation communities dominated or co-dominated by brigalow (*Acacia harpophylla*), which is a wattle growing to 25 m tall (Maslin 2001). Other species commonly present as emergents or co-dominants include Dawson's gum (*Eucalyptus cambageana*) and belah (*Casuarina cristata*). Brigalow generally occurs on level and gently undulating land forms in clay soils, and is a relatively dense vegetation community, forming open forests. The understorey is shrubby and often relatively dense, and the denser forms of brigalow are referred to as 'scrubs'.

The majority of brigalow is located in the central sections of the rail study area with 101.4 ha of three endangered REs – 11.3.1 (*A. harpophylla* open forest on alluvial plains), 11.4.8 (*E. cambageana* woodland/open forest with *A. harpophylla*) and 11.4.9 (*A. harpophylla* shrubby open forest with *Terminalia oblongata*). The patches of these REs within the Project footprint are generally in poor to moderate ecological condition, having been modified from natural state through landscape fragmentation, weed incursion (parthenium, buffel grass and creeping bluegrass in particular) and the impacts of decades of grazing.

C.4.2.3.2 Natural Grasslands of the Queensland Central Highlands and Northern Fitzroy Basin

The Natural Grassland TEC is estimated to have declined by 64% since European settlement. Of the 36% remaining, 60% is considered to be in a degraded state, and only 10% is in condition considered sustainable. Parthenium in particular is considered to be a major factor in this decline, with buffel grass, parkinsonia and prickly acacia (*Acacia nilotica*) also of concern as invasive weeds (TSSC 2008adq).

This TEC is comprised of grasslands dominated by native grasses occurring on cracking clay plains or undulating rises. The soils are generally dark and relatively deep, and trees and shrubs are very sparse to absent (projective foliage cover for trees is typically less than 10%, and shrubs less than 50%). A set of native tussock grass species have been nominated as indicator species (mostly *Aristida* spp., *Astrebla* spp., *Dichanthium* spp. and *Panicum* spp.) – at least three to four of these indicator species must be present within at least a one hectare patch for the TEC to be present (among other factors) (TSSC 2008adq).

Six REs are nominated as meeting the description of this TEC (TSSC 2008adq), all of which are mapped within the rail study area. Overall, the Project footprint is estimated to encompass 108.4 ha of these REs, the majority of which is located within two REs, 11.4.4 and 11.9.3. However, it is important to note that the standard a vegetation community must meet to be mapped as remnant vegetation under the Queensland VMA is generally lower than that required by the EPBC Act. For example, grasslands that have a high coverage of exotic species but that are expected to recover to a more natural species diversity within 15 years will be mapped as remnant by the Queensland Herbarium (Neldner *et al.,* 2005). By contrast, the diagnostic criteria for the Central Queensland Natural Grassland TEC requires that perennial, non-woody exotic species comprise less than 30% of the total projected perennial plant cover (TSSC 2008adq). This means that many areas within the Project footprint mapped as one of the seven REs listed above may not satisfy the criteria for the Natural Grassland TEC.

In general, it was noted during the survey that many areas with the highest potential for containing the Natural Grassland TEC are now dominated by the pasture grasses buffel grass and creeping bluegrass, or the declared weed parthenium. If such areas within the Project footprint are consistently dominated by either of these exotic grasses in excess of 30% of the area of the grassland patch, they are unlikely to qualify for the TEC.

C.4.2.3.3 Semi Evergreen Vine Thickets of the Brigalow Belt (North and South) and Nandewar Bioregions

The Semi Evergreen Vine Thicket TEC is a dry rainforest variant that occurs in areas with soils of moderate to high fertility with a seasonally dry climate. It contains a mixture of evergreen, semi-deciduous and deciduous plants, has a generally low (to 10 m), uneven canopy in which vines and scramblers are prominent, and is frequently characterised by the presence of an emergent layer of bottle trees (*Brachychiton australis* and *B. rupestris*) (McDonald 2010). This vegetation community is estimated to have been reduced to 9-30% of the pre-European extent (TSSC 2001o).

A list of 10 REs have been included as meeting the definition of this TEC. Five of these REs are mapped as occurring within the rail study area, of which the most significant in terms of area is the RE 11.2.3. In total, an estimated 13.9 ha of the Semi-evergreen vine thicket TEC may occur within the Project footprint, 12.17 ha of which is located in the RE 11.2.3. This TEC is located on soils of moderate to high fertility and does not occur on granite landscapes or in soils derived from granite, such as the vine thicket REs that occur on landzone 12 (including the vegetation communities at the base of Mt Roundback near Abbot Point) (Bill McDonald pers. comm. 17 May 2010). No semi-evergreen vine thicket was identified in areas to be traversed by the alignment during the field investigations. It should be noted that the vegetation alliance ‘Semi-evergreen vine thicket’ identified in the survey encompasses a broader range of communities than that included in this TEC.

C.4.2.3.4 Weeping Myall Woodlands

The Weeping Myall Woodland TEC is a woodland to open woodland community with a canopy to 12 m tall dominated by the weeping myall tree (*Acacia pendula*). As this community occurs on fertile soils there has been a trend towards clearing for agricultural purposes, and it is estimated that approximately 75% of this TEC has been lost in Queensland since Europeans arrived. Weeping myall woodlands cycle through stages where the canopy is partly to completely dead, then move into a recovery period in which the weeping myall trees re-establish. However, if the weeping myall species is not present, this TEC is likewise not present (TSSC, 2009ads). The main stronghold of the Weeping Myall Woodland TEC is in New South Wales, and in Queensland it is mostly found in the Darling River catchment. It is known to occur within the REs 11.3.2 and 11.3.28 (TSSC, 2008ads), of which RE 11.3.2 was confirmed to be present at many locations in the south of the alignment. However, the weeping myall species was not located during the survey and consequently this TEC is not considered to be present in the rail study area.

The REs present within the Project footprint that form part of the above TECs are listed in Table C-5, Table C-6, Table C-7 and Table C-8 with the location within the Project footprint.

Table C-5 Brigalow (*Acacia harpophylla* dominant and co-dominant) TEC REs

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

Table C-6 Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin TEC REs

RE	VMA Status	Short Description
11.3.21	E	*Dichanthium sericeum* and/or *Astrebla* spp. grassland on alluvial plains. Cracking clay soils
11.4.4	LC	*Dichanthium* spp., *Astrebla* spp. grassland on Cainozoic clay plains
11.4.11	LC	*Dichanthium sericeum*, *Astrebla* spp. and patchy *Acacia harpophylla*, *Eucalyptus coolabah* on Cainozoic clay plains
11.8.11	OC	*Dichanthium sericeum* grassland on Cainozoic igneous rocks
11.9.3	LC	*Dichanthium* spp., *Astrebla* spp. grassland on fine-grained sedimentary rocks
11.9.12	E	*Dichanthium sericeum* grassland with clumps of *Acacia harpophylla* on fine-grained sedimentary rocks

Table C-7 Semi-Evergreen Vine Thickets of the Brigalow Belt (North and South) and Nandewar Bioregions TEC REs

RE	VMA Status	Short Description
11.2.3	OC	Microphyll vine forest ("beach scrub") on sandy beach ridges and dune swales
11.4.1	E	Semi-evergreen vine thicket +/- *Casuarina cristata* on Cainozoic clay plains
11.5.15	LC	Semi-evergreen vine thicket on Cainozoic sand plains/remnant surfaces
11.8.3	LC	Semi-evergreen vine thicket on Cainozoic igneous rocks
11.8.13	E	Semi-evergreen vine thicket and microphyll vine forest on Cainozoic igneous rocks.

Table C-8 Weeping Myall Woodlands TEC REs

RE	VMA Status	Short Description
11.3.2	OC	*Eucalyptus populnea* woodland on alluvial plains

C.4.2.4 Listed Migratory Species

Twenty-three EPBC-listed Marine and/or Migratory bird species were recorded in the rail study area. Twenty- three bird species listed as Marine or Migratory under the EPBC Act were recorded during dry season surveys. Fifteen bird species listed as Marine or Migratory under the EPBC Act were recorded during wet season surveys. *Crocodylus porosus* (estuarine crocodile) was assessed as possibly occurring within the rail study area. Migratory species observed within the rail study area are listed in Table C-9, below.

Table C-9 Marine and Migratory species observed within the Rail Study Area

Species Name	Common Name	EPBC Status
Anthus novaeseelandiae	Australasian pipit	Marine
Apus pacifica	fork-tailed swift	Marine Migratory
Ardea intermedia	intermediate egret	Marine
Cacomantis flabelliformis	fan-tailed cuckoo	Marine
Coracina novaehollandiae	black-faced cuckoo-shrike	Marine
Coracina papuensis	white-bellied cuckoo-shrike	Marine
Coracina tenuirostris	cicadabird	Marine
Dicrurus bracteatus	spangled drongo	Marine
Egretta garzetta	little egret	Marine
Eurostopodus argus	spotted nightjar	Marine
Eurystomus orientalis	dollarbird	Marine
Falco cenchroides	nankeen kestrel	Marine
Haliaeetus leucogaster	white-bellied sea-eagle	Marine, Migratory
Haliastur sphenurus	whistling kite	Marine
Merops ornatus	rainbow bee-eater	Marine, Migratory
Myiagra cyanoleuca	satin flycatcher	Marine, Migratory
Nettapus coromandelianus	cotton pygmy-goose	Marine
Ninox novaeseelandiae	southern boobook	Marine
Pelecanus conspicillatus	Australian pelican	Marine
Petrochelidon nigricans	tree martin	Marine
Scythrops novaehollandiae	channel-billed cuckoo	Marine
Todiramphus macleayii	forest kingfisher	Marine
Todiramphus sancta	sacred kingfisher	Marine

C.5 Assessment of Relevant Impacts

C.5.1 Coal Mine and Associated Infrastructure

C.5.1.1 Land Clearing

Twelve vegetation communities were identified on the Project site during the AARC field survey. None of these communities were listed under the EPBC Act although eleven of these communities were classed as Remnant Vegetation as defined in the VM Act. Associations within the communities reflect

different vegetation structures and compositions, which occur on different geophysical locations. The corresponding Queensland Herbarium RE classifications are noted for each of the described remnant vegetation communities and are shown below in Table C-10.

Table C-10 Conservation Significance of Regional Ecosystems Identified in the Mine Study Area.

Vegetation Community	RE or Ecological Community	EPBC Act Status	Queensland VM Act Status	DERM Biodiversity Status
Brigalow Open Woodland	10.3.3	Not Listed	Least Concern	No Concern at Present
Silver-leaved Ironbark Open Woodland	10.3.28	Not Listed	Least Concern	No Concern at Present
Silver-leaved Ironbark Open Woodland	10.5.5a	Not Listed	Least Concern	No Concern at Present
Poplar Box Open Woodland	10.3.27a	Not Listed	Least Concern	Of Concern
Poplar Box Open Woodland	10.5.12	Not Listed	Least Concern	No Concern at Present
Non-remnant Grassland	Not Classed	Not Listed	Not Listed	Not Listed
Silver-leaved Ironbark / Poplar Box Mixed Woodland	10.5.5a	Not Listed	Least Concern	No Concern at Present
Silver-leaved Ironbark / Poplar Box Mixed Woodland	10.5.12	Not Listed	Least Concern	No Concern at Present
White Cypress Pine Woodland	11.5.5b	Not Listed	Least Concern	No Concern at Present
Gidgee Open Woodland	10.3.4	Not Listed	Least Concern	Of Concern
Fringing Riparian Woodland	10.3.14	Not Listed	Least Concern	Of Concern
Fringing Riparian Woodland	11.3.2 (south eastern watercourse only)	Not Listed	Of Concern	Of Concern
Weeping Bottlebrush Heath	10.7.7	Not Listed	Least Concern	No Concern at Present
Thozet's Box Open Woodland	10.7.5	Not Listed	Least Concern	Of Concern
Lancewood Woodland	10.7.3	Not Listed	Least Concern	No Concern at Present
Queensland Yellowjacket Low Woodland	10.5.1	Not Listed	Least Concern	No Concern at Present

C.5.1.2 EPBC Act Listed Threatened Ecological Communities

Although no EPBC Act listed TECs have been identified in the mine study area, land clearing and mining activities may reduce the available habitat for native flora species. This may lead to a loss of habitat connectivity across the mine infrastructure and pit areas and a possible restriction of fauna movements within adjacent wildlife corridors. Furthermore, vegetation clearing may lead to the degradation of habitat values in adjacent habitats.

C.5.1.3 Subsidence

Subsidence impacts are not anticipated from this project given that all mining operations will utilize the open cut method.

C.5.1.4 Water Resources and Pollution

Mine water demands for the Project comprise:

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

A summary of the water demands is provided in Table C-11Table C-11. The demand increases over the life of the Project, with the peak occurring in Year 30.

Table C-11 Water Demand Summary for Mine

Year	CHPP make-up water (ML/yr)	Dust suppression (ML/yr)	MIA demand (ML/yr)	Potable water demand (ML/yr)	Total site demand (ML/yr)
Year 1	4,981	1,952	240	210	7,383
Year 5	8,111	2,201	391	167	10,870
Year 10	8,111	2,512	391	140	11,154
Year 20	8,111	3,134	391	144	11,780
Year 30	8,111	3,757	391	154	12,413

One of the waterways within the Project, Lagoon Creek, will need to be partly diverted at the commencement of the Project in order to facilitate mining operations and minimize sterilization of coal. The planned diversion of Lagoon Creek is 300 metres (m) wide, and extends for 9.6 km and may result in some impacts on the environmental values of the aquatic flora and fauna:

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

- Works occurring in the creek during and immediately following periods of flow may impede fish movements.

Mitigation measures to reduce the potential impacts to water resources are discussed in Section C.6.1.4.

Conversely, there is potential for mine-related infrastructure, such as sediment dams, to be accessible to fauna and these may be used as additional water sources.

C.5.1.5 Weeds and Exotic Fauna

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

An increase in introduced fauna species may occur as the mine study area becomes utilised. This includes species such as the cane toad, feral pig, house mouse and feral goat.

C.5.2 Impact Assessment for MNES

C.5.2.1 Flora

The field survey and desktop assessments indicate that no EPBC Act listed flora species are considered likely to be present within the mine study area and therefore the Project is not considered likely to have an impact on EPBC Act listed flora species.

C.5.2.2 Fauna

C.5.2.2.1 Squatter Pigeon (Southern Subspecies)

The southern squatter pigeon was recorded during the surveys, with approximately 30 individuals observed in Non-remnant Grassland habitat within the mine study area. This species is listed as Vulnerable under the EPBC Act.

Threats to this species include overgrazing of habitat by domestic stock and the European rabbit, trampling of nests by domestic stock, predation by feral cats and foxes, illegal shooting and clearing and fragmentation of grassy woodland habitat for agriculture and development (Department of Environment and Conservation, 2009).

Given the species' regional abundance and abundance of available habitat within the region, the Project is considered unlikely to have a substantial impact on local populations of the species.

C.5.2.2.2 Marine/Migratory Species

The distribution of all observed marine and migratory avifauna species is widespread throughout eastern Queensland, and the local populations on the mine study area are unlikely to constitute an 'ecologically significant proportion' of the total population of the species. Furthermore, the mine study area is not at the limit of these species' range, nor are these species considered to be declining within

the region. Therefore, it is unlikely the Project will have a substantial impact on the regional populations of these species.

C.5.2.3 Summary of Impacts on Matters of National Environmental Significance

Assessment of the impacts to MNES identifies that the Project may potentially impact a small number of avifaunal species. Of the 26 fauna and 21 migratory fauna EPBC Act listed species identified from the desktop survey, only the squatter pigeon (*Geophaps scripta scripta*) is anticipated to be potentially impacted by the Project. The remaining species are generally widely distributed throughout Queensland and are not anticipated to be substantially impacted.

Results from this assessment show that no EPBC Act listed flora species or TECs are likely to be affected by the Project.

C.5.3 Rail

C.5.3.1 Land Clearing

Loss of vegetation represents one of the most substantial impacts causing localised reductions in vegetation community extent and a reduction in the diversity and abundance of habitats and resources for flora and fauna.

The Alpha Coal Project (Rail) crosses 10 Endangered REs, comprising 111.4 ha in total. All are listed as components of a TEC under the EPBC Act. Six Endangered REs are brigalow communities, two are grasslands and two are semi-evergreen vine thicket communities (Queensland Herbarium, 2009). Impact on the four Endangered TECs listed under the EPBC Act identified within the rail study area are discussed in Section C.5.4.2 below. Table C-12 provides a summary of the higher conservation status REs within the Project footprint, the expected clearing area, and the current extent of these REs across the bioregion and within the subregions traversed by the Project.

The Endangered REs within the Project that are most vulnerable to impacts from clearing are those with low overall current extents, and those with low representation within the protected area estate. Of the 10 REs within the Project footprint, four have a current extent of less than 10,000 ha, and three had less than 5,000 ha in 2005 (Accad *et al*. 2008). Of the latter, the RE with the lowest remnant coverage in 2005 was 11.4.1, with 2,312 ha. However, this RE has a relatively high representation within the protected area estate (60% of the current extent), and less than 0.11% of the current extent is located within the Project footprint.

The remaining REs with current extents less than 5,000 ha are 11.5.16 (3,027 ha, with 156 ha in the protected area estate) and 11.9.12 (4,135 ha, and with 8 ha in the protected area estate). Of these, the RE 11.9.12 (a native grassland RE that is also part of the Natural Grassland TEC under the EPBC Act) (Queensland Herbarium, 2009; TSSC 2008adq) is particularly poorly protected, with only 0.19% of its total current extent in the protected area estate.

The Alpha Coal Project (Rail) crosses 19 Of Concern REs, comprising 104.1 ha in total. One third of these REs are situated on alluvial plains, the most commonly encountered being the RE 11.3.2. This RE was present in the Alpha Coal (Rail) Project. south of the Suttor Creek crossing, and is the Of Concern RE with the largest area within the Project footprint (25 ha). Forms of RE 11.3.2 that contain weeping myall (*Acacia pendula*) can meet the description of the Weeping Myall Woodland TEC. However, no weeping myall trees were located within the Alpha Coal (Rail) Project. and this TEC is not

considered likely to be present. Two Of Concern REs within the Project footprint are listed as components of the Endangered Natural Grasslands TEC, and one Of Concern RE is listed as a component of the Endangered Semi Evergreen Vine Thicket TEC.

As shown in Table C-12, six of the 19 Of Concern RE's have a current extent less than 10,000 ha, and three have a current extent less than 5000 ha (Accad, 2008). The most substantial impact on Of Concern REs will be on RE 11.2.3 (an RE considered part of the Semi Evergreen Vine Thicket TEC). The Project requires the removal of 12.2 ha of RE 11.2.3. This represents 7.7% of its subregional extent of 158 ha. Approximately 12.7% of its current extent is held within protected areas estates. The remaining Of Concern REs are either well represented in the protected area estate relative to their current extent, or have a current extent in excess of 18,000 ha (generally much more). The percentage figure for RE 11.2.3 is likely to be high in relation to other REs because RE 11.2.3 is a littoral community, confined to the coast. This project footprint traverses only one coastal subregion, the Townsville Plains subregion. By contrast, inland subregions are well-represented within the Project footprint.

When the expected clearing extent is compared against the total current extent, the figure is 0.5%, which is not as low in relative terms, but which still places this RE as the second highest in terms of relative impact, behind RE 11.9.12 (whose project loss relative to overall current extent is expected to be 0.9%). All other Of Concern REs within the Project footprint have relative clearing areas of less than 0.5% of their subregional extent.

Table C-12 Higher Conservation Status REs Showing Expected Clearing Impacts

REs	VMA/EPBCA Status	Proposed Clearing Area (ha)	Bioregion Current Extent (ha)	Subregion[2] Current Extent (ha)	%	Protected Area Estate (% of total
Endangered REs						
11.3.1	Endangered Brigalow TEC	24.45	80, 679	23,811	0.10%	30, 702 ha (39.05 %)
11.3.21	Endangered Natural Grassland TEC	0.09	54, 459	7,581	0.00%	196 ha (0.36 %)
11.4.1	Endangered SEVT TEC	0.42	2, 312	381	0.11%	1, 388 ha (60.03 %)
11.4.8	Endangered Brigalow TEC	25.45	71, 909	40,088	0.06%	7, 032 ha (9.78 %)
11.4.9	Endangered Brigalow TEC	51.55	96, 425	43,699	0.12%	25, 851 ha (26.81 %)
11.5.16	Endangered Brigalow TEC	1.13	3, 027	888	0.13%	156 ha (5.15 %)
11.8.13	Endangered SEVT TEC	0.07	6, 327	4,826	0.00%	383 ha (6.05 %)
11.9.1	Endangered Brigalow TEC	7.25	55, 195	5,245	0.14%	6, 930 ha (12.56 %)
11.9.5	Endangered Brigalow TEC	0.57	168, 841	11,402	0.00%	32, 049 ha (18.98 %)
11.9.12	Endangered Natural	0.45	4, 135	2,914	0.02%	8 ha (0.19 %)

REs	VMA/EPBCA Status	Proposed Clearing Area (ha)	Bioregion Current Extent (ha)	Subregion[2] Current Extent (ha)	%	Protected Area Estate (% of total
	Grassland TEC					
Of Concern REs						
11.2.3	Of Concern Semi-Evergreen Vine Thicket TEC	12.16	2,513	158	7.70%	319 ha (12.69 %)
11.3.2	Of Concern Myall Woodland TEC	25.42	528,081	107,484	0.02%	142, 824 ha (27.04 %)
11.3.3	Of Concern	15.40	282,541	113,706	0.01%	33, 025 ha (11.69 %)
11.3.4	Of Concern	7.17	186,652	37,528	0.02%	39, 442 ha (21.13 %)
11.3.13	Of Concern	0.15	2,853	1,488	0.01%	562 ha (19.70 %)
11.3.33	Of Concern	7.61	1,672	1,294	0.59%	Not represented
11.3.34	Of Concern	3.38	9,044	9,024	0.04%	Not represented
11.4.2	Of Concern	0.97	34,633	10,307	0.01%	849 ha (2.45 %)
11.4.5	Of Concern	0.45	13,260	12,911	0.00%	2, 866 ha (21.61 %)
11.4.6	Of Concern	0.68	34,851	29,268	0.00%	9, 339 ha (26.80 %)
11.4.11	Of Concern Threshold RE Natural Grassland TEC	8.48	23,372	22,767	0.04%	200 ha (0.86 %)
11.5.10	Of Concern	7.80	9,901	2,052	0.38%	Not represented
11.8.3	Of Concern	0.001	26,458	2,738	0.00%	3411 ha (12.89 %)
11.8.11	Of Concern Natural Grassland TEC	2.90	176,127	22,366	0.01%	1, 858 ha (1.05 %)
11.9.10	Of Concern	4.95	83,507	19,526	0.02%	6, 937 ha (8.31 %)
11.11.10	Of Concern	0.13	88,109	50,060	0.00%	7, 656 ha (8.69 %)
11.11.13	Of Concern	4.30	53,711	24,737	0.02%	1, 101 ha (2.05 %)
11.11.16	Of Concern	0.09	18,085	8,975	0.00%	1, 589 ha (8.79 %)
11.12.10	Of Concern	2.12	8,918	730	0.29%	Not represented
Least Concern REs of High Conservation Significance – TECs or Threshold REs						
11.3.5	Least Concern Threshold RE	8.39	56,064	44,464	0.02%	6, 036 ha (10.77 %)
11.4.4	Least Concern Brigalow TEC	54.58	24,917	20,940	0.26%	Not represented
11.5.5	Least Concern Threshold RE	2.62	134,826	4,938	0.05%	40, 865 ha (30.31%)
11.5.15	Least Concern Threshold RE SEVT TEC	1.32	14,955	2,286	0.06%	1, 793 ha (12.00 %)

REs	VMA/EPBCA Status	Proposed Clearing Area (ha)	Bioregion Current Extent (ha)	Subregion[2] Current Extent (ha)	%	Protected Area Estate (% of total
11.8.3	Least Concern Threshold RE SEVT TEC	0.001	26,458	2,738	0.00%	3411 ha (12.89 %)
11.9.3	Least Concern Natural Grassland TEC	41.90	160,830	9,411	0.45%	484 ha (0.30%)

Notes:
[1]Figures calculated from Accad *et al*. 2008: 'current extent' is of 2005, where this is <10, 000 ha it is shown in bold; [2] This is the sum of each REs current extent from all of the subregions/provinces traversed by the Alpha Coal (Rail) Project. – Bogie River Hills (2), Northern Bowen Basin (6), Belyando Downs (7), South Drummond Basin (13), Upper Belyando Floodout (8) in the Brigalow Belt; [3] % = proposed clearing extent as % of subregion current extent – if less than 0.01% then 0.00% is shown; [4] Protected area estate = national park, state forest, conservation park, timber reserve – figures in bold highlight REs with no representation or less than 500 ha.

C.5.3.2 Subsidence

The construction of the railway will not cause subsidence.

C.5.3.3 Water Resources and Pollution

During construction water will be required for several activities, including:

Water of reduced quality:

- Moisture conditioning of earthworks;
- Dust suppression; and
- Vehicle wash-down.

High quality water:

- Concrete batching; and
- Construction campsite and offices.

It has been estimated that approximately 11 x 10^9 litres will be required for construction purposes. As long as the construction water does not interfere with the natural waterways, impacts on surface water will be minimal. However, while washing down vehicles weed seeds and other contaminants are easily released. Surface water run-off can carry these seeds and contaminants into a waterway.

During the operational phase water supply for operating the rail will be minimal. However, the use of low residual chemicals (glycophosphate based) for weed and vermin control may impact on surface water.

C.5.3.4 Sedimentation and Erosion – Construction Phase

Construction activities will require substantial earthworks. This could result in point-source pollution from sedimentation and run-off. These can have a localised impact on wildlife through habitat degradation by reducing the quality and abundance of refuges, microhabitats and food availability by smothering native vegetation and water bodies with sediment.

Sedimentation of aquatic habitats can result in increased turbidity; decreased oxygen levels; reduced light penetration; change in channel morphology and alteration of substrate composition. These impacts may have a localised effect on aquatic flora and fauna by reducing habitat value in the immediate downstream area. For this reason, areas of permanent water, such as Caley Valley, the Bowen River and adjacent farm dams, may require additional protective measures to minimise impacts from sedimentation and run-off. The impacts of run-off and sedimentation can be reduced by implementing the mitigation measures detailed in Section C.6.2.1.6.1.

C.5.3.5 Changes to Floodplain Hydrology – Construction Phase

The rail study area is located in a low gradient catchment with extensive floodplains. The construction of the rail line will cross these floodplains and create a barrier to the previous flow of water. Note that the previous flow may not be natural, as many of the flat expanses of land have been human altered. Despite this the alteration of floodplain hydrology may impact downstream locations and that may play an important role in the ecology of water reliant species.

C.5.3.6 Sedimentation and Run-off – Operational Phase

There are potential indirect impacts to flora and fauna as a result of minor localised run-off and sedimentation throughout the operational life of the Project and associated all weather access road. Permanent water sources, e.g. adjacent farm dams and the Bowen River are likely to be sensitive to indirect impacts from sedimentation and run-off including reduced water quality and introduction of contaminants or pollutants into the water supply. Such effects could impact on the health of riparian and water dependant vegetation or could prove toxic to fauna species. The incorporation of suitable vegetated drains and catch dams along the length of the rail alignment will substantially reduce the impacts of runoff and sedimentation. This can be further reduced by implementing a range of mitigation measures as outlined in Section C.6.2.1.6.2 .

C.5.3.7 Weeds and Exotic Fauna

Vegetation clearance and increased human activities have the potential to further degrade the quality of adjoining habitats through edge effects. These typically lead to a localised increase in weed and pest fauna, changes in habitat microclimates, such as increased light penetration, and have the potential to change the species composition within the affected vegetation community.

Environments comprising much of the rail study area are already highly disturbed from current grazing land use practices with large areas already containing infestations of weeds such as parthenium and rubber vine and pest animals including the European rabbit and cane toad.

An increase in bare ground and open areas will favour weedy species, particularly parthenium, which can suppress the regeneration of native species and reduce the available habitat for native species. Pest species can also use the rail easement as a linear pathway for movement between populations. Competition and predation by feral animals has the potential to reduce the abundance and diversity of local terrestrial and aquatic fauna.

While the existing landholders undertake periodic weed and pest management actions including spraying, baiting and shooting, the entire rail alignment is not actively managed for weed and pest species. The impacts of weed and pest infestations can be reduced and potentially improved by developing and implementing a weed and pest management plan for the Project.

C.5.4 Impact Assessment for MNES

C.5.4.1 Protected Areas

No vegetation clearing is required within protected areas for this Project. As three protected areas; Mazeppa National Park, Mount Abbot and the Bowen River Wetlands each occur within five kilometres of the rail study area, indirect impacts such as changes to hydrology, water quality and fauna movement away from the rail study area and into these protected areas are a likely result. The rail alignment also has the potential to restrict regional movement of ground-dwelling fauna within the Bioregional Wildlife Corridor connected to Mount Abbot.

The proposed rail alignment does cross the Belyando River upstream of Epping Forest National Park. As such, there is potential for coal debris and other point source pollution to impact the river. However, the impacts of coal deposition are unlikely to be transported as far as the Epping Forest National park and are likely to be intercepted by vegetation and substrates within the vicinity of the Belyando River crossing. Sediment controls and coal dust barriers will be established at the Belyando River crossing (and other river and stream crossings) to mitigate the potential for point source pollution. For these reasons and given restriction of this species to Epping Forest National Park, the project is unlikely to have direct or indirect impacts on the Northern Hairy-nosed Wombat or its habitat.

Vegetation clearing for the rail alignment construction and increased vehicular movements as a result of construction nearby to these protected areas will open up new areas to disturbances, such as weeds and pest animals, which may also start to invade the nearby protected areas. Previously described impacts such as changes to floodplain hydrology and sedimentation and run off may have cumulative downstream impacts on the Bowen River and directly impacts on the 14.5 ha of Caley Valley Wetlands which the rail loop intercepts. Potential impacts could include changes in water quality and quantity. In order to minimise impact the construction phase will occur in the dry season if possible and the rail loop will include culverts to allow water movement.. Following mitigation, the residual impact of sedimentation and run-off is expected to be negligible.

C.5.4.2 EPBC Act Listed Threatened Ecological Communities

Four TECs listed under the EPBC Act were identified within the rail study area, all of which are classified as endangered. These are:

- Brigalow (Acacia harpophylla dominant and co-dominant);
- Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin;
- Semi Evergreen Vine Thickets of the Brigalow Belt (North and South) and Nandewar Bioregions; and
- Weeping Myall Woodlands.

The REs present within the Project footprint that form part of these TECs are listed in Table C-13 to Table C-16 with the location within the Project footprint and the estimated area of direct impact.

The area to be cleared has been minimised in the design phase by locating the Project footprint in areas that have been previously cleared or degraded by past land use practices. However, the Project footprint will require the disturbance of approximately 233 ha of REs listed under the EPBC Act as constituents of TECs, including a potential 110 ha of the Brigalow TEC REs, 108 ha of the Natural

Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin TEC REs, and 14 ha of the Semi Evergreen Vine Thicket TEC REs.

Table C-16 indicates that approximately 25 ha of Weeping Myall Woodlands TEC occurs within the Project footprint. This TEC is known to occur within the RE 11.3.2, which is present at many locations along the alignment. However, as the weeping myall species (*Acacia pendula*) was not present, this TEC was considered likewise not present.

Table C-13 Areas of Impact for Brigalow (Acacia harpophylla dominant and co-dominant) TEC REs

RE	VMA Status	Location	Area[1]
11.3.1	E	Between Bowen and Belyando Rivers	24.45 ha (24.13 ha)
11.4.8	E	Between Suttor Creek and Belyando River	25.45 ha (1.41 ha)
11.4.9	E	Between Suttor Creek and Belyando River	51.55 ha (15.77 ha)
11.5.16	E	Area immediately north of Suttor Creek crossing	1.13 ha[2]
11.9.1	E	Between Leichhardt Range and Bowen River	7.25 ha
11.9.5	E	Between Leichhardt Range and Bowen River	0.57 ha
		Brigalow TEC TOTAL	**110.00 ha**

Table C-14 Areas of Impact for Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin TEC REs

RE	VMA Status	Location	Area[1]
11.3.21	E	Central section of project footprint	0.09 ha
11.4.4	LC	Centred on Pelican Creek, west of Collinsville	54.58 ha
11.4.11	LC	Mostly between Gregory Devt. Rd and Eaglefield Creek	8.48 ha
11.8.11	OC	South of Native Companion Creek, and between Leichhardt Range and Bowen River	2.90 ha
11.9.3	LC	Between Leichhardt Range and Pelican Creek	41.90 ha
11.9.12	E	Between Pelican Creek and the Bowen River	0.45 ha
		Natural Grassland TEC TOTAL	**108.40 ha**

Table C-15 Areas of Impact for Semi-Evergreen Vine Thickets of the Brigalow Belt (North and South) and Nandewar Bioregions TEC REs

RE	VMA Status	Location	Area[1]
11.2.3	OC	Near Abbot Point railhead	12.16 ha
11.4.1	E	In the vicinity of the Suttor Creek crossing	0.42 ha
11.5.15	LC	Adjacent to the Newlands Mine, just north of the Leichhardt Range	1.32 ha (8.98 ha)
11.8.3	LC	In ‘gorges’ of the Leichhardt Range, and plains to the north of the range	0.001 ha (2.46 ha)
11.8.13	E	Between Suttor Creek and Bowen River crossings	0.07 ha (14.31 ha)
		Semi evergreen vine thicket TEC TOTAL	**13.97 ha**

Table C-16 Areas of Impact for Weeping Myall Woodlands TEC REs

RE	VMA Status	Location	Area[1]
11.3.2	OC	Between Bowen River and Eaglefield Creek, and between Clermont-Laglan Rd and Native Companion Creek	25.42 ha (43.53 ha)
		Weeping Myall TEC TOTAL	**25.42 ha**
		OVERALL TOTAL	**257.79 ha**

Notes for Tables 5-1 to 5-4:
[1] Area as calculated based on ground-truthed RE mapping. Figure in brackets is the area according to the official version 6 RE mapping (only provided where there is disagreement between the sources);
[2] RE 11.5.16 does not occur in the Project footprint under the version 6 RE mapping.

C.5.4.3 Flora

One species of flora listed as being of conservation significance was detected during the field surveys – *Eucalyptus raveretiana* (black ironbox), which is listed as Vulnerable under the EPBC Act. This species was one of the dominant components of fringing riparian open forest along the Elliot River, near the far northern terminus of the Project footprint. The alignment is now located some four kilometres downstream of the location of this survey site, at a point that was not able to be reached during the field surveys. However, as black ironbox was the dominant species along the river it is considered highly likely that it will still be present at the location of the current crossing point.

Another species, *Dichanthium queenslandicum* (king bluegrass), is considered to be likely to occur within the Project footprint. King bluegrass is listed as Vulnerable under the EPBC Act. This species is known to occur in the central sections of the Project footprint on native grasslands on self mulching, black cracking clays, between chainage 285,000 and 325,000 (collected from adjacent to the Project footprint by GHD previously - voucher specimen SD120308.1). It is also likely to occur in any native grassland south of Eaglefield Creek.

A further three species have suitable habitat within the Project footprint and may occur. Of these, one has habitat requirements met by eucalypt woodland/open forest, one occurs in semi evergreen vine thicket or similar communities, and one occurs in native grasslands. These species include:

- *Croton magneticus* (Magnetic Island croton) (EPBC Act: Vulnerable) – occurs in semi-evergreen vine thicket no further inland than Collinsville (Calvert et al. 2005), and has been recorded from within the general vicinity of the rail study area previously;
- *Dichanthium setosum* (EPBC Act: Vulnerable) – recorded in native grasslands on black clays from within the vicinity of the rail study area (Herbrecs records); and
- *Ozothamnus eriocephalus* (EPBC Act: Vulnerable) – recorded in rocky sclerophyll woodland/open forest from within the vicinity of the rail study area.

The major threat to these species from the Project are related to direct removal of populations or parts of populations, permanent removal of suitable habitat area taken up by rail infrastructure, or due to habitat modification, and the introduction of pests or diseases that may result in population declines. In particular, the introduction of parthenium into new areas of grassland adjacent to the Project footprint that are subject to heavy grazing pressures has the potential to interrupt breeding cycles for small herbs and rare grasses for many seasons. If this occurs over an entire population for enough seasons, the entire population could be permanently extinguished.

C.5.4.4 Fauna

One conservation significant fauna species was recorded from field surveys within the rail study area - *Geophaps scripta scripta* (squatter pigeon). Another conservation significant species, the Northern Hairy-nosed Wombat (*Lasiorhinus krefftii*), was not identified on site nor identified by the MNES search. Given the restricted distribution of the Northern Hairy-nosed Wombat (*Lasiorhinus krefftii*) to Epping Forest National Park and the distance to the proposed railway alignment, it is unlikely that the project will have direct or indirect impacts on this species or its habitat.

An additional eight conservation significant fauna species may occur as suitable habitat exists within the rail study area. These include the EPBC Act listed *Erythrotriorchis radiatus* (red goshawk), *Egernia rugosa* (yakka skink), *Denisonia maculata* (ornamental snake), *Paradelma orientalis* (brigalow scaly-foot), *Furina dunmalli* (Dunmall's snake), *Rostratula australis* (Australian painted snipe), *Poephila cincta cincta* (black-throated finch (southern)) and *Dasyurus hallucatus* (northern quoll). Twenty-three EPBC Act listed Marine and/or Migratory bird species have been recorded within the rail study area. Potential specific impacts relating to the EPBC Act listed fauna species recorded from the rail study area are listed below:

C.5.4.4.1 *Geophaps scripta scripta* (squatter pigeon)

Geophaps scripta var. *scripta* is listed as Vulnerable under the EPBC Act. This species was observed during survey work. The species spends much of the time on the ground where it nests and forages. *Geophaps scripta scripta* (squatter pigeon) is known to freeze in its position when danger approaches. For this reason individuals may be susceptible to direct mortality. The bird has been seen feeding besides railway lines and roadsides. In Queensland, much of the pigeon's original habitat has been planted to pasture grass for cattle. This has led to a decrease in the abundance of natural food source, however improved pastures are possibly an important source of food especially when at least a few scattered trees are found nearby (Higgins and Davies 1996).

Threats to the squatter pigeon in the rail study area include:

- Potential direct mortality of a small number of individuals as this ground-dwelling species is known to remain still on the ground when danger approaches and is therefore susceptible to mortality from vehicle strike for example;
- Reduced movement within remaining habitats bisected by the rail alignment; and
- Indirect impacts on this species as a result of habitat displacement from vegetation clearing include:
  - Competition for grasses from introduced herbivores;
  - Predation by feral pests (cats and foxes); and
  - Loss of preferred riparian habitats through stock grazing and clearing.

Given the species' regional abundance and abundance of available habitat within the region, the Project is considered to have a negligible impact on local populations of the species. The incidence of direct mortality will also be reduced by implementing the mitigation measures outlined in Section C.6.2.1.4.

C.5.4.4.2 *Denisonia maculata* (Ornamental snake), *Paradelma orientalis* (Brigalow scaly-foot) and *Egernia rugosa* (yakka skink)

Three EPBC Act listed reptile species are considered likely to occur within the rail study area. These species were not recorded in surveys but are considered likely to occur based on the presence of suitable habitat. All three species occur in *Acacia harpophylla* (brigalow) with black cracking clay soils and gilgais. *Egernia rugosa* also occurs in open woodland and dry sclerophyll forest. The project footprint traverses a number of areas of suitable habitat, however the majority of these areas have been cleared of woody cover (*Acacia harpophylla*), fallen timber and leaf litter. These ground features are important in maintaining soil moisture and thermal conditions, all of which are considered important habitat requirements for invertebrates and this in turn on the diversity and abundance of frogs which feed on them and then in turn on the snakes. These features also are considered important refuges during drier conditions. It is considered that prior to European settlement the region would have been likely to support good quality habitat for these species. However, given the high level of cattle grazing within the rail study area and the associated disturbances, much of the region only supports marginal and poorer quality habitat for these species.

Threats to the ornamental snake, brigalow scaly-foot and yakka skink include:

- Direct mortality as a result of vegetation clearing within gilgai habitat areas; and
- Habitat fragmentation and restricted movement due to the 'barrier effect' of the rail alignment in habitat areas. The use of the culverts by ornamental snakes is unknown, but other snake species are known to use such structures. Provided mitigation measures are implemented the Project is not considered to likely to substantially impact on these species.

C.5.4.5 Aquatic Fauna

MNES relating to aquatic environmental values that may be impacted by Alpha Coal Project (Rail) include the estuarine crocodile (*Crocodylus porosus*) and freshwater crocodile (*Crocodylus johnstoni*).

Potential impacts of Alpha Coal Project (Rail) construction and operation on the crocodiles are primarily associated with the degradation of potential habitat as a result of altered in-stream hydrology; increased sedimentation, run-off and dust; coal dust emission and increase noise, light and vibration disturbance. These impacts have been assessed against DSEWPCs Significant Impact Guidelines for Listed Migratory Species (Table C-17) for the estuarine crocodile and DSEWPCs Significant Impact Guidelines for The Commonwealth Marine Environment (Table C-18) for the freshwater crocodile. Due to the extremely low abundance of estuarine crocodiles and potential estuarine crocodile habitat within the study area the impact of Alpha Coal Project (Rail) construction and operation on this MNES is considered low.

Table C-17 MNES Significant Impact Criteria Assessment – Listed Migratory Species

MNES Significant Impact Criteria	Estuarine Crocodile (*Crocodylus porosus*)
Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species.	No important estuarine crocodile habitat occurs within the Alpha Coal (Rail) Project footprint. A small number of individuals may potentially occur in the Bowen and Bogie Rivers however permanent habitat does not occur at the locations of the rail crossings.
Result in an invasive species that is harmful to the	The increase in abundance and diversity of

MNES Significant Impact Criteria	Estuarine Crocodile (*Crocodylus porosus*)
migratory species becoming established in an area of important habitat for the migratory species.	introduced species within the Alpha Coal (Rail) Project footprint as a result of Alpha Coal (Rail) Project construction and operation is considered a Medium risk. An increase in weeds species within the riparian zone has the potential to decrease the suitability of nesting habitat for the estuarine crocodile however as nesting is unlikely to occur within the study area, the likelihood of impact is low.
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.	Habitat degradation, as a result of altered in-stream hydrology; increased sedimentation, run-off and dust; coal dust emission and noise, light and vibration disturbance, has the potential to disrupt estuarine crocodile behaviour within habitats adjacent to the rail corridor. As these habitats have a low value for the estuarine crocodile and are likely to support only a small number of individuals, the likelihood of impact is considered low.
Have a substantial adverse effect on a population of a marine species or cetacean including its life cycle (for example, breeding, feeding, migration behaviour, and life expectancy) and spatial distribution.	No important freshwater crocodile habitat occurs within the Alpha Coal (Rail) Project footprint. A small number of individuals may potentially occur in the Bowen and Bogie Rivers however these individuals have been introduced to the Catchment and are not an important component of the larger freshwater crocodile population.

Table C-18 Matters of National Environmental Significance Significant Impact Criteria Assessment – The Commonwealth Marine Environment

MNES Significant Impact Criteria	Freshwater Crocodile (*Crocodylus johnstoni*)
Have a substantial adverse effect on a population of a marine species or cetacean including its life cycle (for example, breeding, feeding, migration behaviour, and life expectancy) and spatial distribution.	No important freshwater crocodile habitat occurs within the Alpha Coal (Rail) Project footprint. A small number of individuals may potentially occur in the Bowen and Bogie Rivers however these individuals have been introduced to the Catchment and are not an important component of the larger freshwater crocodile population.

C.5.4.6 Summary of Impacts on Matters of National Environmental Significance

Table C-19 below provides a summary of MNES present at the site and the residual impacts. These impacts have been assessed against DSEWPC's Significant Impact Guidelines.

Table C-19 Summary of impacts on Matters of National Environmental Significance

Name/EPBC Status	Location	Likelihood of Impact	Response against criteria
Australian Heritage places			
Mazeppa National Park	South of chainage 155,000	Not likely	The study area is located 3.2 km from this National Park
Mount Abbot	South and east of chainage 440,000 &	Not likely	The study area is located 4 km from Mount Abbot

Name/EPBC Status	Location	Likelihood of Impact	Response against criteria
	460,000		
Threatened Ecological Communities			
Brigalow	Refer to Table C-13	Likely	Restricted to clearing of approximately 110 ha. Detailed mapping of brigalow communities meeting the EPBC Act TEC description required so as to quantify impacts in detail. Locally, impacts may be substantial to some patches.
Natural Grasslands	Refer to Table C-14	Likely	Restricted to clearing of approximately 108 ha. Detailed mapping of natural grassland communities meeting the EPBC Act TEC description required so as to quantify impacts in detail. Locally, impacts may be substantial to some patches.
Semi-Evergreen Vine Thicket	Refer to Table C-15	Possible	Restricted to clearing of approximately 14 ha. Detailed mapping of semi- evergreen vine thicket communities meeting the EPBC Act TEC description required so as to quantify impacts in detail. Locally, impacts may be highly substantial to some patches.
Threatened Flora			
Eucalyptus raveretiana Black ironbox (vulnerable)	Located at chainage 465,150, along both sides of Elliot River	Possible	This species is rare but can be locally common, as it is along the banks of the Elliot upstream of the Project footprint. Removal of a limited number of individuals to construct a river crossing is highly unlikely to constitute a substantial impact to the species or the population on the Elliot River.
Dichanthium queenslandicum King bluegrass (vulnerable)	Not located during surveys but likely to occur. Known to be present between chainage 285,000 and 325,000. Predicted to occur south of Eaglefield Creek (chainage 225,000)	Possible	This species is rare but can be locally common, although it is included as among 13 indicator species for the Natural Grassland TEC (TSSQ 2008adq). Targeted surveys need to be conducted for this species in all native grassland within clearing areas. If present, this species can be transplanted relatively easily. However, with appropriate mitigation measures and offsetting, this Project is unlikely to represent a substantial impact to this species.
Croton magneticus Magnetic Island croton (vulnerable)	Not located during surveys but may occur given the presence of suitable habitat. May be present in areas of Semi-evergreen vine thicket – see Table	Not likely	This species is unlikely to be encountered as the Project footprint does not pass through high quality habitat for this species in the coastal areas (where the species has been previously located). The area of Semi-evergreen Vine Thicket TEC traversed will be low (~17 ha) and

Name/EPBC Status	Location	Likelihood of Impact	Response against criteria
	C-15 for locations		targeted surveys will be conducted for this species. With appropriate mitigation measures and offsetting, this Project is unlikely to represent a substantial impact to this species.
Dichanthium setosum Bluegrass (vulnerable)	Not located during surveys but may occur given the presence of suitable habitat. May occur in similar locations to *D. queenslandicum*.	Possible	Targeted surveys need to be conducted for this species in all native grassland within clearing areas. If present, this species can be transplanted relatively easily. However, with appropriate mitigation measures and offsetting, this Project is unlikely to represent a substantial impact to this species.
Ozothamnus eriocephalus (vulnerable)	Not located during surveys but may occur given the presence of suitable habitat. May occur at a number of locations in the northern section of the Project footprint section within sclerophyll or vine thicket vegetation on granite or sandstones.	Not likely	This species is protected in three National Parks in the region, and is known from five separate locations. Due to the broad range of habitats it occupies, all of which are commonly encountered in the Project footprint, targeted surveys would be problematic. A Species Management Plan will be prepared that will outline procedures to be followed if this species is encountered during clearing operations (clearing to be done under the supervision of an ecologist who is acquainted with the details of this relatively conspicuous shrub).
Threatened Fauna			
Geophaps scripta Scripta Squatter pigeon (vulnerable)	Observed at the following fauna survey sites AD1, AD5, AD25, AR3, AR24, AR28, AR29 and during opportunistic searches	Not likely	The species is regionally abundant. This species has abundant habitat throughout the Brigalow Belt bioregion. Loss of habitat is negligible given its abundance in the regional landscape. Mortality of individuals may occur but is not likely to impact at the population level. SectionC.5.4.4.1 details mitigation measures to minimise direct mortality in both the operational and construction phase of the Project.
Denisonia maculata Ornamental snake (vulnerable)	Historically recorded from area. Not located in surveys but likely to occur.	Not likely	Mortality of individuals may occur but is not likely to impact at the population level. Section C.5.4.4.2 details mitigation measures to minimise direct mortality in both the operational and construction phase of the Project. A localised realignment may be advisable depending on the final realignment. At present a section of DERM Essential Habitat (ornamental snake) is situated within the rail study area.
Egernia rugosa Yakka skink	Not located during surveys but likely to	Not likely	Field surveys did not confirm the presence of any individuals in the rail

Name/EPBC Status	Location	Likelihood of Impact	Response against criteria
(vulnerable)	occur.		study area. Suitable habitat is present in dry sclerophyll forest and open woodlands surrounding the southern half of the rail study area. Limited impact on preferred habitat. Mortality of individuals may occur but is not likely to impact at the population level. Section C.6.2.1.4 details mitigation measures to minimise direct mortality in both the operational and construction phase of the Project.
Furina dunmalli Dunmall's snake (vulnerable)	Not located during surveys but may occur given the presence of suitable habitat.	Not likely	Field surveys did not confirm the presence of any individuals in the study area. Furthermore the species has not been historically recorded in the region surrounding the rail study area. However, *Furina dunmalli* is known to inhabit remnant brigalow woodland vegetation. Limited impact on preferred habitat. Mortality of individuals may occur but is not likely to impact at the population level. Section C.6.2.1.4 details mitigation measures to minimise direct mortality in both the operational and construction phase of the Project.
Paradelma orientalis Brigalow scaly-foot (vulnerable)	Not located during surveys but likely to occur.	Not likely	Field surveys did not confirm the presence of any individuals in the rail study area. Mortality of individuals may occur but is not likely to impact at the population level. Section C.6.2.1.4 details mitigation measures to minimise direct mortality in both the operational and construction phase of the Project.
Dasyurus hallucatus Northern quoll (endangered)	Not located during surveys but may occur given the presence of suitable habitat.	Not likely	Targeted field surveys failed to confirm the presence of any individuals in the rail study area. *Dasyurus hallucatus* prefers habitats associated with rocky woodland vegetation found on hillslopes. This habitat is not likely to be impacted.
Erythrotriorchis radiatus Red goshawk (vulnerable)	Not located during surveys but may occur given the presence of suitable habitat.	Not likely	Field surveys did not confirm the presence of any individuals in the rail study area. This bird is known to nest in trees taller than 20 m that are generally within one km of water. There is expected to be limited clearing in the vicinity of permanent water bodies.
Poephila cincta cincta Black-throated finch – southern subspecies) (endangered)	Not located during surveys but may occur given the presence of suitable habitat. Not located during surveys but may occur given the	Not likely	Targeted field surveys failed to confirm the presence of any individuals in the rail study area. Furthermore the species has not been historically recorded in the region surrounding the rail study area, although is known to occur within the

Name/EPBC Status	Location	Likelihood of Impact	Response against criteria
	presence of suitable habitat.		vicinity of Bowen. The alignment intersects predominantly cleared areas in the northern sections of the rail study area.
26 marine and/or migratory species	At a number of locations in the Study Area	Not likely	The Caley Valley wetland supports a significant community of marine and migratory wetland birds. The Project is unlikely to substantially modify, destroy or isolate important habitat. Apart from Caley Valley few permanent water sources will be affected by the Project. The Project is unlikely to result in invasive species becoming established in important habitat for migratory species. Most species are regionally abundant and an ecologically significant proportion of a species population is unlikely to occur within the rail study area.

C.6 Avoidance and Mitigation Measures to Reduce the Impacts to Matters of National Environmental Significance

C.6.1 Coal Mine and Associated Infrastructure

Strategies to minimise the impacts on native flora and fauna, and those regarding rehabilitation of the Project site, are outlined below.

A general principle of environmental management is to, in order of preference:

- Avoid environmental impacts;
- Minimise the impacts;
- Mitigate for impact; and
- Where impact cannot be avoided or minimised, compensation for residual impact by mitigative means such as offsets.

C.6.1.1 Avoidance and Mitigation Measures

Avoiding environmental impacts has been planned for where possible throughout the Project planning and design phases. There will also be ongoing opportunities to further avoid impacts at a local scale through the detailed design process.

C.6.1.2 Vegetation Clearing

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

Clearing of vegetation along Lagoon Creek will be minimised to maintain habitat connectivity and provide a movement corridor for small terrestrial fauna species. Whilst this community will be

physically fragmented, the actual degree of habitat fragmentation is highly dependent on the mobility of the organism in question (McIntyre and Hobbs 1999) and disconnected areas may continue to be utilised by some species if kept intact. Given the abundance of this community in the wider region it is unlikely the disturbance will have a considerable impact on its ecological value or habitat provision.

Native vegetation removal will be conducted only after:

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

C.6.1.3 Native Fauna

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

C.6.1.4 Water Resources and Pollution

A Site Water Management System has been developed for the Alpha Coal Project and aims to minimise the impact to natural water resources from runoff and sedimentation.

As described in the management system, clean water from undisturbed catchments will be diverted around the mine site to Greentree and Lagoon Creeks as much as practical. This will assist to maintain flows in the creek system.

C.6.1.5 Erosion and Sedimentation

Dirty water runoff from disturbed areas will be directed to sediment dams to encourage settling. This water potentially contains elevated levels of suspended solids. Captured water will be discharged to Lagoon Creek when water quality discharge criteria has been met, which will assist to maintain flows in the creek system. Water will be discharged at a single licensed discharge point located at the outlet of the final sediment dam. Discharge would only take place during periods of natural flow, and would not exceed 20% of the flow in Lagoon Creek. In the event that overburden runoff contains elevated salinity and/or heavy metals, water stored in sediment dams would be reused onsite and not released to Lagoon Creek.

Contaminated runoff captured in-pit will be pumped to pit dewatering dams. Contaminated runoff from the CHPP, MIA and coal stockpile pads will be pumped to environmental dams. This water potentially contains high levels of suspended solids, elevated salinity levels, and other contaminants. Contaminated water will not be discharged to Lagoon Creek, and will instead be used to meet site demands as a priority. To minimize groundwater seepage into the pit, it is proposed to extract groundwater using a borefield.

The reuse and evaporation of water captured in the site water management system results in a reduction in the volume of runoff to the creek system. Runoff volumes will decrease over the life of the Project as the area draining to the water management system increases.

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

C.6.1.6 Pests and Weeds

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

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

Infrastructure planning will where possible avoid the creation of permanent, shallow water areas, such as septic and other tank overflows that form a permanent seep. These areas attract Cane Toads that are lethal to most snakes and other fauna species when ingested.

C.6.1.7 Proposed Offsets for Residual Impacts

Although no EPBC listed communities will be impacted by the Project within the mine study area, the VM Act listed 'Of Concern' vegetation community of *Eucalyptus populnea* on alluvial plains (RE 11.3.2) is proposed to be impacted and will require the appropriate considerations for environmental offsetting. An Environmental Offset Program will be implemented where required and carried out in accordance with current policies for the offsetting of conservation significant vegetation communities. This will include the development of a biodiversity offset strategy and management plan where it is required.

C.6.2 Rail

C.6.2.1 Avoidance and Mitigation Measures

C.6.2.1.1 Protected Areas

To ensure that indirect impacts do not affect the protected areas identified in Section C.5.4.1, the following strategies will be implemented:

- A Weed and Pest Management Strategy is to be developed and stringently followed particularly for areas adjacent to protected areas; and
- An Erosion and Sediment Management Plan is to be developed and stringently followed particularly for areas adjacent to protected areas.

C.6.2.1.2 EPBC Act listed flora species

Due to the very large size of the Project footprint, it was not possible to survey all areas exhaustively and as a result, populations of these species could be present in areas earmarked for clearing. These species are generally small herbs or grasses, and most are not identifiable (or do not have a presence above ground) during the dry season. Therefore, surveys for these species within the construction area must occur prior to any clearing in a suitable season (late wet season, depending on access issues). Once the location and size of populations is determined, appropriate management strategies relating to clearing, removal or relocation of each species can be developed (most likely into a species-specific management plan, or an overall management plan for populations of conservation significant species). Mitigation measures are expected to include:

- Avoidance of impacts wherever possible through:
  - Carefully mapping and clearly marking on the ground the locations of populations of species of conservation significance;
  - Relocation of infrastructure wherever possible to avoid such populations and individuals; and
  - Restricting access to ground within the drip line of any tree or shrub belonging to a species of conservation significance that is located next to impact areas, by erecting temporary fencing, and through signage.
- Minimising impacts on populations by:
  - Clearly marking as no-go areas the boundaries of individual populations of small plants, and flagging trees and shrubs;
  - Conducting clearing only in accordance with a Species or Population Management Plan (which will be approved by DERM under the clearing permit requirement) and under the supervision of a suitably briefed ecologist (to ensure clearing does not occur except where approved);
  - Stockpiling top soil and vegetative material (which can contain seeds) from within conservation significant populations that are to be cleared, for redistribution in offset areas (where feasible) or in areas of similar habitat and soil type adjacent to the Project footprint (with approval of the relevant landowner);

- Collecting seeds from black ironbox trees and where feasible, other species of conservation significance that may occur within the Project footprint prior to removal, for redistribution in adjacent areas, to be added to the seed stock of a suitable conservation group, or to supplement rehabilitation efforts in approved offset areas;
- Raising seed stock in nurseries and re-establishing populations, either on site where possible or elsewhere, ideally at a ratio of at least 5:1 (five times the number removed), to allow for loss of saplings;
- Transplanting conservation significant species where it is not possible to avoid impacts, for translocation to a suitable site elsewhere (ideally, an offset area, but otherwise areas of suitable adjacent habitat); and
- Offsetting in accordance with DERM policies and clearing permit conditions.

C.6.2.1.3 Vegetation Communities

Impact on native vegetation has been reduced by the rail alignment traversing large areas of previously cleared lands. Where native vegetation clearance cannot be avoided, the following mitigation measures are proposed:

- The extent of vegetation clearing must be clearly identified on construction plans and in the field. Areas that must not be cleared or damaged in any way must also be clearly identified.
- Clearing teams, particularly in the early stages of work when working in vegetation to be retained after the Project, will be accompanied by an ecologist at all times. The ecologist's role is to mark out 'no – go' zones before work commences in a new area, and who is responsible for supervising compliance.
- The extent of clearing is to be restricted to the minimal amount necessary, particularly in the following locations:
  - REs listed as constituents of TECs protected under the EPBC Act;
  - Endangered and of concern REs; and
  - Threshold REs.
- Any additional construction areas and construction sites, such as site offices, soil stockpiles, machinery/equipment storages and construction camps are to be located within existing cleared areas or disturbed areas to the greatest extent possible.
- Where clearing TECs of conservation significant REs is absolutely unavoidable offsets will be required.
- Hollow logs and hollow bearing trees will be cleared of wildlife by a licensed wildlife spotter, and wherever possible these should be stockpiled for use in rehabilitation activities or otherwise carefully placed in adjoining bushland;
- Areas of high ecological value such as riparian corridors must be approached with care, and effort made to ensure connectivity is re-established to the highest realistic extent.
- Locate culverts in areas where the Project footprint bisects important habitat. This will be done to maintain landscape permeability.

- Trees with large raptor nests will not be cleared, where possible, after consideration of safety, operational and maintenance issues. If this is not possible, removal should only occur after consultation with the fauna spotter, who should be given the longest possible lead time prior to clearing.

C.6.2.1.4 EPBC Act listed fauna species

Mitigation measures relevant to EPBC Act listed fauna species that have been recorded or may occur within the rail study area include:

- Minimise the width of the transport corridor within ephemeral creek habitats;
- Construct alternate dry season water resources such as dams where appropriate;
- Ensure a fauna spotter is located on site during all vegetation removal to identify, capture and relocate fauna from within areas of vegetation as they are cleared;
- Develop a Management Plan to monitor potential changes in hydrology and water quality; and
- Design to include culverts with an area of dry passage within gilgaied landscapes to allow uninterrupted surface flows and allow small fauna such as frogs and snakes, especially the ornamental snake dry passage to cross beneath the rail alignment.
- Design to incorporate purpose-built fauna underpasses for bridges within the Bioregional Wildlife Corridor that connects to Mount Abbot. This will allow for regional movement of native wildlife, particularly ground-dwelling mammals.

C.6.2.1.5 Mortality of Terrestrial Fauna

The impacts to fauna from construction activities in general can be mitigated by:

- Ensuring a fauna spotter is located on site prior to and during all vegetation removal to identify, capture and relocate fauna, including conservation significant fauna;
- Developing a flora and fauna species relocation plan particularly for threatened species to allow individuals to be relocated according to species requirements (particularly if threatened species are encountered during clearing activities);
- erecting temporary fencing around the construction zone to exclude mobile animals such as livestock, macropods, echidnas, snakes and lizards from the construction zone;
- If any pits/trenches are to remain open after daily site works have completed, ensure they are securely covered by an impenetrable barrier, if possible, or fauna ramps (e.g. log ramps or wooden planks) are put in place to provide a potential means of escape for trapped fauna;
- Work areas are to be checked for fauna that may have become trapped within the worksite before work commences each day; Educating employees of environmental responsibilities during inductions including treating all native fauna species as protected;
- Enforcing on-site speed limits to restrict the incidence of wildlife road kill;
- Construction to occur during the dry season to minimise direct mortality of aquatic fauna or migratory species (Caley Valley and Bowen River between Birralee and Pelican Creek); and

- A fauna mortality register is to be kept and maintained to determine the location, frequency of mortality, and types of species most susceptible to enable further modifications to fauna conservation mechanisms to be made where necessary.

Following mitigation, the residual impact will be reduced.

C.6.2.1.6 Water Resources and Pollution

C.6.2.1.6.1 Sedimentation and Erosion - Construction

The impacts of sedimentation and run-off associated with the Alpha Coal (Rail) Project construction and operation can be mitigated by:

- Preparation and implementation of an Erosion and Sedimentation Management Plan which includes:
  - Installation and maintenance of sediment fences in appropriate locations around all earthworks (particularly important in areas adjacent to wetlands and watercourses), to be in place to the greatest extent possible before construction and clearing commences; and
  - Installation and maintenance of temporary sediment traps at key locations where run-off is expected throughout the course of the construction period.
- Top soil will be stockpiled and marked appropriately in areas where it is to be redistributed after works are completed. In particular, care must be taken not to mix soil profiles as the subsurfaces of many soils in this region are likely to be sodic (ie highly erodible); and
- Rehabilitating disturbed ground surfaces as soon as is practicable to minimise exposed surface periods.

Further mitigation measures are discussed in the aquatic technical report. Following mitigation, the residual impact on both the terrestrial and aquatic flora and fauna is expected to be low.

C.6.2.1.6.2 Sedimentation and Run-off – Operation

The incorporation of suitable vegetated drains and catch dams along the length of the rail alignment will substantially reduce the impacts of runoff and sedimentation. The impacts can be further reduced by implementing the following mitigation measures:

- Establish protective vegetation and sediment ponds to buffer sensitive flora and fauna habitats from run-off and sedimentation;
- Establish sediment traps, silt fencing and biofilters were appropriate at strategic locations to protect waterbodies from sediment and pollutants; and
- Establish a water and sediment quality monitoring plan (adequate baseline information will be required) to monitor composition and condition of the important water sources with respect to potential pollution or contamination due to deposition of particulate matter in the water body and surrounds. Following mitigation, the residual impact of sedimentation and run-off is expected to be negligible.

C.6.2.1.6.3 Changes to Floodplain Hydrology - Operation

Impacts to floodplain ecology can be reduced through the implementation of the following strategies:

- Utilise culverts in order to allow the movement of water;
- Conduct hydrology modeling of the relevant areas; and
- Identify areas that are potentially impacted.

C.6.2.1.7 Weeds and Pests

Mitigation measures to reduce the impacts of weeds and pest species include:

- Development of a Weed and Pest Management Plan for implementation throughout the construction phase including:
  - Vehicle wash down stations located along the rail study area, particularly wherever the Project footprint enters/leaves known parthenium 'hotspots' such as black soil plains, or ecologically sensitive areas such as major waterways (the Belyando River, the Suttor Creek, the Bowen River, Pelican Creek, the Bogie River, the Elliot River), wetlands, native grasslands;
  - Training and orientation stressing the need to be thorough and conscientious in wash-down procedures;
  - Develop procedures for washdown and provide training to all staff;
  - Regular monitoring of pest species and weed inspections; and
  - Weed and pest control where necessary.
- A weed audit of up to 20 percent of the Project footprint, at high risk locations, will be conducted after the Project footprint has been marked out, and preferably at a time when annual weeds can be recognised (and when black soil country can be negotiated) e.g. late wet season (April to June). This audit would result in weed maps identifying hotspots for the various declared weeds inside the Project footprint, with a focus on parthenium, and the preparation of a Weed Management Plan.
- All declared weeds within the Project footprint will be removed (after mapping has occurred) and burnt or otherwise disposed of in such a way as to ensure the cleared material is neutralised, before construction occurs..
- Signage will be in place throughout the Project footprint where parthenium is prevalent advising staff to take care to arrest its spread, and advising when staff are entering or leaving infestation 'hotspots'.
- Ensure that all construction machinery and materials brought onto site are certified weed free and records are kept of compliance with this requirement.
- Soil in areas known to contain parthenium and other declared weeds is not moved elsewhere.

Following mitigation, the residual impact from weeds and pests is expected to be reduced.

C.6.2.2 Proposed Offsets for Residual Impacts

An Offsets Package for the Project will be developed in consultation with DERM, DEEDI and DSEWPC, giving consideration to relevant state and Commonwealth policies relating to offsets. This package will include environmental offsetting for the three TECs listed under the EPBC Act that were

identified within the rail study area, all of which are classified as endangered. These communities and their associated offset areas are:

- Brigalow (*Acacia harpophylla* dominant and co-dominant) (110 ha);
- Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin (108.40 ha); and
- Semi Evergreen Vine Thickets of the Brigalow Belt (North and South) and Nandewar Bioregions (13.97 ha);

The DSEWPC released a draft policy statement Use of environmental offsets under the *Environment Protection and Biodiversity Conservation Act 1999* (DEWR 2007) in 2007.

Under this policy, environmental offsets for impacts on MNES may be used to maintain or enhance the health, diversity and productivity of the environment as it relates to those MNES on projects where impacts are not excessive and cannot be adequately managed through avoidance or mitigation. Environmental offsets are assessed on a case-by-case basis, and can include financial support for research relevant to the MNES being targeted, or towards the implementation of a recovery plan for a MNES TEC or species being affected by the Project. Alternatively, habitat can be provided and legally protected from future development as an offset. Offsets are likely to be important for this project to demonstrate that impacts on MNES are adequately managed.

Where required, management of biodiversity offsets will include development of a strategy to address the requirements of the following policies:

- Queensland Government Environmental Offset Policy, 2008;
- Policy for Vegetation Management Offsets (DERM 2009); and
- Use of Environmental Offsets under the EPBC Act, 1999 (Commonwealth, 2007).

Objectives of the strategy will include:

- Identification of suitable potential offset areas with ecological values analogous to impacted ecological communities;
- Assessment of property extent and condition;
- Options available for pooling or consolidation of offset requirements; and
- Options for securing offsets.

Further to the development of the offset strategy a site specific Biodiversity Offset Management Plan for identified offset properties will be developed and implemented over an appropriate time frame to accomplish the following specific aims:

- Assessment of the ecological value and equivalence of offsets to ensure suitable offset extent, species assemblage, floristic structure and ecological integrity utilising an appropriate biometric field methodology;
- Development of appropriate management prescriptions to ensure long term viability of offsets (e.g. pest control, livestock management, access exclusion, ameliorative plantings and fire regime management);
- Placement of appropriate covenants for future conservation and management of offsets; and

- Development of appropriate monitoring and maintenance activities and performance review processes to ensure long term protection and viability of the offsets.

C.7 Monitoring and Reporting

C.7.1 Coal Mine and Associated Infrastructure

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

C.7.1.1 Vegetation Clearance

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

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

C.7.1.2 Fauna

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

C.7.1.3 Pests and Weeds

The following monitoring and reporting criteria are to be implemented for the Mine Study Area:

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

C.7.1.4 Sedimentation, Water-Borne Pollution and Hydrology

A Project Site Water Management System has been developed for the Alpha Coal Project to provide some operational flexibility and has been designed to segregate clean, dirty and contaminated water types. This system will minimize sedimentation and erosion issues.

C.7.2 Rail

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

C.7.2.1 Vegetation Clearance

Appropriate management strategies related to vegetation clearing will be developed for the rail study area. These strategies are most likely to include the following management plans:

- A rehabilitation plan;
- A species-specific management plan; and
- An overall management plan for populations of conservation-significant species.

C.7.2.2 Fauna

- A fauna mortality register is to be kept and maintained to determine the location, frequency of mortality, and types of species most susceptible to enable further modifications to fauna conservation mechanisms to be made where necessary.

C.7.2.3 Pests and Weeds

- A Weed and Pest Management Plan is to be developed for implementation throughout the construction Phase;
- A weed audit of up to 20 percent of the Project footprint, at high risk locations, should be conducted after the Project footprint has been marked out, and preferably at a time when annual weeds can be recognised; and
- A post-construction weed audit of the Project footprint should be undertaken at the end of the first wet season following completion.

C.7.2.4 Sedimentation, Water-Borne Pollution and Hydrology

- Preparation and implementation of an Erosion and Sedimentation Management Plan; and
- Establish a water and sediment quality monitoring plan (adequate baseline information will be required) to monitor composition and condition of the important water sources with respect to potential pollution or contamination due to deposition of particulate matter in the water body and surrounds.

C.8 Conclusion

Potential impacts to the MNES associated with the Alpha Coal Project include the clearing of EPBC listed vegetation communities, the direct removal of EPBC listed flora populations, the invasion of pest and weed species, and the reduction of suitable habitat for EPBC listed fauna species.

Proposed avoidance and mitigation measures to reduce the impact to MNES include the implementation of Weed and Pest Management Strategies and Erosion and Sediment Management Plans. An Offsets Package for the Project will be developed in consultation with DERM, DEEDI and DSEWPC, giving consideration to relevant state and Commonwealth policies relating to offsets. This package will include environmental offsetting for the three TECs listed under the EPBC Act that were identified within the rail study area and, if required, for the ‘Of Concern’ vegetation communities present within the mine study area.

The implementation of monitoring and reporting requirements are proposed to further ensure impacts to fauna, flora and vegetation communities are minimised, or that improvements to procedures and

processes can be implemented to further minimise impacts. This process will result in the minimization of potential impacts from the Project on MNES.

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