BHP Billiton Mitsubishi Alliance

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1 Introduction

1.1 Purpose and Structure

This Environmental Management Plan (EM Plan) has been prepared to address the relevant Terms of Reference for the Caval Ridge Coal Mine Project Environmental Impact Statement (EIS).

An EM Plan also is required under *Section 201* of the *Environmental Protection Act 1994* (EP Act) as part of the application for an Environmental Authority (mining activities) process. *Section 202* of the EP Act states that the purpose of an EM Plan is to propose environmental protection commitments to assist the administering authority prepare the draft Environmental Authority.

The content of this EM Plan addresses the EPA's *Guideline No. 8, 'Preparing an Environmental Management Overview Strategy (EMOS) for non-standard Mining Projects'.* The commitments expressed are measurable and auditable; they set objectives and outline control strategies to achieve the objectives.

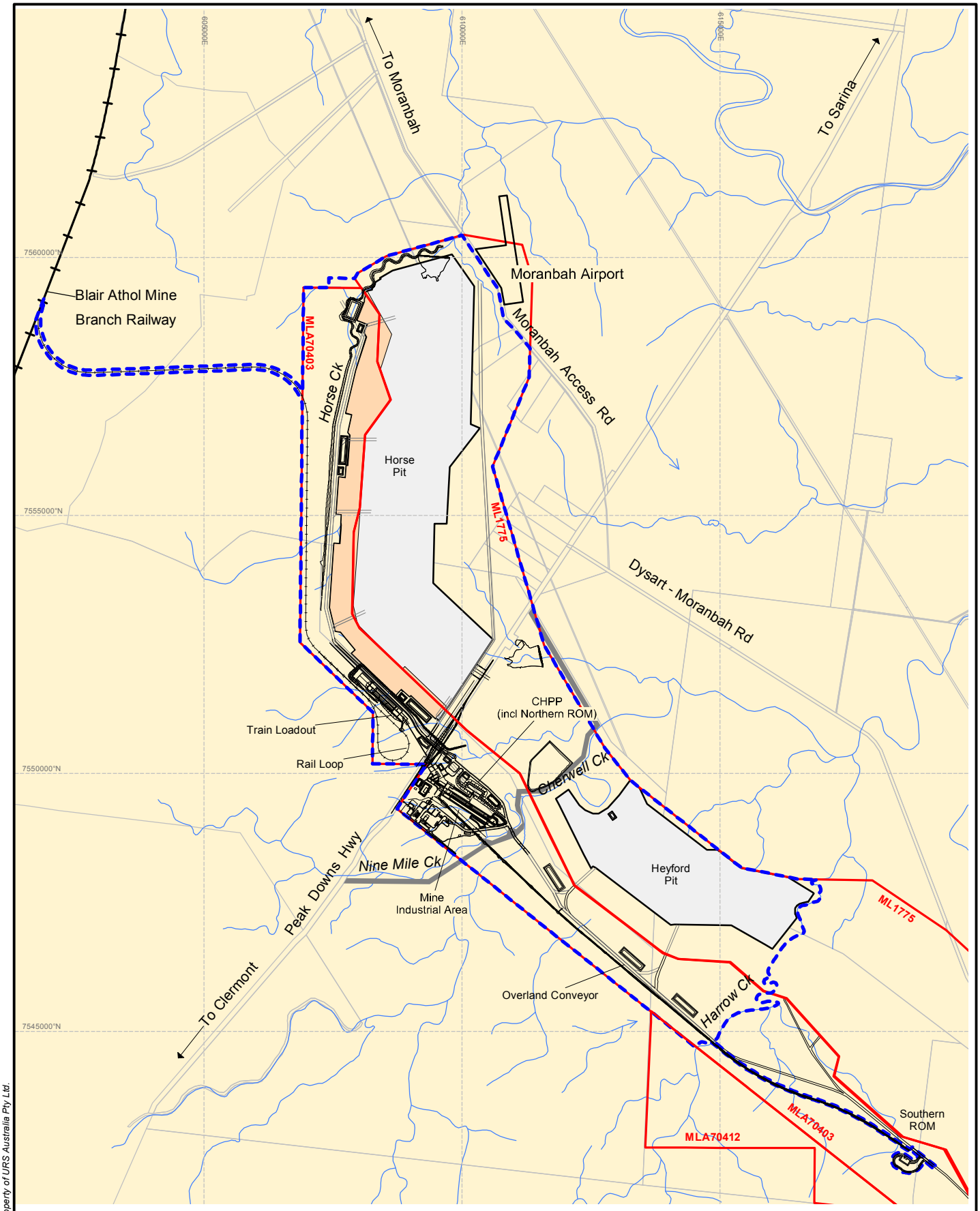
In accordance with *Section 203* of the EP Act, this EM Plan contains the following sections.

- Section 1 – Introduction, provides background on the proponent, describes each of the relevant mining leases and land tenure, and identifies the relevant stakeholders.
- Section 2 – Project Description, describes the relevant mining activities and the land on which the mining activities are to be carried out.
- Section 3 – Environmental Values, Impacts, Commitments, and Draft Conditions describes:
  - environmental values likely to be affected by the mining activities;
  - potential adverse and beneficial impacts of the mining activities on the environmental values,
  - environmental protection objectives,
  - control strategies adopted to achieve the environmental protection objectives, and
  - proposed Environmental Authority conditions.
- Section 4 – Environmental Management, describes details of the Project's systems for monitoring, reporting, research, training and auditing.

1.2 The Project

BHP Billiton Mitsubishi Alliance Coal Operations Pty Ltd (BMA) proposes to develop the Caval Ridge Mine; a new open cut coal mine north of and adjacent to BMA's existing Peak Downs Mine in Central Queensland (Figure 1.2.1). The mine will comprise Horse and Heyford pits and is proposed to be located in the northern section of the existing mining lease (ML) 1775, with Harrow Creek acting as the southernmost boundary. Open cut mining operations using dragline and truck/shovel equipment are proposed, producing approximately 5.5 million tonnes per annum (Mtpa) of hard coking coal product primarily for the export coking coal market. The life of mine is expected to be 30 years.

An additional 2.5 Mtpa of product coal will be produced by the Peak Downs Mine. The run of mine (ROM) coal from Peak Downs Mine will be delivered to the Caval Ridge southern ROM and transported via conveyor to the Caval Ridge coal handling and preparation plant (CHPP) for processing. The southern ROM and conveyor form part of the Caval Ridge project. The Caval Ridge CHPP will process 8 Mtpa of product.



Source: Client Supplied Data

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Client: BMA — BHP Billiton Mitsubishi Alliance	Project: CAVAL RIDGE PROJECT DRAFT ENVIRONMENTAL MANAGEMENT PLAN	Title: **PROJECT SITE**
URS	Drawn: VH | Approved: RS | Date: 30-10-2009 Job No: **4262 6420** /6158 | File No: 42626158-g-2325b.wor	Figure: **1.2.1** | Rev:B | **A4**

1.3 Location

Caval Ridge Mine is situated in the Bowen Basin. The mine is located approximately 160 kilometres (km) by road from Mackay and 6.2 km south of Moranbah. The project covers an area approximately 17 km long and 4 km wide (excluding the rail loop and southern conveyor). The Caval Ridge Mine includes Horse Pit located to the north of Peak Downs Highway, and Heyford Pit to the south of the Peak Downs Highway (north of Harrow Creek). The extent of the proposed operation is depicted in Figure 1.2.1.

1.4 Project Proponent

The project proponent is BHP Billiton Mitsubishi Alliance Coal Operations Pty Ltd (BMA) as manager and agent on behalf of the Central Queensland Coal Associates Joint Venture (CQCA). CQCA is an unincorporated joint venture between BHP Billiton (50%) and Mitsubishi Corp. (50%). Joint venture arrangements are regulated in accordance with the CQCA Joint Venture Agreement as amended most recently by Deed dated 28 June 2001 and a Strategic Alliance Agreement dated 28 June 2001 which created BMA.

Operations are managed by BMA on behalf of the CQCA Joint Venturers under a Management Agreement dated 28 June 2001. BMA has equal ownership and management of seven Central Queensland coal mines: Goonyella Riverside; Broadmeadow; Peak Downs; Saraji; Norwich Park; Gregory Crinum; and Blackwater, and also manages the Hay Point coal terminal near Mackay, Queensland.

In addition, BMA manages the operations of BHP Mitsui Coal, which is owned by BHP Billiton (80%) and Mitsui and Co (20%). These operations include the South Walker Creek Mine and Poitrel Mine.

1.5 Land Use and Tenure

The project site includes a number of lots, with the predominant land tenure being freehold as illustrated in Figure 1.5.1. BHP Billiton Coal and their associated parties (BHP Coal & Others) are the registered owners of the majority of the lots. The project site is located to the north of the operational BMA Peak Downs Mine and covers the northern extent of ML 1775 (from the northern bank of Harrow Creek to the Moranbah Access road near the Moranbah Airport), and part of the future mining lease application MLA70403 (formerly MDLA 364 and 366) running along the western boundary of ML1775. Open cut mining will occur on the northern part of ML1775. The major coal processing infrastructure, haul roads, rail line, rail loop, train loadout and spoil dumps will be located on MLA70403.

The project site overlaps the following tenements:

- ML 1775 – BHP Coal Pty Ltd and Others (C.Q.C.A.) (Status: Granted [expires 31 December 2010])
  - Lots 14 and 16 on SP163605;
  - Lots 7,8,9 and 10 on RP615467;
  - Lot 14 on GV116;
  - Lot 13 on GV225;
  - Lot 18 on GV135;
  - Lot 4 on SP174999;
  - Lot 4 on RP884695; and
  - Lot 13 on SP151669.

- Future Mining Lease application (MLA 70403) by C.Q.C.A (formerly MDLA364 and MDLA 366)
  - Lot 16 on SP163605;
  - Lot 1 on RP616897;
  - Lot 10 on SP137499
  - Lot 14 on GV116;
  - Lot 13 on SP151669);
  - Lot 47 on GV226; and
  - Lot 18 on GV135.

Aside from the Moranbah Airport located to the north-east of the project site, there is no other known land designated for special purposes within or surrounding the site.

1.6 Stakeholders

Post State elections in early 2009, there have been structural changes to government departments. Departments as they are now known are in brackets. Stakeholders include:

Commonwealth and State Government

- Aboriginal and Torres Strait Islander Partnerships (Department of Communities)
- Commonwealth Department of Environment, Water, Heritage and the Arts
- Department of Child Safety
- Department of Communities;
- Department of Corrective Services
- Department of Education, Training & The Arts (Department of Education and Training and Department of Premier and Cabinet)
- Department of Emergency Services (Department of Community Safety)
- Department of Employment & Industrial Relations (Department of Employment, Economic Development and Innovation)
- Department of Housing (Department of Communities)
- Department of Infrastructure and Planning
- Department of Justice
- Department of Local Government, Sport and Recreation (Department of Infrastructure and Planning and Department of Sport and Recreation)
- Department of Main Roads (Department of Transport and Main Roads)
- Department of Mines and Energy (Department of Employment, Economic Development and Innovation)
- Department of Natural Resources and Water (Department of Environment and Resource Management)
- Department of Primary Industry and Fisheries (Department of Employment, Economic Development and Innovation)
- Department of Public Works
- Department of Sustainability, Climate Change and Innovation
- Department of the Premier and Cabinet
- Department of Tourism, Regional Development and Industry
- Department of Transport, Trade, Employment and Industrial Relations
- Disabilities Services Queensland
- Environmental Protection Agency (Department of Environment and Resource Management)
- Member for Charters Towers
- Member for Dawson
- Multicultural Affairs Queensland
- Queensland Health
- Queensland Rail

- Queensland Transport (Department of Transport and Main Roads)
- Queensland Treasury

Private Landowners

- Surrounding Landowners

Community and NGO Groups

- Mackay Whitsunday Regional Natural Resource Management Group
- Mackay Conservation Council
- Construction Forestry Mining Energy Union
- Fitzroy Basin Association
- Rotary – Moranbah
- Isaac/Connors Catchment Landcare

Local Council Groups and Services

- Isaac Regional Council
- Mackay Regional Council
- Central Highlands Regional Council
- Regional Economic Development Corporation Mackay and Whitsunday
- Moranbah District & Support Services Assn Ltd
- Isaac Plains Economic Group
- Queensland Ambulance Service – Moranbah Station;
- Queensland Fire and Rescue Service – Moranbah Station;
- Queensland Police Service – Moranbah and Nebo Stations
- Moranbah Hospital and GPs
- Moranbah State High School
- Moranbah State School

Key Community Suppliers

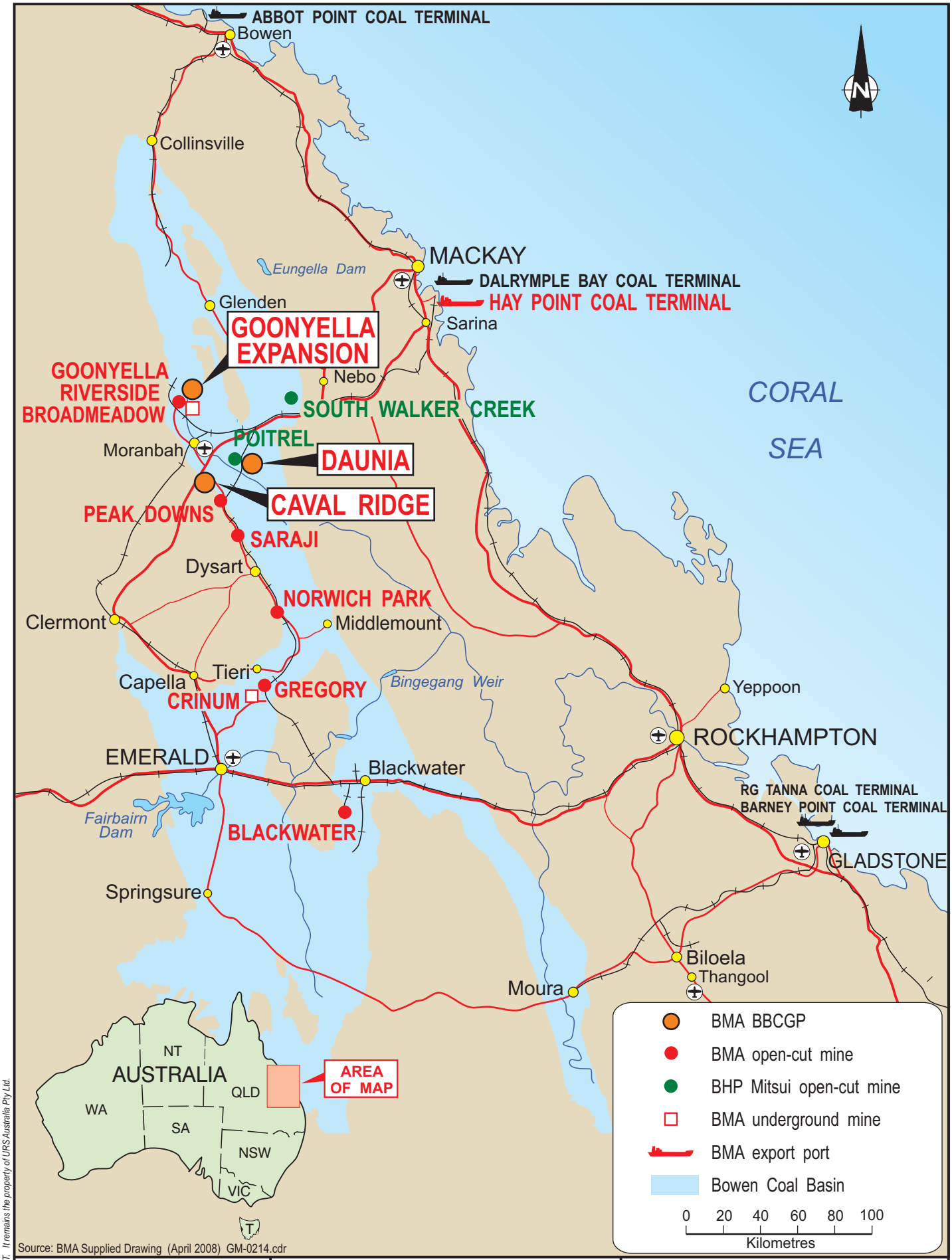
- BAC Moranbah, Nebo, and Coppabella Business Managers
- Moranbah Traders Association
- Emergency & Long term Accommodation Moranbah (ELAM)

Cultural Heritage Groups

- BB Traditional Owners

1.7 Standard Environmental Conditions

The mining activity will be subject to the conditions of an Environmental Authority (mining activities) and the conditions of a Mining Lease.



Source: BMA Supplied Drawing (April 2008) GM-0214.cdr

Client: BMA — BHP Billiton Mitsubishi Alliance

URS

Project: CAVAL RIDGE MINE
DRAFT ENVIRONMENTAL MANAGEMENT PLAN

Title: **PROJECT LOCATION**

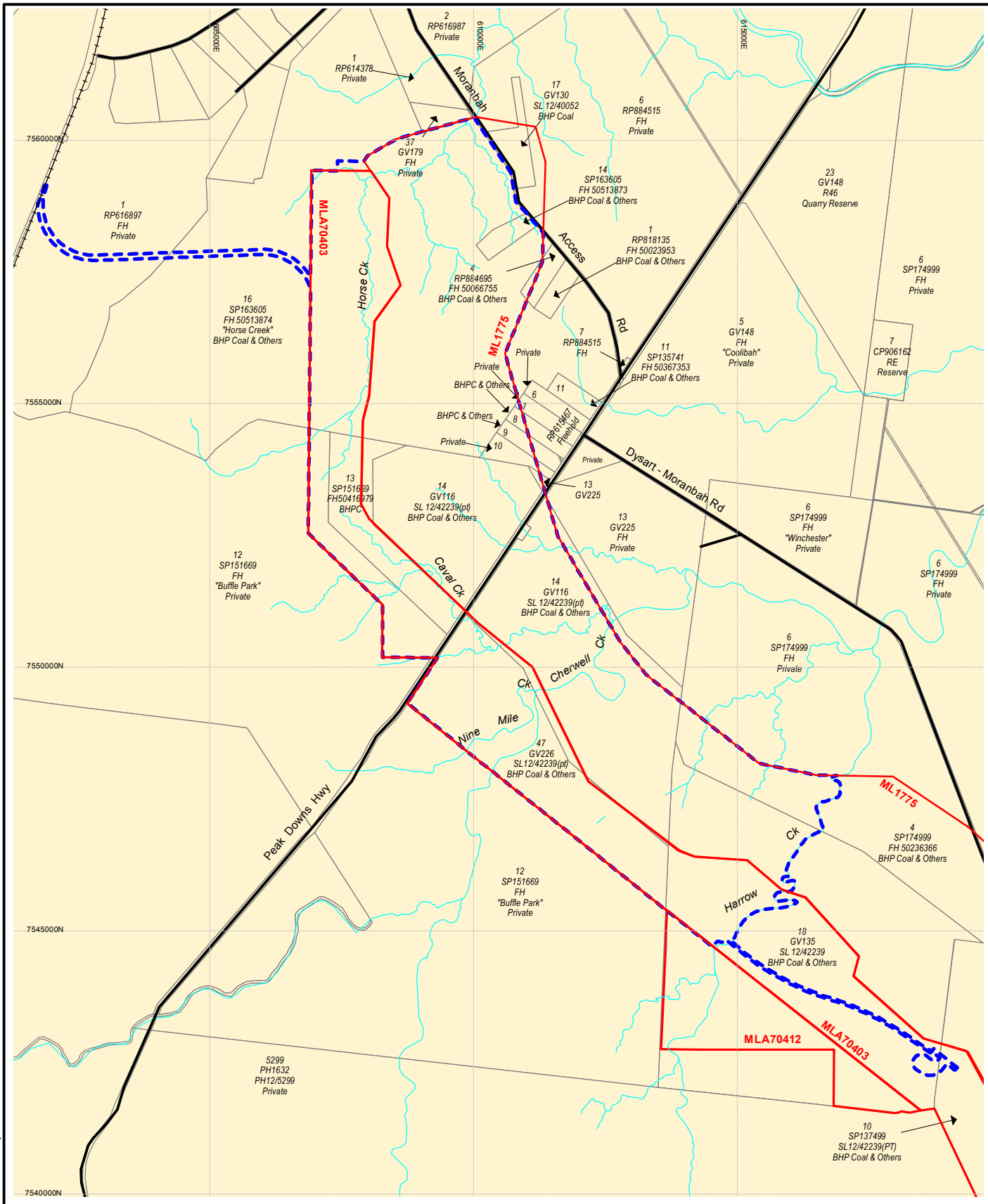
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Figure: **1.3.1**

Rev. B

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URS	Drawn: VH	Approved: RS	Date: 30-10-2009
	Job No: **4262 6420** /6158	File No: 42626158-g-2302.wor	Figure: **1.5.1**
			Rev:A **A4**

2 Project Description

2.1 Description of the Project

The project constitutes a mining activity as defined in *Section 147* of the EP Act. The key elements of the project are outlined below.

- An open cut coal mine will be constructed on the northern section of the Peak Downs ML1775 generating up to 5.5 Mtpa of ROM coal. An additional 2.5 Mtpa will be sourced from Peak Downs Mine and processed at Caval Ridge to produce approximately 8 Mtpa of product hard coking coal for the export market.
- The product coal will be railed to the Hay Point and Dalrymple Bay coal terminals for distribution to international markets. The rail loop will be constructed from the main Blair Athol Line. Opportunity to rail the product coal via Abbot Point Coal Terminal exists upon completion of the proposed Northern Missing Link rail line.
- Out of pit spoil dumps will be created to the west of the open cut mining area on MLA70403. Once there is sufficient space for in pit dumping, pits will be progressively backfilled with spoil (referred to as in pit spoil dumps).
- A mine water management system will be constructed that diverts clean water away from disturbed areas, and captures and manages mine area runoff and pit water for reuse on site.
- Mine haul roads under an overpass across the Peak Downs Highway will connect the open cut pits to a new CHPP on MLA70403.
- An overland conveyor will be constructed to transfer ROM coal from the southern ROM to the CHPP.
- A conveyor will be constructed to transfer product coal from the CHPP to the train load out located on MLA70403.
- Power will be supplied via an overhead 66 kilovolt (kV) transmission line.
- Process waste comprising both coal rejects and dewatered tailings from the CHPP will be returned by truck and disposed of in the spoil dumps.
- Process water will be supplied using a combination of reuse of water contained in mine water dams on the project site, and additional water held in the 12 N Dam, which is supplied from the Eungella-Bingegang pipeline.
- The project site will be accessed via the Peak Downs Highway (Figure 1.3.1).
- The mining industrial area (MIA) including site offices, workshops, stores, magazine, communications, car parking and some other minor facilities will be constructed on MLA 70403.

BMA will contract the construction of the CHPP to a construction contractor. The project will employ approximately 1,200 construction employees and about 495 operational employees.

2.2 Mining Sequence

Mining (in both pits) will commence on the western side of the lease and progress in an easterly direction. The mining sequence will generally entail the following:

- Progressively clearing any vegetation occurring on areas required for the operation;
- Stockpiling topsoil from disturbed areas for storage and use in future rehabilitation of the site;
- Pre-stripping / excavation of unconsolidated/soft overburden waste using excavators and trucks;
- Dumping over previously stripped dragline spoil;
- Drilling and blasting of upper competent overburden waste;
- Removal of waste rock using a combination of dozers, excavators and trucks;
- Dumping waste rock over previously stripped dragline spoil;
- Coal mining of upper seams using a combination of dozers, excavators, loaders and trucks;
- Drilling and blasting of lower competent overburden waste;
- Side casting of lower overburden into the previously mined strip using a dragline;
- Coal mining of lower seams using a combination of dozers, excavators, loaders and trucks; and
- Rehabilitating the site by re-shaping the waste rock dumps, topsoiling and revegetation using native vegetation.

2.3 Mine Rehabilitation

The proposed post-mine land use for disturbed areas is a mosaic of self sustaining vegetation communities and grazing land, containing native tree, shrub and grass species, and improved pasture species as appropriate.

The criteria for achieving self-sustaining final landforms will be developed during the operation as part of the BMA Closure Plan for the project, considering the results of site-specific rehabilitation trials, monitoring and research programs. The design of spoil dumps is an important part of the mine rehabilitation. The spoil dumps will be constructed in lifts of between 10 to 20 metres (m). Final dump slopes will be regraded to an average of 10% slope or less ,with contour drainage benches retained between the lifts at suitable intervals. Local plant species will be included in the seed mix to be applied to the landforms so as to restore elements of the pre-mining vegetation communities to the rehabilitated floral assemblages. The main features of the progressive rehabilitation process are:

- Constructing a stable final landform consisting of out of pit spoil dumps, in pit spoil dumps and rehabilitated final voids;
- Progressively constructing dumps to final landform design, to minimise reshaping at the end of mining;
- Immediately respreading suitable topsoil across available reshaped areas or stockpiling until suitable reshaped areas are available;
- Contour ripping immediately after topsoil placement to control erosion;
- Seeding with an appropriate seed mix prior to the wet season to maximise the benefits of subsequent rainfall;
- Applying appropriate fertiliser for plant establishment if required;

- Respreading cleared vegetation on rehabilitated land; and
- Managing direct rainfall and runoff from the rehabilitated landform in sediment dams and in rehabilitated final voids.

2.4 Mine Facilities and Infrastructure

Mine facilities and infrastructure will include roads, dams, administration buildings, water and sewage treatment plants, and mining industrial area (MIA) (Figures 2.4.1a, 2.4.1b, 2.4.1c and 2.4.1d). Potable water will be supplied from the Caval Ridge potable water treatment plant (WTP) using raw water supplied to the site from the Eungella-Bingegang pipeline. The WTP is proposed to be located near to the raw water dam. A modular sewage treatment plant (STP) will treat the MIA sewage and recycle the water. The STP is planned to be located at the southern end of the MIA.

Access to the MIA will be via a new intersection from the Peak Downs Highway. Mine operational traffic will be grade separated from other traffic using the highway. The highway will cross over the mine roads with an overpass.

Diesel will be stored on site in appropriately designed facilities at the MIA and on haul roads near the pits. Diesel storage capacity on site will total up to 1,200 kilolitres (kl) and diesel will be replenished from Moranbah or Mackay. Mining equipment will be serviced and maintained at the heavy equipment workshops on site. Oil and waste oil will be temporarily stored on site as part of maintenance activities for the mining fleet. All hydrocarbon storage areas will be constructed in accordance with the bunding requirements of Section 5.8 in AS1940:2004 (Bunds and Compounds).

2.5 Coal Processing and Handling

The project will include the construction and operation of a CHPP, two ROMs (north and south), and a train loadout (TLO) facility which will include a spur and loop. The key elements of the CHPP include:

- Receiving, sizing and processing ROM coal at a nominal rate of 2,400 tonnes per hour (tph);
- Reclaiming the product coal from different stockpile sections at a controlled rate up to 4,000 tph and discharging into the existing 400 tonne (t) capacity train load out bin;
- Loading the trains at a rate equivalent to loading 10,000 t trains in 2.5 hours;
- Transferring the coarse and fine dewatered rejects and tailings from the CHPP and discharging into a rejects bin for collection by mining hauls trucks for disposal into the spoil dumps; and
- Producing, stockpiling and loadout of up to 8 Mtpa of product coal.

2.6 Rejects and Tailings Management

The project will manage the disposal of rejects and tailings to avoid any impacts on dump stability. Accordingly the process for rejects and tailings management outlined below will be adhered to.

- Coarse reject will be presented to a reject bin.
- Dewatered tailings will be presented to a bunker set-up for rehandling into a mining truck.
- The dewatered tailings will not be flowable.
- All reject and tailings material will be trucked to in-pit waste dumps.
- No reject material will be placed any closer than 10m to the final landform slope. This will be managed by survey limit pegs (see Figure 2-1).

- There will be no concentrated dumping of reject and tailings materials.
- All reject and tailings material will be dumped and mixed, either over a tiphead or paddock dumped, alongside dry waste material in order to minimise areas of geotechnical instability.
- No reject and tailings material will be used to form any part of tiphead safety bunds, haul roads or ramps;
- No reject and tailings material will be dumped below the pre-mining groundwater table.
- All dumps will be designed and constructed to be free-draining.

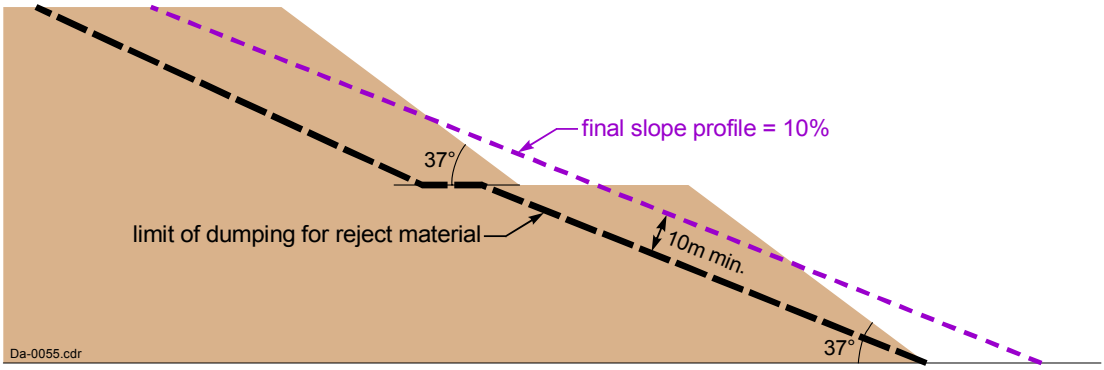


Figure 2-1 Cross section of typical spoil dump showing minimum 10m cover over coarse rejects and dewatered tailings material

2.7 Water Management

The key elements of the water management system at the project are the sediment basins, 12 N Dam and pit water storages. Water will generally be managed as follows:

- Runoff from undisturbed areas at the project site and its vicinity will be diverted away from disturbed areas by diversion drains, which will drain to Horse, Cherwell, Harrow and Caval creeks;
- Runoff from disturbed areas will be captured in sediment basins and used preferentially for dust suppression or as process water in the CHPP; and
- Water will be transferred as necessary between sediment basins at the project and the 12 N Dam to optimise the use of water at the site.

Water Supply and Storage

Approximately 3,200 megalitres (ML) per year of raw water can be sourced from the Eungella-Bingegang pipeline to service the requirements of the Caval Ridge mine. The water will be delivered to the raw water dam via an underground pipe. This pipe will run parallel to the Peak Downs Highway and enter the MIA. A tee from this pipeline will also provide water to the WTP. A raw water dam is proposed to store a nominal 10 days raw water supply for the incoming raw water pipeline for the dust suppression requirements of the coal handling plant (CHP), truck wash station and fire water reserve.

A 5 m deep lined 12 N Dam is proposed as the water storage dam for the coal preparation plant (CPP), raw coal stockpile dust suppression, ROM dust suppression and product stockpile dust suppression. The 12 N

Dam will receive pit water from the Heyford and Horse Pit pit-water dams, stockpile and remediated area run-off water collected from the Heyford and Horse Pit sediment dams, runoff water from industrial area runoff dams and raw water from the raw water dam. Fixed pumps will deliver the process water through underground HDPE pipelines to the CPP, Raw Coal Stockpile, ROM and Product Stockpile.

Water for Dust Suppression

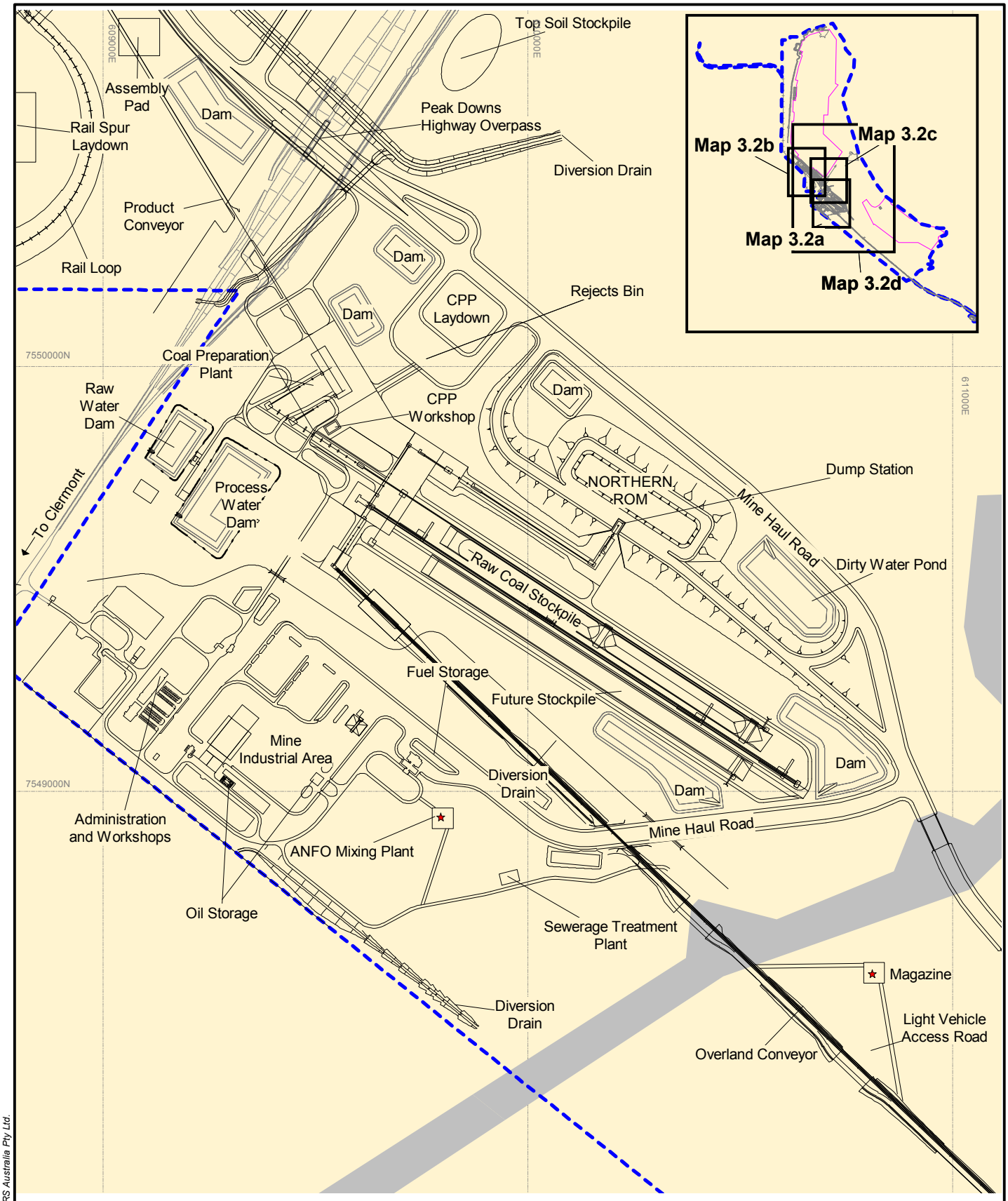
The water for dust suppression at the project will be supplied from sediment dams on site or the 12 N Dam, if the various sediment dams are dry.

Stormwater Drainage

Stormwater runoff during operations will be managed within the mine water management system (refer Section 3.4), designed to contain dirty water and prevent discharge to receiving water environments and provide water supply for reuse within the CHPP, for industrial use and for haul road dust suppression. The mine water management system (Figure 2.6.1) will comprise a combination of storages (for water collection and containment) interconnected by open channels, and pumps and pipelines used to transfer mine water between storages, to demands and to dewater mining pits. The mine water management system will:

- Divert clean catchment runoff away from areas disturbed by mining activities;
- Provide water to assist in the progressive rehabilitation of spoil stockpiles; and
- Contain runoff from all disturbed areas (e.g. haul roads, MIA).

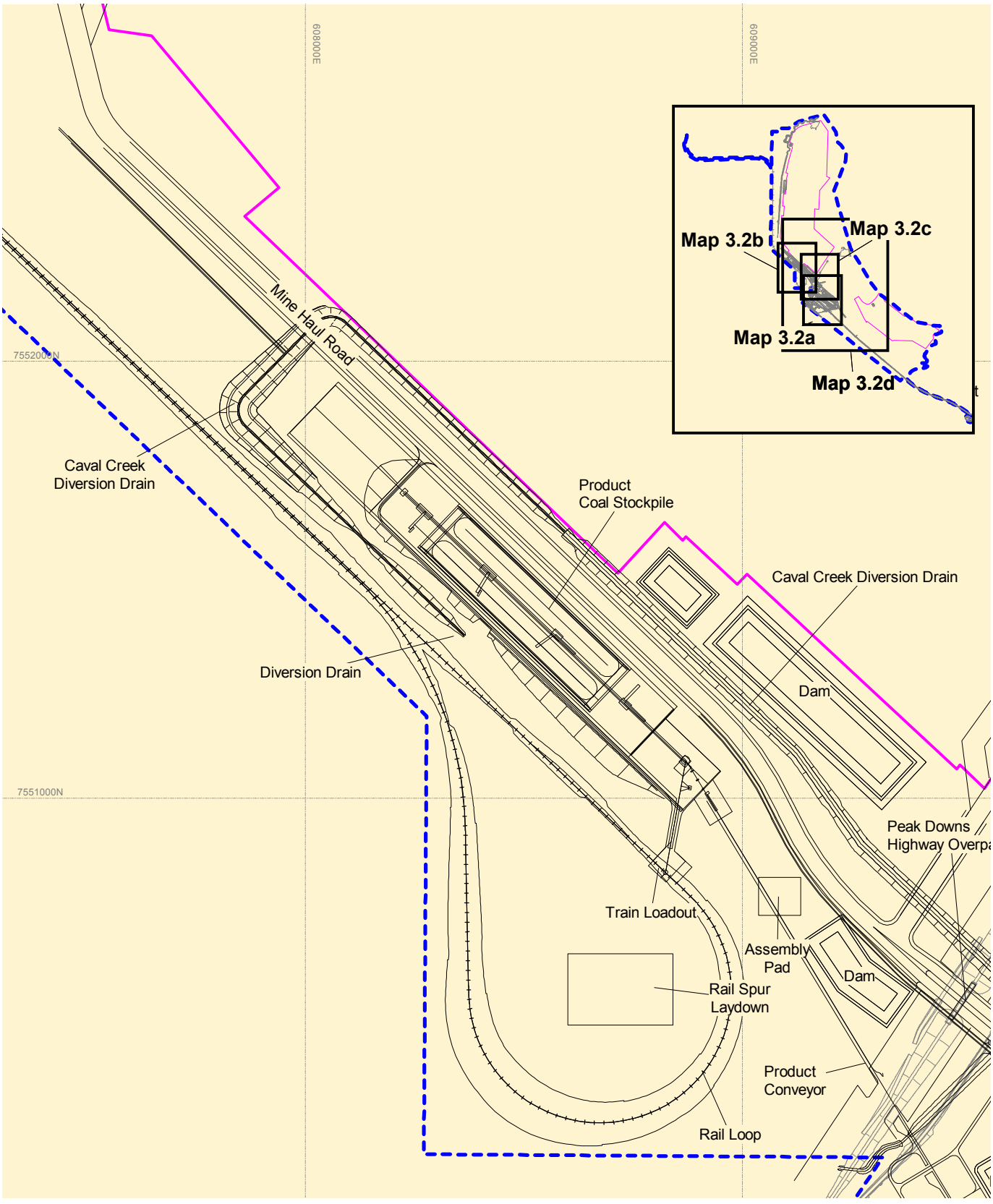
Cut off drains upstream of the CHPP pad will allow clean water to bypass the CHPP area. Runoff from dirty water falling within the CHPP area will drain to Industrial Area Runoff Dams. Stormwater runoff will be managed during construction to minimise erosion and sedimentation of watercourses (refer Section 3.4). Water will be discharged to Cherwell Creek, Nine Mile Creek and Horse Creek only when natural flows are present and when quality criteria are met (Section 3.4).



Source: SKM Drawing PHCVR02-0000-CC-DG-0022, 27-10-2008

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URS	Drawn: VH | Approved: RS | Date: 30-10-2009 Job No: **4262 6420** /6158 | File No: 42626158-g-2303.wor	Figure: **2.4.1a** | Rev:B | **A4**

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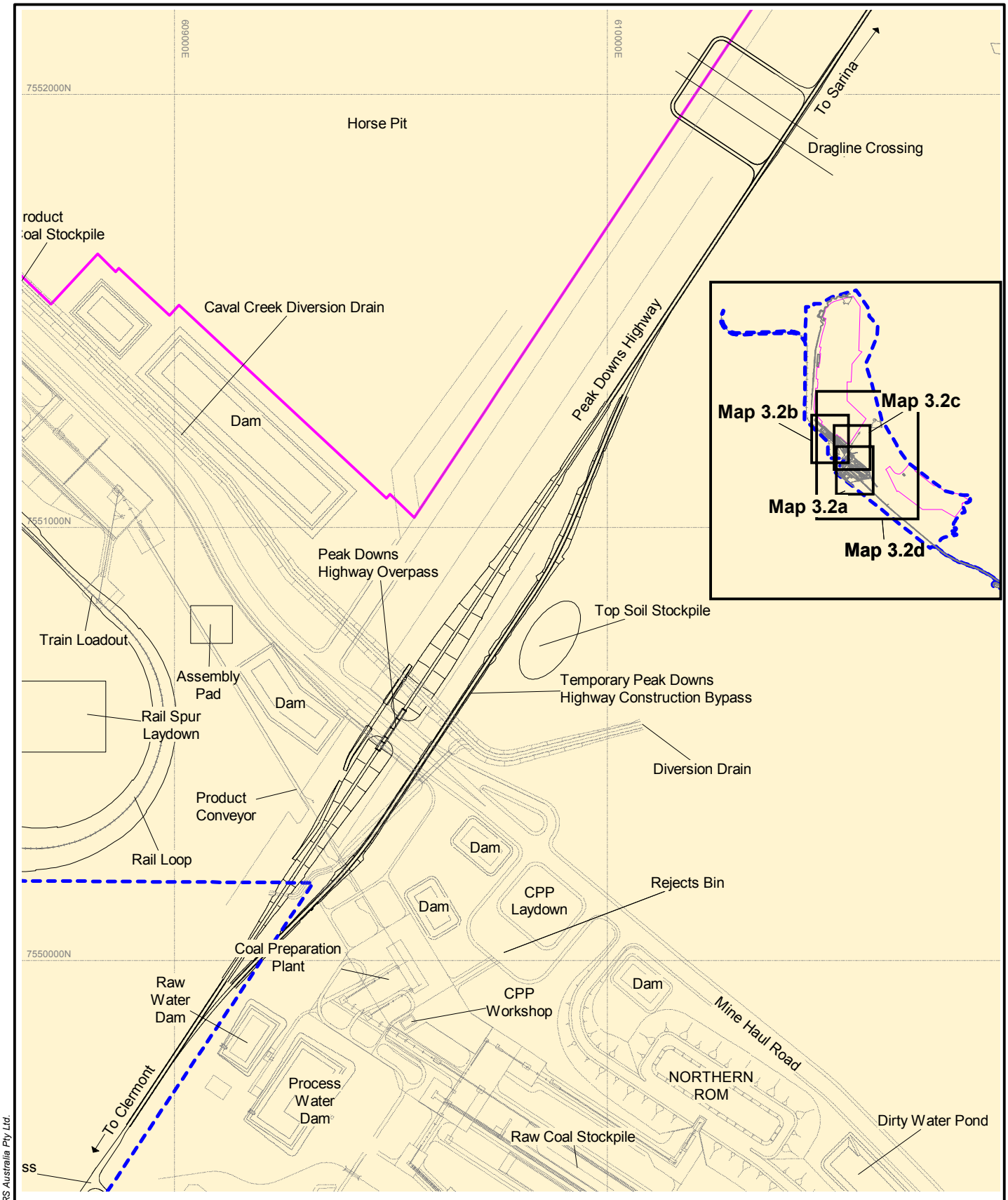
Project Site

Pit Outline

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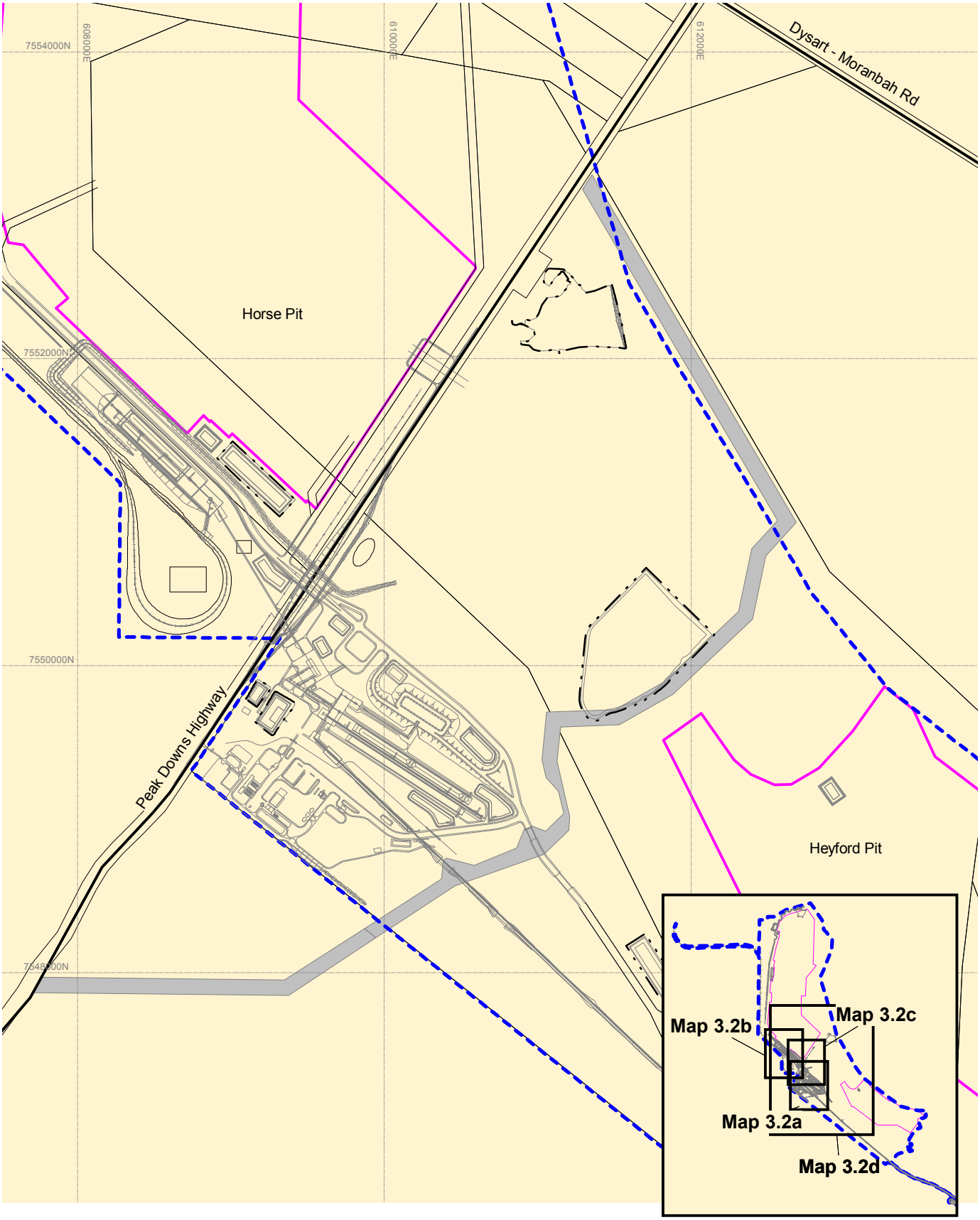
Client: BMA / BHP Billiton Mitsubishi Alliance	Project: CAVAL RIDGE PROJECT DRAFT ENVIRONMENTAL MANAGEMENT PLAN	Title: **TRAIN LOADOUT**
URS	Drawn: VH | Approved: RS | Date: 30-10-2009 Job No: **4262 6420** /6158 | File No: 42626158-g-2303.wor	Figure: **2.4.1b** | Rev:B | **A4**



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Client: BMA / BHP Billiton Mitsubishi Alliance	Project: CAVAL RIDGE PROJECT DRAFT ENVIRONMENTAL MANAGEMENT PLAN	Title: **PEAK DOWNS HIGHWAY OVERPASS**
URS	Drawn: VH | Approved: RS | Date: 30-10-2009 Job No: **4262 6420** /6158 | File No: 42626158-g-2303.wor	Figure: **2.4.1c** | Rev:B | **A4**



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W E
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Scale 1:12 500 (A4)

Datum: AGD84, AMG Zone 55

Project Site
Pit Outline
Proposed Stock Route

Source: SKM Drawing PHCVR02-0000-CC-DG-0022, 27-10-2008

Client: BMA / BHP Billiton Mitsubishi Alliance	Project: CAVAL RIDGE PROJECT DRAFT ENVIRONMENTAL MANAGEMENT PLAN	Title: **PROPOSED STOCKROUTE**
URS	Drawn: VH | Approved: RS | Date: 30-10-2009 Job No: **4262 6420** /6158 | File No: 42626158-g-2303.wor	Figure: **2.4.1d** Rev:B A4

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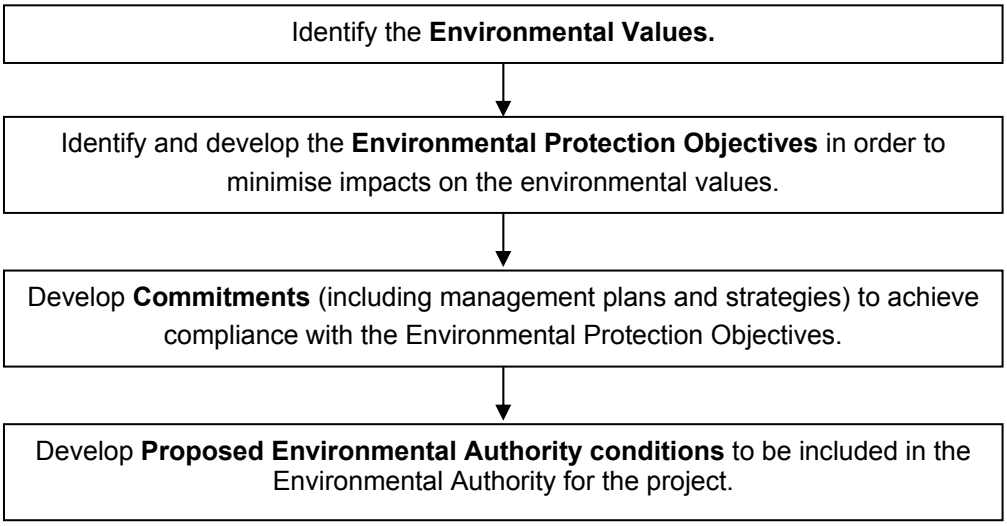
Source: SKM, Drawing PHCVR02-0000-CC-DG-0101.dwg, Date 05/09/2008

Client: BHP Billiton Mitsubishi Alliance (BMA)	Project: CAVAL RIDGE MINE DRAFT ENVIRONMENTAL MANAGEMENT PLAN		Title: **WATER MANAGEMENT SYSTEM**
URS	Drawn: VH	Approved: RS	Date: 30-10-2009
	Job No.: 42626420 /6158	File No.: 42626158-g-2304.dwg	Figure: 2.6.1
			Rev. B A4

3 Environmental Values, Impacts, Commitments, and Draft Conditions

3.1 Content of the Section

This EM Plan was compiled by following the process outlined in the Guidelines published by the Queensland Department of Environment and Resource Management (DERM). This process is shown below.



The guiding definitions for the terms that are used throughout the EM Plan are as follows:

Environmental Values: Environmental values are those qualities or physical characteristics of the environment that are conducive to ecological health, public amenity or safety.

Section 9 of the EP Act describes an Environmental Value as:

1) *a quality or physical characteristic of the environment that is conducive to ecological health or public amenity or safety; or*
2) *another quality of the environment identified and declared to be an environmental value under an environmental protection policy or regulation."*

Environmental Protection Objectives: Describe the key elements of the environment and the outcomes to be protected in order to minimise impacts on the environmental values.

Control Strategies: Provide a contextual framework for the proposed Environmental Authority conditions and describe the strategies proposed to meet the environmental protection objectives.

Proposed Environmental Authority Conditions: These are draft conditions containing measurable indicators and standards that are proposed to be included in the Environmental Authority to protect identified environmental values that may be impacted on by the Project.

Indicators: These are the indicators by which the level of achievement of the environmental protection objectives can be determined, in a measurable and auditable way.

Standards: These are numerical standards for each of the indicators by which adequate levels of achievement of the environmental protection objectives and protection of the environmental values can be determined.

Words and phrases used throughout this EM Plan are defined in Section 5 Definitions except where identified in the EP Act or subordinate legislation. Where a word or term is not defined, the ordinary English meaning applies, and regard should be given to the Macquarie Dictionary.

3.2 General Conditions

There are a number of general issues that do not relate to environmental values or control strategies, but are to be included in the Environmental Authority. Conditions of the Environmental Authority are proposed here for '*Schedule A – General Conditions'*.

3.2.1 Proposed Environmental Authority Conditions: Schedule A – General Conditions

Financial assurance

(A1-1) Provide a financial assurance in the amount and form required by the administering authority prior to the commencement of activities proposed under this environmental authority.

NOTE: The calculation of financial assurance for condition (A1-1) must be in accordance with Guideline 17 and may include a performance discount. The amount is defined as the maximum total rehabilitation cost for complete rehabilitation of all disturbed areas, which may vary on an annual basis due to progressive rehabilitation. The amount required for the financial assurance must be the highest Total Rehabilitation Cost calculated for any year of the Plan of Operations and calculated using the formula: (Financial Assurance = Highest Total Annual Rehabilitation Cost x Percentage Required)

(A1-2) The financial assurance is to remain in force until the administering authority is satisfied that no claim on the assurance is likely.

NOTE: Where progressive rehabilitation is completed and acceptable to the administering authority, progressive reductions to the amount of financial assurance will be applicable where rehabilitation has been completed in accordance with the acceptance criteria defined within this environmental authority.

Maintenance of measures, plant and equipment

(A2-1) The environmental authority holder must ensure:

a) that all measures, plant and equipment necessary to ensure compliance with the conditions of this environmental authority are installed;

b) that such measures, plant and equipment are maintained in a proper condition; and

c) that such measures, plant and equipment are operated in a proper manner.

Monitoring

(A3-1) Record, compile and keep for a minimum of five years all monitoring results required by this environmental authority and make available for inspection all or any of these records upon request by the administering authority.

(A3-2) Where monitoring is a requirement of this environmental authority, ensure that a competent person(s) conducts all monitoring.

Storage and handling of flammable and combustible liquids

(A4-1) Spillage of all flammable and combustible liquids must be contained within an on-site containment system and controlled in a manner that prevents environmental harm (other than trivial harm) and maintained in accordance with Section 5.8 of *AS 1940 - Storage and Handling of Flammable and Combustible Liquids of 2004*.

Definitions

(A5-1) Words and phrases used throughout the environmental authority are defined in the **Definitions** section at the end of the Environmental Authority. Where a definition for a term used in the environmental authority is sought and the term is not defined within the environmental authority, the definitions in the *Environmental Protection Act 1994*, its Regulations and Environmental Protection Policies must be used.

Notification of Emergencies, Incidents and Exceptions

(A6-1) All reasonable actions are to be taken to minimise environmental harm, or the risk thereof, resulting from any emergency, incident or circumstances not in accordance with the conditions of this environmental authority.

(A6-2) As soon as practicable after becoming aware of any emergency, incident or information about circumstances which results or may result in environmental harm not in accordance with the conditions of this environmental authority, the administering authority must be notified in writing.

(A6-3) Not more than ten (10) business days following the initial notification of an emergency, incident or information about circumstances which result or may result in environmental harm, written advice must be provided to the administering authority in relation to:

a) proposed actions to prevent a recurrence of the emergency or incident;
b) the outcomes of actions taken at the time to prevent or minimise environmental harm; and
c) proposed actions to respond to the information about circumstances which result or may result in environmental harm.

(A6-4) As soon as practicable, but not more than six (6) weeks following the conduct of any environmental monitoring performed in relation to the emergency or incident, which results in the release of contaminants not in accordance, or reasonably expected to be not in accordance with the conditions of this environmental authority, written advice must be provided of the results of any such monitoring performed to the administering authority.

END OF CONDITIONS FOR SCHEDULE A

3.3 Air Quality

3.3.1 Background

Dust is the main potential air contaminant to be emitted from Caval Ridge Mine. Pollutants such as SO_2, NO_x and volatile organic compounds are potential air contaminants associated with the combustion of diesel fuels at the mining site but are considered to be emitted in insufficient levels to result in measurable adverse air quality impacts at nearby sensitive locations.

Greenhouse gas emissions from the project are not considered as air contaminants but contribute to anthropogenic climate change. Greenhouse pollutants related to the project are carbon dioxide (CO_2), Methane (CH_4) and nitrous oxide (N_2O). These are converted to a CO_2-equivalent for evaluation of the whole site inventory and comparison to Australian emissions from all sectors.

The project site is situated within a rural setting, with a number of coal mines currently operating in the area. Background measurements of dust deposition do not suggest that current dust levels exceed those expected as a result of normal agricultural activity, unsealed roads or natural occurring phenomena such as bushfires or dust storms. The prevailing wind direction is from the south-east and thus, relative to the project site, blows in the west of Moranbah. Sensitive receptors near the project site comprise residences north of the mine, locations in southern Moranbah, and homesteads to the east and west of the mine (Figure 3.3.1).

The following existing sources contribute to particulate emissions in the vicinity of the project site:

- Nearby coal mines
- Coal seam gas projects
- Dust generated from agricultural activities such as cropping and grazing
- Quarrying
- Smoke from bushfires and controlled burns
- Motor vehicle emissions from roads.

Background concentrations of dust (Table 3.1) were estimated in the project EIS using:

- Continuous PM_{10} monitoring data obtained at the Caval Ridge monitoring site; and
- Dust deposition measurements made by Peak Downs Mine on the Caval Ridge Mine site. These measurements were influenced by operations from Peak Downs Mine but were sufficiently remote from active mining operations that they are considered appropriate to represent ambient air quality at sensitive receptor locations.

Table 3-1 Background Particulate Levels

Air Quality Indicator	Averaging Time	Value
Particles as PM10	24 hour	18.8 µg/m3
Particles as PM2.5	24 hour	2.9 µg/m3
	Annual	1.6 µg/m3
Total Suspended Particulates (TSP)	Annual	26.2 µg/m3
Dust deposition	Monthly	1.5 g/m2

3.3.2 Environmental Value

The environmental values of the air environment to be enhanced or protected are:

- The qualities that make the air environment suitable for the life, health and wellbeing of humans.

3.3.3 Potential Impacts on the Environmental Value

Dust

The mining processes that will generate dust at the project are as follows:

- Creation of initial box cut which is the construction of Horse Pit.
- Pre-strip removal of overburden with the truck and shovel fleet and in pit dumping of overburden.
- Dragline removal of overburden, operating close to the bottom of each pit.
- Excavator removal of coal from the bottom of the pit and transfer to coal trucks.
- Drilling and blasting of overburden and coal seams.
- Dozers, shovels and graders as support to the draglines, truck and shovel fleet, on the overburden dumps and on the coal stockpiles.
- Box-cut spoil disposal area and in-pit dumps for dumping of overburden, grading of the surface and wind-generated dust prior to rehabilitation.
- Trucks on haul roads to transport ROM coal to the CHPP for processing, to transport overburden to the dumps and to transport the rejects from the CHPP for disposal in Horse and Heyford pits.
- ROM coal handling area, including dumping of coal, dozer operations, stacking and reclaiming ROM coal and coal crushing and sizing.
- ROM coal from the Southern ROM which is crushed at the Southern ROM receival station and transported by overland conveyor to the ROM coal stockpile.
- Product coal handling during reclaiming from the product coal stockpiles and due to wind erosion.
- Train load out entails the dumping of product coal into the rail wagons.

Results of the dispersion modelling suggest that air quality impacts due to construction activities in Year 1 are below the EPP(Air) objectives for TSP, $PM_{2.5}$ and dust deposition at residential locations. Operational impacts in Year 2 and Year 20 also satisfy the EPP (Air) objectives for TSP, $PM_{2.5}$ and dust deposition for typical operating conditions.

The dispersion modelling highlights the potential for PM_{10} levels to exceed the EPP(Air) objective of 50 µg/m³ for the 24-hour average concentration at some sensitive receptor locations for each of the Year 1, Year 2 and Year 20 scenarios modelled. A detailed investigation into modelled worst-case meteorological conditions highlights the strong dependence of the model results on the model default value of the mixing height which plays a key role in the calculation of night time impacts.

Impacts under worst-case short-term operating conditions, accounting for the possible proximity of key dust-generating equipment to either the north or south of each pit, show that high dust levels are possible to the north of the project under adverse meteorological conditions. An ambient air monitoring program has been developed that will monitor the impact of dust-generating emission sources at sensitive receptor locations.

The information obtained from the monitoring program will feed into the operational management of site-based dust emission sources.

Estimated impacts for upset conditions, namely the failure of dust suppression measures on the haul roads, shows that high dust levels are predicted for locations to the north and west of the project. The occurrence of these upset conditions can be managed by BMA by ensuring that adequate dust suppression measures are maintained at all times.

Greenhouse Gases

The following sources would contribute to direct and indirect greenhouse gas emissions from the project:

- Fugitive emissions of coal seam gas (CSG) from the open cut mining of coal;
- Fuel (diesel) consumption in heavy equipment and light vehicles;
- Combustion in explosives used in blasting;
- Electricity consumption in plant and machinery;
- Emissions from the end use of the coal in metallurgical uses as coking coal.

The National Greenhouse Accounts and site-specific data on coal seam gas content of the target coal seams were used to estimate the greenhouse gas emissions from the project.

In total, the project is estimated to result in approximately 11.1 Mt CO2-e of greenhouse gases over its life, or average 0.37 Mt CO2-e on an annual basis. The annual greenhouse gas emissions for the project represent 0.06% of Australia's 2006 greenhouse gas emissions.

Spontaneous Combustion

The level of spontaneous combustion is low due to the low sulphur levels and low inherent moisture in the coal. In the event of a fire developing, the impact on air quality due to smoke or gases will be localised and temporary.

3.3.4 Environmental Protection Objective

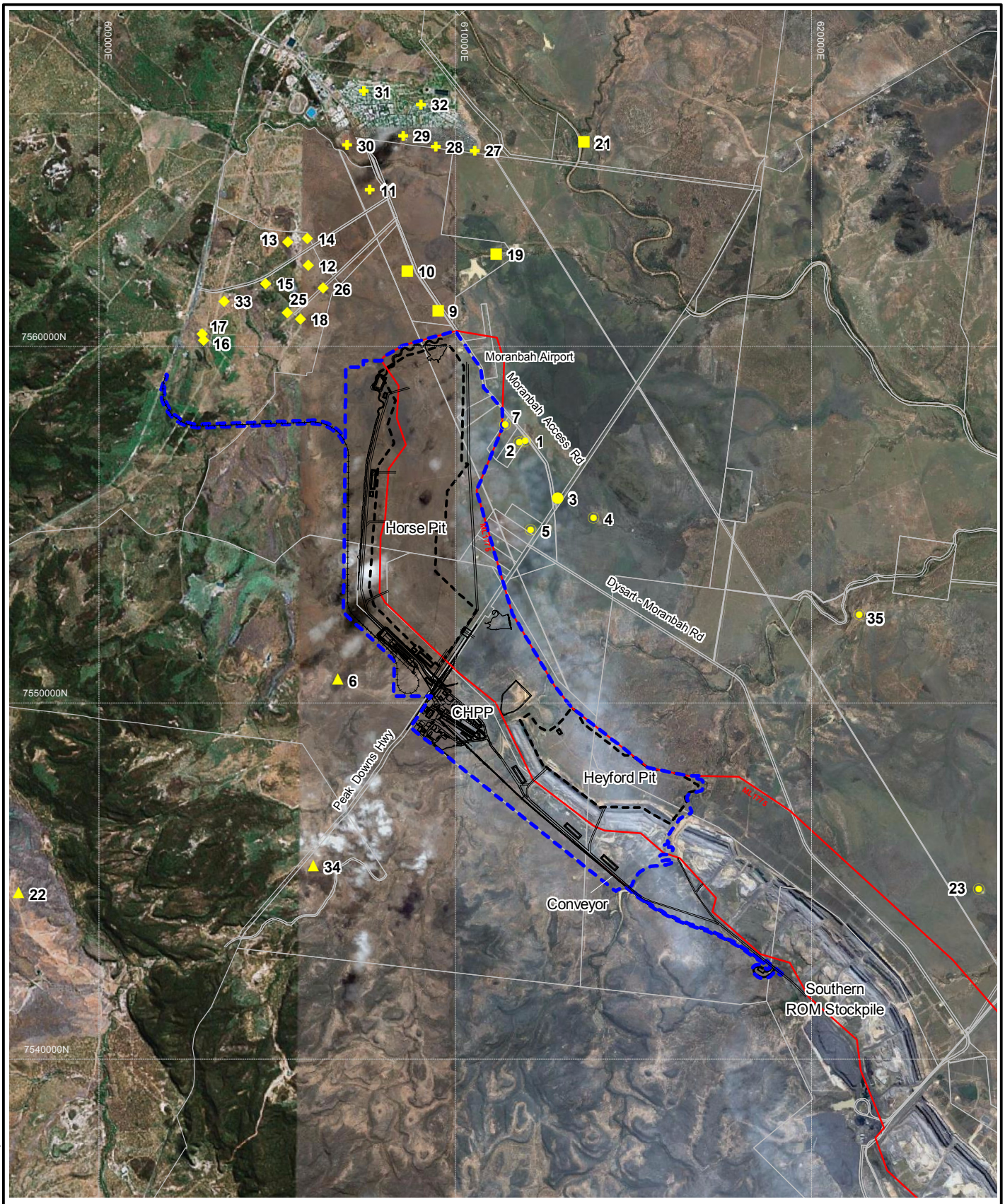
The environmental protection objectives for air quality are:

- To minimise the impacts of mine-derived dust on sensitive receivers beyond the boundaries of the relevant mining leases, and
- To implement energy efficiency initiatives.

3.3.5 Performance Criteria

The performance criteria for air quality are:

- Compliance with the requirements of the project's environmental authority
- Ambient air monitoring in accordance with the monitoring program outlined below
- The number of air quality complaints.



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Client: BHP Billiton Mitsubishi Alliance	Project: CAVAL RIDGE MINE DRAFT ENVIRONMENTAL MANAGEMENT PLAN		Title: **LOCATION OF AIR EMISSION SOURCES AND SENSITIVE RECEPTORS**
URS	Drawn: VH	Approved: RS	Date: 30-10-2009
	Job No: **4262 6420** /6158	File No: 42626158-g-2305.wor	Figure: **3.3.1** Rev:B A4

3.3.6 Air Quality Control Strategies

Dust mitigation for the operation of Caval Ridge Mine involves several elements to ensure adequate management of air quality in the vicinity of the mine, namely:

- Engineering control measures;
- Dust suppression measures;
- Rehabilitation of exposed surfaces; and
- Operational procedures.

Engineering Control Measures

BMA has designed engineering control measures into the project where appropriate and technically possible. In particular, these control measures have been applied at the CHPP and include the following:

- Enclosure of transfer points and sizing stations;
- Roof on overland conveyors;
- Belt washing and belt scrapers to minimise dust from the return conveyors;
- Reduced drop height from stackers to stockpiles;
- Enclosure of raw coal surge bins
- Install improved coal train loading infrastructure to control overloading and minimise spillage; and
- Install improved load profiling systems to create a more streamlined and consistent surface of coal in each wagon.

Dust Suppression Measures

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

- Watering of haul roads to best-practice level of more than 2 litres/m²/hour of water applied.
- Watering of ROM stockpiles using water sprays and water cannons that are operated on timers. The use of timers avoids the potential for missing a scheduled watering operation. The timers can also be operated manually in particularly hot or windy conditions.
- Fogging system on outlets from transfer points and sizing stations.
- Water sprays on stacker/reclaimer units.
- High moisture content of product coal and reject material as they leave the CHPP which avoids the need for supplementary watering. Immediately after the coal is dewatered in the CHPP, the coal will be above the dust extinction moisture limit (the lower limit at which dust-prone materials will no longer create dust) and so will not be a source of dust.
- BMA has budgeted for and designed the train load out facility to allow for a polymer-based dust suppression unit. However a decision on construction and installation of the dust suppression unit at the train load out, to reduce dust emissions during rail transport, will be made as QR and industry confirm arrangements across the coal industry

In the event that adverse conditions are encountered during operation of the project, additional dust suppression measures will be implemented.

Rehabilitation of Exposed Surfaces

Rehabilitation of exposed surfaces will be undertaken progressively as mining and stockpiling activities are completed (time from disturbance to rehabilitated estimated at approximately 2-5 yrs), and will include the use of fast-growing temporary cover material to accelerate the effectiveness of dust controls.

Operational Procedures

The following operational procedures for the project will be implemented in order to meet targets for air quality performance:

- Use of water trucks to achieve sufficient watering of haul roads and other high-risk areas. The schedule for truck use will be developed for the project and will incorporate consideration of recent rainfall and weather conditions;
- Use of water sprays and foggers as directed, with additional use as determined by ambient conditions;
- Maintenance of water spray equipment and engineering controls to minimise dust emissions;
- Sufficient number of watering trucks to allow for continuation of dust suppression when one or more truck is out of service;
- Monitoring of ambient air quality in the vicinity of the mine;
- Maintain a register of dust complaints;
- Implementation of an appropriate speed limit for light vehicles on unsealed roads;
- Manage topsoil stripping so that dust does not become a safety hazard or severe nuisance;
- Restrict land disturbance to that necessary for the operation and minimise the area of land disturbed at any one time;
- Implement a permit to disturb system; and
- Avoid burning cleared vegetation.

3.3.7 Product coal supplied for coal transport will have a coal-surface water content designed to reduce dust emissions during rail transport.Greenhouse Gas Abatement

The following greenhouse gas emission management control strategies will be implemented.

- Improve efficiency and minimise energy use through mine planning, including minimising haul distances.
- Consider fuel efficiency of mining equipment and haul trucks during procurement.
- Maintain mining equipment and haul trucks in good working order to maximise equipment fuel efficiency.
- Use appropriately sized equipment.
- Review annual energy use to identify potential energy efficiency opportunities on a regular and ongoing basis.
- Estimate and report annual greenhouse gas emissions to the relevant regulatory authority, as required.

In addition to this, BMA have a number of greenhouse actions being undertaken at a corporate level which is outlined below.

- Energy Excellence program - a comprehensive program of energy efficiency improvement review and implementation in response to the Energy Efficiency Opportunities Act 2006 that identifies initiatives, and develops and implements processes that ensure energy efficiency and energy source substitution opportunities are integrated into mine planning and operations.
- Mine methane management – a program where BMA has sought and received expressions of interest from gas operators to assist BMA in trialling coal seam methane recovery and utilisation.
- Australian Emissions Trading Scheme - BMA supports the introduction of emissions trading as an article of Australia's leadership role in the pursuit of comprehensive international climate change response measures and an important policy tool for achieving greenhouse gas reductions at least cost to the Australian economy.

3.3.8 Monitoring

Air quality monitoring will be undertaken in accordance with Proposed Environmental Authority Conditions: Schedule B – Air, below. The air quality management strategy for the site includes the use of dust monitoring equipment that can assist in determining the effectiveness of dust control strategies. Data obtained from the monitoring program will be used to identify potential air quality issues related to the operational management of mining activities at the project site. The data will aid in the identification of key dust-emission source(s) and will allow BMA to develop targeted and effective mitigation measures than can be incorporated into the operational procedures for the daily management of dust impacts.

A three stage program will be undertaken:

Stage 1

- Dust deposition monitoring at thirteen (13) nearby receptor locations on a 30 ± 2 day cycle;
- Monitoring of PM_{10} at two (2) locations for a minimum of one year of mining operations (the requirement for additional monitoring of PM_{10} will be reviewed after the initial one year monitoring of operational mining);
- Monitoring of the meteorological parameters of wind speed and wind direction at three (3) locations.

Stage 2

Stage 2 will be implemented at any and all sites for which there is an exceedence of the DERM dust deposition goal of 4 g/m^2/month for two consecutive months. For all sites(s) for which there have been exceedences of the DERM dust deposition goal of 4 g/m²/month for two consecutive months, one month of continuous monitoring of PM_{10} using a method approved in consultation with DERM will be conducted. The one month period is to coincide with the 30 day cycle of the dust deposition monitoring.

Stage 3

- Stage 3 monitoring will be implemented if there is an exceedence of the DERM guideline of 4 g/m_2/month for a period of 4 consecutive months. The need to implement Stage 3 monitoring will result from the inability of the Stage 2 monitoring program to isolate and mitigate problematic dust emission source(s).
- Continuation of Stage 2 monitoring.
- An air quality specialist will be commissioned to conduct a site-based Dust Audit, review the suitability of the site-based monitoring program and provide recommendations.

Caval Ridge Mine will also:

- Investigate all complaints about dust promptly and take appropriate action to reduce dust nuisance;
- Maintain a register of dust complaints;
- Review dust monitoring data to identify trends and implement corrective actions if necessary; and
- Prepare annual summaries of the dust measurements around Moranbah that will be available to the community.

3.3.9 Commitments

- The project will achieve and maintain the level of dust control outlined in the EA.
- The project will meet the Ambient Air Monitoring program requirements.
- The project will investigate all substantiated dust complaints.
- The project will implement corrective action resulting from complaints investigations as required.
- All monitoring and sampling techniques will be consistent with the DERM's Air Quality Sampling Manual and applicable Australian Standards.

3.3.10 Proposed Environmental Authority Conditions: Schedule B – Air

Dust Nuisance

Departmental Interest: Air

(B1-1) When requested by the administering authority or as a result of a complaint (which is neither frivolous nor vexatious nor based on mistaken belief in the opinion of the authorised officer), dust and particulate monitoring must be undertaken, and the results thereof notified to the administering authority within **fourteen (14) days** following completion of monitoring. Monitoring must be carried out at a place(s) relevant to the potentially affected dust sensitive place. Dust and particulate matter must not exceed the following levels when measured at any sensitive or commercial place:

a) Dust deposition of 120 milligrams per square metre per day, when monitored in accordance with *Australian Standard AS 3580.10.1 of 2003* (or more recent editions); and

b) A concentration of particulate matter with an aerodynamic diameter of less than 10 micrometre (µm) (PM_{10}) suspended in the atmosphere of 50 micrograms per cubic metre over a 24 hour averaging time, at a sensitive or commercial place in proximity to the site, when monitored in accordance with:

i. Australian Standard AS 3580.9.6 of 2003 (or more recent editions) Ambient air - Particulate matter - Determination of suspended particulate PM_{10} high-volume sampler with size-selective inlet - Gravimetric method; or

ii. any alternative method of monitoring PM_{10} which may be permitted by the *Air Quality Sampling Manual* as published from time to time by the administering authority.

Background dust and particulate matter monitoring

(B2-1) The holder of the environmental authority must develop and implement a background dust and particulate matter monitoring program. The program must be able to detect a significant change to dust levels to sensitive receptors due to activities that are part of this mining project.

(B2-2) The program must include, but not be limited to, the details as specified in Table 1 – Background dust and particulate matter monitoring.

(B2-3) The holder of the environmental authority must report the results and analysis of dust and particulate matter monitoring to the administering authority on request.

Table 1 (Background dust and particulate matter monitoring)

Air Quality Determination	Monitoring Point Location (GDA94)	Monitoring Point Description
A concentration of particulate matter with an aerodynamic diameter of less than 10 micrometre (µm) (PM_{10}) suspended in the atmosphere over a 24 hour averaging time	610,852 7,559,876 (TBA) 607,996 7,563,606 (TBA)	Moranbah Airport Long Pocket Road (TBA)

Odour nuisance

(B3-1) The release of noxious or offensive odour(s) or any other noxious or offensive airborne contaminant(s) resulting from the mining activity must not cause an environmental nuisance at any nuisance sensitive or commercial place.

(B3-2**)** When requested by the administering authority, odour monitoring must be undertaken within a reasonable and practicable timeframe nominated by the administering authority to investigate any complaint (which is neither frivolous nor vexatious nor based on mistaken belief in the opinion of the authorised officer) of environmental nuisance at any sensitive or commercial place, and the results must be notified within fourteen (14) days to the administering authority following completion of monitoring.

(B3-3) If the administering authority determines the odour released to constitute an environmental nuisance, then the environmental authority holder must:

a) address the complaint including the use of appropriate dispute resolution if required; and

b) immediately implement odour abatement measures so that emissions of odour from the activity do not result in further environmental nuisance.

END OF CONDITIONS FOR SCHEDULE B

3.4 Water Resources

3.4.1 Background

Surface Water Resources

The project site covers tributary streams of the Isaac River in the headwaters of the greater Fitzroy River catchment. The area is divided by a relatively indistinct ridgeline dividing two watersheds as follows:

- The northern watershed includes Horse Creek and tributaries; and
- The southern watershed includes Nine Mile Creek, Caval Creek, Harrow Creek, Cherwell Creek and tributaries.

Within the project site, Nine Mile Creek and Caval Creek flow into Cherwell Creek, and Harrow Creek flows into Cherwell Creek downstream of the project site, before flowing into the Isaac River. Horse Creek flows into Grosvenor Creek (Isaac River tributary) downstream of the project site.

The project site is approximately 65 km^2 and approximately 50% of the area drains to Horse Creek, the remainder draining to Nine Mile Creek, Caval Creek, Cherwell Creek, Harrow Creek and their tributaries. The infrastructure area is drained by Caval, Nine Mile and Cherwell Creeks which then flow into the Isaac River.

All watercourses and tributaries within the project site are ephemeral watercourses. Periods of flow are generally short and limited to periods during and immediately after rainfall. Mean monthly flows are significantly higher in the wet season between January and March than for the rest of the year, reflecting the higher rainfall totals through this period. Any flow within these creeks is rare during the dry season. There is no evidence of significant contribution to stream flows from groundwater sources. Figure 3.4.1 shows the surface water resources around the project site.

Cherwell Creek

Cherwell Creek, a tributary of the Isaac River, is the most significant watercourse within the project site (Figure 3.4.1). The Cherwell Creek catchment begins in the Cherwell Range and Denham Ranges at an elevation of 380 m (west of the project site) and flows downstream to join the Isaac River at an elevation of 200 m (east of the project site). Cherwell Creek is approximately 65 km long to the Isaac River junction with a catchment area of approximately 750 km^2. The catchment is susceptible to the impacts of agricultural land use activities, such as increase runoff, scouring, erosion and unstable creek banks.

Cherwell Creek has previously been diverted (in 1991 and 1995) to enable Peak Downs Mine to access coal reserves with open cut pit mining. Both diversions replaced meandering sections of creek floodplain, terraces, benches, low flow channel, active channel, and high flow channel features with a relatively straight alignment and trapezoidal channel. The designs were developed in accordance with best practice at the time, which preceded current best practice design guidelines (ACARP 2000). The Cherwell Creek diversions were subject to erosion (channel widening and deepening) and failure of stream stabilisation structures. In 2000, rehabilitation works were undertaken on the diversions.

Horse Creek

Horse Creek, a tributary of Grosvenor Creek, flows in a north, north-easterly direction through the northern watershed of the project site. Horse Creek is approximately 15 km long to the junction with Grosvenor Creek with a catchment area of approximately 57 km^2. Horse Creek will be diverted as part of the project. The

works (including a clean water diversion upstream of Horse Creek) will divert Horse Creek flows adjacent to the haul road that runs along the length of the proposed open cut pit and along the mining lease boundary. The haul road will act as a bund to protect the open cut pit from flooding during larger events up to 1 in 3000 ARI.

Nine Mile Creek

Nine Mile Creek, a tributary of Cherwell Creek, flows in a south-easterly direction through the project site before joining Cherwell Creek. Nine Mile Creek catchment area is approximately 72 km^2 at the junction with Cherwell Creek.

Harrow Creek

Harrow Creek, a tributary of Cherwell Creek, flows along the southern boundary of the project site. Harrow Creek catchment area is approximately 223 km^2 at the junction with Cherwell Creek. Harrow Creek was previously diverted in 1984 to allow for the expansion of open cut coal mining. The Harrow Creek diversion comprises a constructed section of approximately 1 km in length and is bounded by the open cut Heyford pit to the west and the Harrow pit to the east. Works have been undertaken as a staged process, with Phase 1 involving lengthening of the upstream channel and Phase 2 involving the rehabilitation of the existing diversion.

Caval Creek

Caval Creek, a minor tributary of Cherwell Creek and previously unnamed, flows in an easterly direction before joining Cherwell Creek. The Caval Creek catchment area is approximately 15 km^2 at the junction of Cherwell Creek. Caval Creek will also be diverted. The Caval Creek diversion is a partial diversion of Caval Creek around the product stockpile and rejoining Caval Creek further downstream (this includes a clean water diversion upstream of Caval Creek).

Surface Water Environmental Values

The Environmental Protection (Water) Policy 1997 (EPP Water) and Environmental Protection (Water) Amendment Policy (No. 1) 2008 (EPP Water Amendment), established under the Queensland *Environmental Protection Act 1994*, are intended to protect and/or enhance the suitability of Queensland's waters for various beneficial uses. The policy and amendment identifies environmental values (EVs) for waters within Queensland and guides the setting of water quality objectives to protect the EVs of any water resource. The location of the project is outside those areas described in Schedule 1 of the EPP (Water) 1997 and EPP (Water) Amendment 2008. The EPP (Water) 1997 and EPP (Water) Amendment 2008, states that for waters not listed in Schedule 1 the EVs to be enhanced or protected are the following qualities:

- For high ecological value waters – the biological integrity of an aquatic ecosystem that is effectively unmodified or highly valued;
- For slightly to moderately disturbed waters – the biological integrity of an ecosystem that is affected adversely to a relatively small but measurable degree by human activity;
- For highly disturbed waters – the biological integrity of an aquatic ecosystem that is measurably degraded and of lower ecological value than waters mentioned above;
- Suitability for:
  - Primary recreational use;
  - Secondary recreational use;

  - Visual recreational use;
- Suitability for minimal treatment before supply as drinking water;
- Suitability for agricultural use;
- Suitability for aquacultural use;
- Suitability for producing aquatic food for human consumption;
- Suitability for industrial use; and
- The cultural and spiritual values of the water.

Within the project area there are three named watercourses and various minor tributaries that area subject to protection under the EPP Water, however, specific EVs for Cherwell Creek, Nine Mile Creek, Harrow Creek, Caval Creek and Horse Creek are not defined within the EPP Water and there are no detailed local plans relating to EVs for the catchment. The general EVs relevant to Cherwell Creek, Nine Mile Creek, Harrow Creek, Caval Creek and Horse Creek comprise:

- The biological integrity of a modified aquatic ecosystem; and
- Suitability for use in primary industries (namely stock watering and farm use).

Surface Water Quality

Guidelines

The Australian and New Zealand Environment and Conservation Council Guidelines 2000 (ANZECC) provide guideline values or descriptive statements for environmental values to protect aquatic ecosystems and human uses of waters (e.g. primary recreation, human drinking water, agriculture, stock watering). The ANZECC Guidelines are a broad scale assessment and it is recommended that, where applicable, locally relevant guidelines are adopted.

The Queensland EPAs Queensland Water Quality Guidelines 2006 (QWQG) are intended to address the need identified in the ANZECC Guidelines by:

- Providing guideline values that are specific to Queensland regions and water types; and
- Providing a process/framework for deriving and applying local guidelines for waters in Queensland (i.e. more specific guidelines than those in the ANZECC).

Relevant water quality objectives for the project site were identified from QWQG to support and protect different environmental values for waters in the upper Fitzroy River Catchment. The physico-chemical indicators were obtained from the Central Coast Region upland stream values. Salinity guidelines were obtained from Appendix G of the QWQG.

Data

The existing water quality of the watercourses and downstream receiving environment of the Caval Ridge project site was assessed to characterise the baseline water quality conditions. The assessment was based on results gathered from three sources:

- Water quality monitoring activities undertaken in January, February and March 2008. Samples were taken at six different sites during periods of flow following rain events in:
  - Cherwell Creek;

  - Nine Mile Creek; and
  - Horse Creek and its tributaries (Figure 3.4.2).
- Water quality data sourced from BMA for January 2007 through May 2008. Sites sampled by BMA comprised Cherwell Creek and Harrow Creek.
- Water quality data was obtained from DNRW at Isaac River at Deverill gauging station located upstream of the project site (sampling events from 1964 to 2000) (Figure 3.4.2).

Results

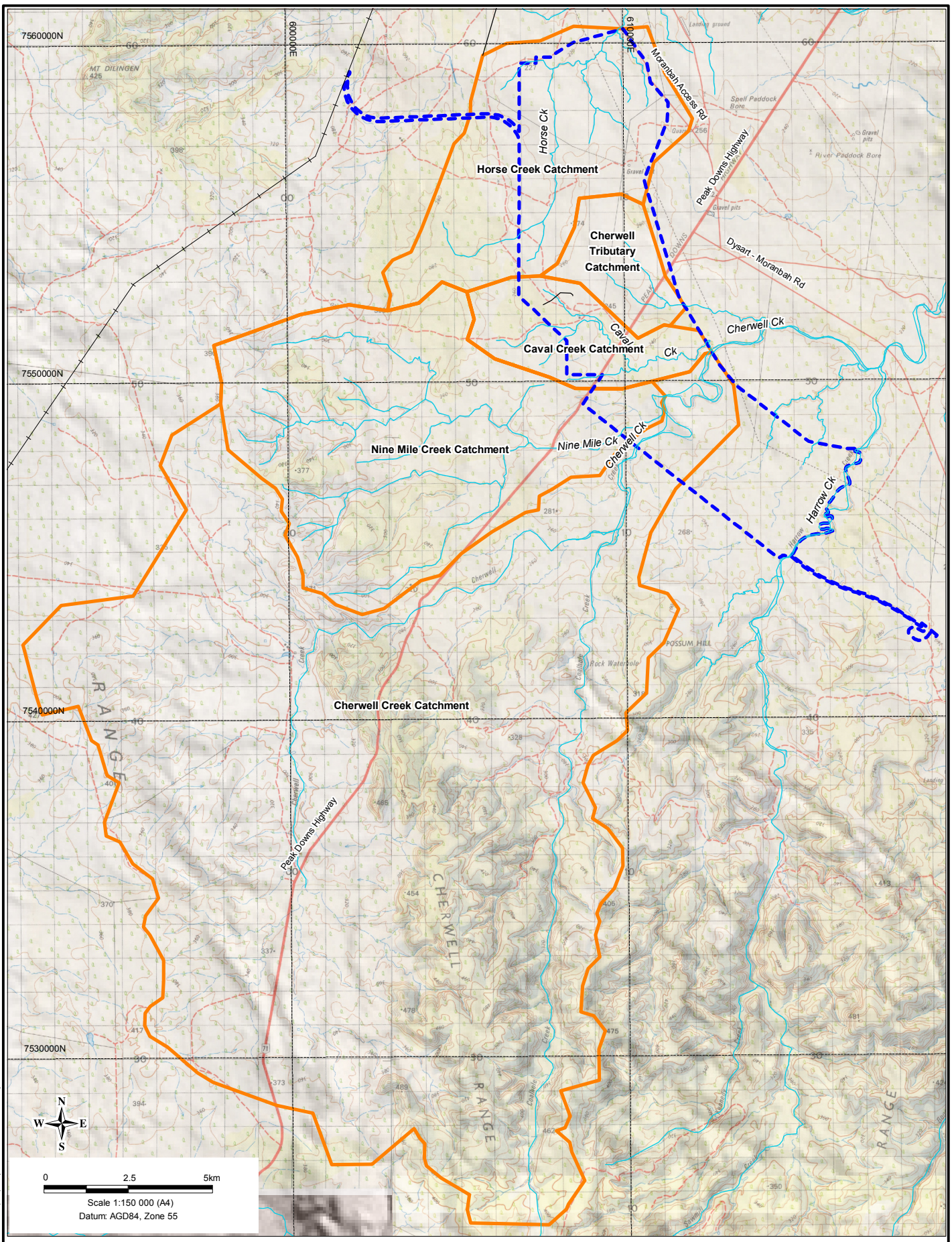
The assessment of water quality found that turbidity values exceed the QWQG water quality objectives at the Isaac River gauging station and at the majority of the upstream and downstream sites. Dissolved Oxygen (DO) levels were analysed only at Isaac River gauging station and were found to be below the water quality objectives. It is widely acknowledged that water within stagnant pools can naturally experience low DO values. Whilst flow measurements were not recorded at the time of sampling it is considered the the low DO recorded at the Isaac River gauging station may be a consequence of stagnation. pH results indicated slight exceedance of the QWQG water quality objectives for upland streams in the central coast region. The median electrical conductivity (EC) as a measure of salinity was within the water quality objectives at the majority of sampled sites.

The results of the assessment indicate that both total nitrogen (TN) and total phosphorus (TP) exceed the water quality objectives at all sites. Inorganic N (NH_4) concentrations were substantially lower than the organic N concentration which indicates a high proportion of nitrogen coming from organic sources, This suggests that the elevated nutrient levels may be a consequence of surrounding agricultural landuses.

Water quality samples were also analysed for Total Petroleum Hydrocarbons (TPHs) and metals . The TPH results were all within the control limits. All samplies complied with the QWQG for metals with the exception of Harrow Creek and Cherwell Creek where slighty elevated concentrations of aluminium were detected.

Surface Water Uses

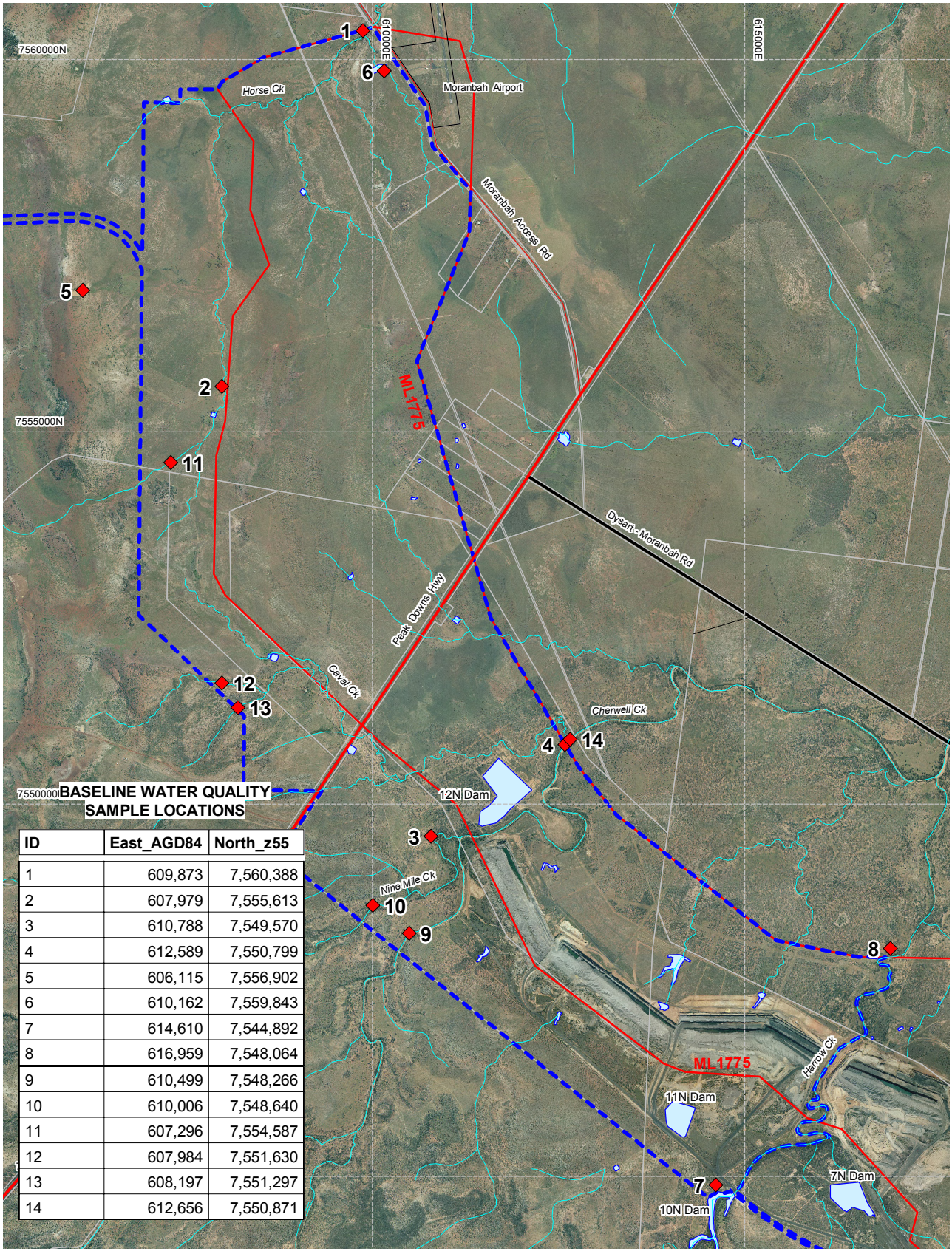
The land surrounding the project is dominated by agricultural grazing and other mining operations. The primary industry values for Cherwell Creek, Harrow Creek, Caval Creek, Nine Mile Creek and Horse Creek are for stock watering, farm use and industrial use. Industrial users of surface water resources in the surrounding area include Peak Downs Mine and Kalari Workshop. Peak Downs Mine is currently licensed to extract 230 ML per annum from Harrow Creek, but is not currently licensed to extract water from Cherwell Creek. Kalari Workshop is not currently licensed to extract water from Horse Creek, and it is unlikely that a sustainable water supply could be provided from this source. The watercourses within the project site are ephemeral in nature and this provides seasonal habitat for aquatic fauna and flora.



Source: Natmap 1:100000 Series Mapping

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Client: BHP Billiton Mitsubishi Alliance	Project: CAVAL RIDGE PROJECT DRAFT ENVIRONMENTAL MANAGEMENT PLAN	Title: **LOCAL AND REGIONAL DRAINAGE PATTERNS**	
URS	Drawn: VH	Approved: RS	Date: 30-10-2009
	Job No: **4262 6420** /6158	File No: 42626158-g-2306.wor	Figure: **3.4.1**
			Rev:B A4



BASELINE WATER QUALITY SAMPLE LOCATIONS

ID	East_AGD84	North_z55
1	609,873	7,560,388
2	607,979	7,555,613
3	610,788	7,549,570
4	612,589	7,550,799
5	606,115	7,556,902
6	610,162	7,559,843
7	614,610	7,544,892
8	616,959	7,548,064
9	610,499	7,548,266
10	610,006	7,548,640
11	607,296	7,554,587
12	607,984	7,551,630
13	608,197	7,551,297
14	612,656	7,550,871

N W E S

0 1 2km

Scale 1:75 000 (A4)

Datum: AGD84, AMG Zone 55

Water Sampling Locations

Project Site

Mining Lease

Source: Client Supplied Data

Client: BHP Billiton Mitsubishi Alliance (BMA)

URS

Project: CAVAL RIDGE MINE
DRAFT ENVIRONMENTAL MANAGEMENT PLAN

Title: **BASELINE SURFACE WATER QUALITY SAMPLING LOCATIONS**

Drawn: VH	Approved: RS	Date: 30-10-2009
Job No: **4262 6420** /6158	File No: 42626158-g-2307.wor	

Figure: **3.4.2**

Rev:B

A4

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Aquatic Ecology

Aquatic habitats within the project site consist of natural streams and drainage lines, predominantly associated with Cherwell Creek, but also Horse Creek and Nine-mile Creek, and a number of artificial waterbodies in the form of mine and farm dams, including the modified (dammed) channel of Harrow Creek. All natural drainage lines occurring within the project site are ephemeral, as indicated by deep sandy stream beds and an absence of aquatic (and often riparian) vegetation, with the frequency of flows expected to be considerably reduced and restricted to periods of heavy rainfall, while the artificial dams contain water throughout the year.

No aquatic fauna of special conservation significance were recorded during recent or previous surveys of the project site and immediate surrounds. The ephemeral nature of the natural drainage lines and their substrate within the project site mean that flows of any substance are likely to be restricted to periods of, and immediately after, heavy rainfall. Given the ephemeral nature of the local drainage system, most of the aquatic species within the vicinity of the project site are wide ranging and capable of withstanding a wide range of aquatic conditions.

Groundwater Resources

The project is located on the relatively undisturbed western limb of the northern Bowen Basin which overlies the Collinsville Shelf (part of the Clermont Block) in the area. The Bowen Basin in the area is characterised by a relatively thin accumulation of sediments, gentle easterly dips and minor to moderate deformation. Regionally, the stratigraphic sequence is summarised as follows: the Permo-Triassic sediments of the Bowen Basin are overlain by a veneer of unconsolidated Quaternary alluvium and colluvium, poorly consolidated Tertiary sediments and, in places, remnants of Tertiary basalt flows. The Moranbah Coal Measures, which contain the coal seams proposed to be extracted by the project, conformably overlie the German Creek Formation and are conformably overlain by the Fort Cooper Coal Measures.

The main factors influencing natural groundwater levels are groundwater recharge, evapotranspiration, and regional flow patterns. The low number of groundwater wells in the area indicates that groundwater extraction is unlikely to have had a significant impact on historical regional groundwater levels. On a time-frame of years and decades, land-use and land-cover changes may have significantly altered the natural water-balance and groundwater levels. The typical impact in Australia has been a tendency towards deforestation and greater net recharge and therefore higher water-tables.

The depth to water in monitoring wells on-site in the Quaternary alluvium aquifer during this investigation was typically less than 15 metres below ground level (mbgl). The depth to water on site in the Tertiary basalt aquifer was less than 30 mbgl. Depth to groundwater for the Tertiary sediment is likely to be similar to the depth to groundwater in the Quaternary alluvium and basalt aquifers due to the similar depth.

The groundwater flow direction is likely to be topographically controlled, flowing from higher elevations to lower elevations. The groundwater level in the Cherwell Creek alluvium falls from approximately 216 to 212 mAHD as it traverses the site (Pz08-S to Pz07-S), indicating that groundwater will generally flow along the line of the creek. The groundwater level in the basalt in the north of the site falls from approximately 220 to 214 mAHD (Pz03-S to PZ02) to the north. No data exist on the seasonal fluctuations of groundwater level within the Tertiary or Quaternary aquifers. However due to the shallow depth of these aquifers, they are expected to show a relatively rapid response to rainfall in areas where the coarser sediments or fractured basalt are exposed and no substantial clay barriers occur in the shallow sub-surface.

The groundwater flow direction in the coal seam aquifers north of Cherwell Creek appears to be from west to east across the site. This flow direction is consistent with recharge to the coal seams occurring at the subcrops in the west of the site. The flow direction has been altered locally with groundwater flow towards the existing mine pits in the Peak Downs Mine to the south of Cherwell Creek. The depth and confined nature of the Permium aquifers would like yresult in a subdued response to recharge.

Groundwater Environmental Values

As discussed above for surface water, the Environmental Protection (Water) Policy 1997 (EPP Water 2000) identifies environmental values (EVs) for waters within Queensland and guides the setting of water quality objectives to protect the EVs of any water resource. The EVs include the biological integrity of the aquatic ecosystem and recreational, drinking water supply, agricultural and/or industrial uses.

The EV relating to groundwater in the vicinity of the project site is the availability and suitability of groundwater for agricultural use. The local area around the project has been cleared and used for agriculture, predominantly beef cattle grazing, since at least 1957. These farming practices modify the landscape, affecting the volume and rate of runoff, the flow characteristics of the creeks, and the recharge to groundwater. As such, the aquatic ecosystems of the area have been modified. Water available to ecosystems may include a mix of groundwater with soil water (unsaturated zone) and surface water. The depths to groundwater and the lack of springs or seeps in the area indicate that groundwater dependent ecosystems are not likely to exist in the vicinity of the project site. The vegetation species and regional soil/geology types suggest that the level of groundwater dependence is likely to be relatively low and vegetation is likely to be able to satisfy plant water requirements using retained soil moisture.

Groundwater Quality

The physico-chemical results from groundwater sampling at the project site (Figure 3.4.3) indicate the water chemistry is typically of near neutral pH for all geological formations. The coal seam and basalt formation groundwaters have a variable salinity level (measured as electrical conductivity), ranging from brackish to saline, while the alluvium groundwaters are fresh to brackish. Sodium is the dominant cation in the groundwater from all monitoring wells (apart from Pz07-S in the alluvium which is calcium dominant). The dominant anion is chloride in monitoring wells in the coal measures (Pz01, Pz03-D, Pz07-D, Pz08-D, Pz09, Pz10 and Pz11), basalt (Pz03-S) and alluvium (Pz08-S), while the dominant anion is bicarbonate in the other monitoring wells in the coal measures (Pz04, Pz05 and Pz06-D), basalt (Pz02 and Pz06-S) and alluvium (Pz07-S).

The existing concentrations of some dissolved metals (boron, chromium, copper, manganese, nickel, selenium and zinc) and nutrients (ammonia, total nitrogen and total phosphorous) in the groundwater are above the water quality guidelines for freshwater ecosystems (ANZECC 2000; Queensland Water Quality Guidelines 2006). Elevated concentrations of these elements in groundwaters in coal measures are not uncommon, and are considered to be naturally occurring.

The water quality from the monitoring wells indicates that in general, the water is unsuitable for human consumption as assessed against the Australian Drinking Water Guidelines (2004). This is due to elevated levels of sulphate and some dissolved metals (manganese, nickel and selenium) in some of the groundwaters. The groundwaters also generally have elevated levels of salinity (>1000 mg/L) which are above the guideline for aesthetics based on unsatisfactory taste. Compared to the ANZECC (2000)

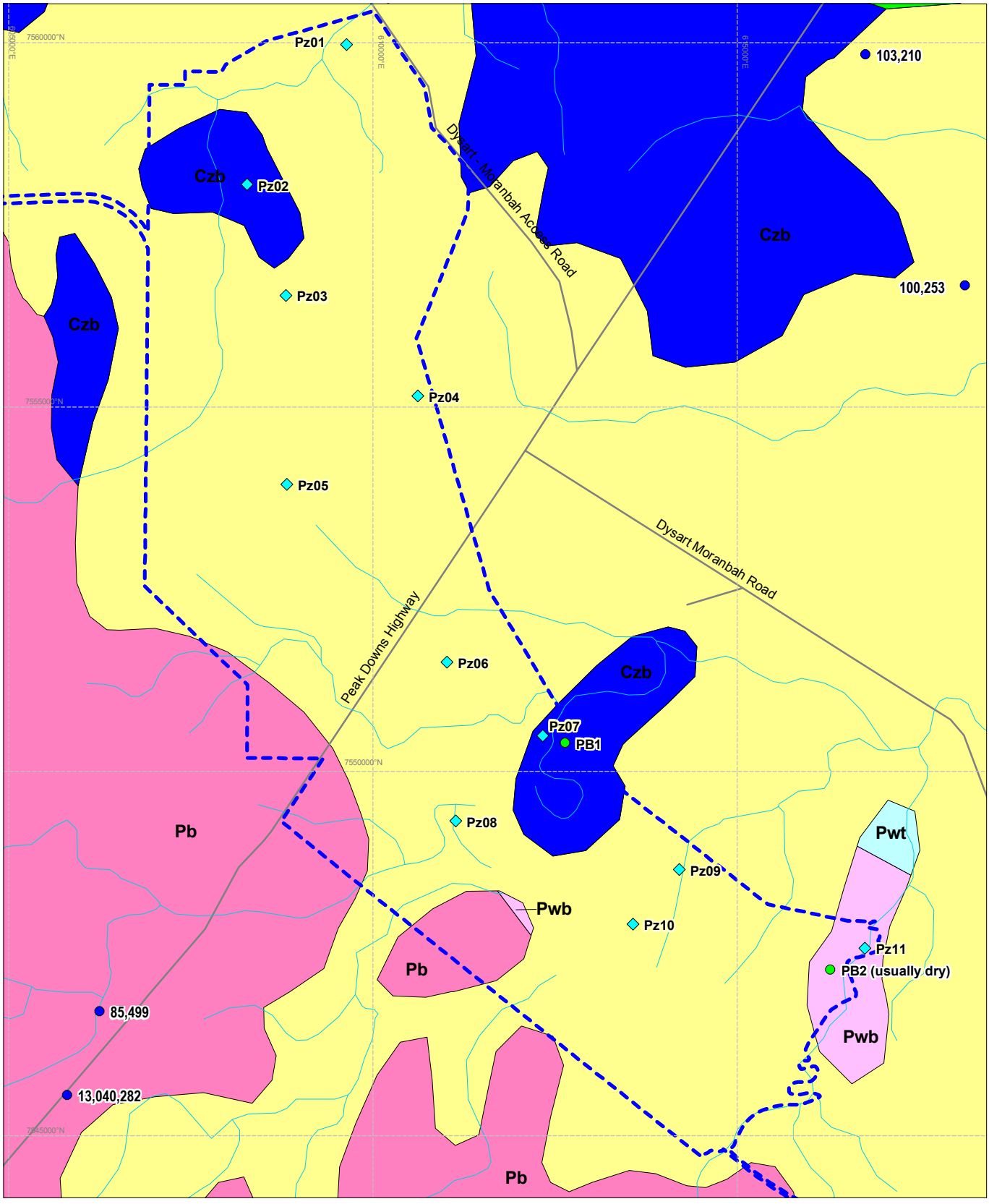
guidelines, groundwater present within the project site is generally useable for livestock drinking water. Some samples of groundwater contained slightly elevated level of sulphate and/or selenium and salinity levels above the upper guideline limit for beef cattle. The generally low sustainable yield of the water bores in the area precludes the usage and potential for usage of the groundwater as a source of irrigation water or water for aquaculture or the production of aquatic foods.

There are no known industrial users of groundwater within the local area as use for industry would be unsustainable due to the low sustainable yield of the aquifers. There are no groundwater springs or seeps that supply surface water bodies in the area that are used for recreational use. There are no groundwater springs or seeps that supply surface water bodies in the area that may have significant indigenous and/or non-indigenous cultural heritage.

Groundwater Users

In Queensland, a number of areas have been declared as subartesian areas under the *Water Act 2000* which is administered by DNRW. The project site is within the Highlands Declared Subartesian Area and there is a requirement for all wells in this area to be licensed with an allocation by the DNRW for uses other than stock and domestic supply.

Local groundwater use is primarily for livestock watering purposes owing to the variable salinity levels and generally low yields. Thirteen groundwater bores have been installed and registered within a 10 km radius of the project site. Registered bores within the vicinity of the project site are presented on Figure 3.4.3. Of the 13 groundwater bores installed, 9 have been installed for private use, and 4 have been installed by DNRW for groundwater monitoring and assessment. Of the nine bores installed for private use, none have been installed in the Moranbah Coal Measures, four have been installed in the Back Creek Group underlying the coal measures to the west of the site, four have been installed to unknown depth by Mitsubishi Gas Company (MGC) for coal seam gas exploration, and one (RN 103210) has been installed into the Fort Cooper Coal Measures overlying the Moranbah Coal Measures.



N
W E
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0 1 2km

Scale 1:75,000 (A4)

Datum: AGD84, AMG Zone 55

Czb	Undifferentiated Tertiary Basalts		Monitoring Wells Installed
Czr	Undifferentiated Tertiary Sediments		Monitoring Wells - Peak Downs
Pwt	Fair Hill Formation		DNRW Registered Bore
Pwb	Moranbah Coal Measures	Pb	Geological Boundary and Geological Regime
Pb	Back Creek Group		Project Site

Source: Client Supplied Data (December 2007), Qld Gov. DME Geological Mapping, 2007

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Client: BMA — BHP Billiton Mitsubishi Alliance

URS

Project: CAVAL RIDGE MINE
DRAFT ENVIRONMENTAL MANAGEMENT PLAN

Title: **LOCATION OF GROUNDWATER MONITORING WELLS INSTALLED AROUND THE PROJECT AREA**

Drawn: VH	Approved: RS	Date: 30-10-2009	Figure: **3.4.3**
Job No: **4262 6420** /6158	File No: 42626158-g-2308.wor		Rev:B A4

3.4.2 Potential Impacts on the Environmental Values

Surface Water

Construction Activities

Construction activities at the project site have the potential to impact environmental values of surface water as a result of earthmoving activities, works adjacent to/within drainage lines, contaminant mobilisation, pollution, flooding, water supply, as follows:

- Sediment mobilised during construction activities (including those carried out within or adjacent to drainage lines and watercourses), may enter surface water runoff during rainfall events and discharge to watercourses leading to deleterious effects on water quality and aquatic habitats. Sediment exposed or generated during construction may also be blown by wind into surface water bodies and potentially dry up wet areas.
- Potential sources of on site pollution during the construction phase predominantly comprise diesel and other petroleum-based fuels and lubricants used by excavation and construction machinery. Contaminants may be mobilised through runoff from chemical storage areas, fuel oil storage areas, oil-filled transformer yard areas and general wash down areas. Contaminants may enter drainage lines and creeks, soak into the soil and enter the groundwater.
- Out-of-bank/flash flood rainfall events during construction can cause erosion of drainage lines and damage to erosion and sediment control infrastructure.
- A lack of water supply during the construction phase could result in inadequate dust suppression, soil compaction and wash down facilities, allowing sediment movement into neighbouring creeks, leading to deterioration in water quality.

Operational Activities

Operational activities have the potential to impact on environmental values of surface water as follows:

- Mining activities can lead to erosion and sediment mobilisation causing deleterious effects on downstream water quality and aquatic habitats. Activities include:
  - Open cut mining operations including topsoil stripping, blasting, overburden removal, handling, stockpiling;
  - CHPP operations including crushing and stockpiling;
  - Earthworks including construction of additional haul road, relocation of back access roads, new drainage, levees etc; and
  - Inadequate erosion protection in drains.
- Failure of the water management system could result in a non-compliant discharge of poor quality mine water to the environment, detrimentally impacting downstream receiving waters, ecosystems and landholders through changes in water quality, changes in flow regime, erosion and sedimentation at discharge points, and alteration of riparian and aquatic species.
- Caval and Horse Creeks will be diverted as part of the project. Construction of creek diversions will likely change channel flow velocities and stream power causing:
  - Erosion of the new channel or upstream reaches sufficient to alter creek channel form (shape and plan alignment) in the alluvial sections.

  - Sedimentation downstream of the project, either from quantities of sediment mobilised from the new channel or by changed creek hydraulics as a result of the new channel.
  - Changes in flood regime in Horse Creek, Grosvenor Creek and Cherwell Creek and in the vicinity of the mine and open cut pits.
- Out-of-bank/flash flood events during the operational phase of the project could result in inundation of the open cut mining pits due to inadequate containment capacity of the designed floodplain. With the existing creek network and proposed diversion channels, some pit inundation is expected to occur for 100 year annual recurrence interval (ARI) flood events and higher.

Groundwater

Construction and Operational Activities

Regional Groundwater Levels

The project site is within the declared Highlands Subartesian Management area. Thirteen bores are registered with DERM as being located within 10 km of the site boundary.

Groundwater ingress into the pits will not be significant, as indicated by inflow in the Peak Downs Mine. Ingress into the pits will cause drawdown around the pits, which in turn causes regional groundwater levels to lower as seen around the existing Heyford Pit. Following the cessation of mining, groundwater will continue to discharge to the final voids with water levels within the surrounding aquifers recovering to an equilibrium with the new hydrological regime.

An estimate of groundwater inflows, and thus dewatering / discharge requirements, was made based on the vertical hydrogeology within the Permian formation. It can be divided into three main zones:

- Zone 1 – the upper weathered overburden which based on drilling results is assumed to act as an aquitard;
- Zone 2 – the interburden sandstone and siltstone which has a permeability an order of magnitude lower than the coal seams and is estimated to be up to 150 m thick; and
- Zone 3 – the coal seams with a coalesced thickness of up to 30 m.

As the pit depth increases, the inflow rate into the pit void increases. The estimated hydraulic conductivity (k) values utilised for the three zones indicates that the combined ingress of groundwater to the bottom of the pits, some 180 m below surface, will be ± 27,900 m^3/day (up to ± 96,600 m^3/day) for the Horse Pit and ± 22,300 m^3/day (up to ± 78,800 m^3/day) for the Heyford Pit. These ingress rates equate to ± 2 m^3/day (up to ± 7 m^3/day) per metre of the circumference of both the Horse Pit and Heyford Pit. The mine pits are located in or close to the outcrop of the coal seams such that ingress to the pit from upgradient of the pit will be negligible, and that the seepage face on pit walls will be above the base of the pit, which will decrease the expected ingress into the pits by at least a half of that estimated. Seepage into the pits will be collected in in-pit sumps and used for dust suppression or as process water where suitable.

The radius of influence of the drawdown of the groundwater level (distance to negligible drawdown) is also calculated to extend up to approximately 800 m down dip from the high wall and along strike from the end wall of the pits. However, the mine pits are located in the recharge area of the coal seams such that recharge to the coal seams will be reduced, which will have an additional impact on the extent of drawdown of groundwater levels. The extent of the radius of influence of the current Heyford Pit extends approximately

1,800 m from the highwall. The radius of influence of the project pits is expected to be in the order of 1,800 m, taking into account the reduction of recharge to the coal measures.

The cumulative impact of the Peak Downs Mine and the proposed Caval Ridge Mine will be to superimpose the drawdown of each mine along strike, resulting in a greater drawdown between the mines. No groundwater users were identified between the mines. The drawdown of the mines down-gradient of each mine will be as a result of that particular mine such that there will be no cumulative impact of drawdown on groundwater levels.

The groundwater wells identified on neighbouring properties are greater than 2 km from the site, thus it is anticipated that the proposed mine activities and subsequent groundwater drawdown will not have a significant impact on the regional groundwater users of the Permian aquifers.

All creeks within the study area are ephemeral and there are no perennial water holes or groundwater dependant environments present. Under dry season conditions, groundwater does not contribute to surface water flow within these creeks. In exceptionally wet years it is possible that the Quaternary alluvium and shallow Tertiary aquifers may contribute some groundwater to the surface water system along water courses. The drawdown of the potentiometric surface of the Permian strata aquifers during mining is unlikely to have an impact on these discharges as the shallow aquifers sit above, and are generally poorly connected to, the aquifers below.

If the pits encounter the Quaternary alluvium, pit inflow will occur. Due to their shallow depth and lack of continuity and thickness, the Quaternary alluvium is not considered a significant aquifer. However, during periods of creek flow, the alluvium may become fully saturated and discharge to the pits.

Based on the heterogeneity and discontinuous nature of the Tertiary basalt, it is anticipated that the proposed mine activities will not have a significant impact on the isolated areas of basalt. No regional groundwater users of the Tertiary basalt aquifers were identified.

Groundwater Quality

The groundwater quality of the Permian strata is brackish to brine and not suitable for human consumption or irrigation, but has some use for stock water (according to the Australian Drinking Water Guidelines (2004) and Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2000)).

During mining operations, water quality within aquifers surrounding the project site is expected to remain the same as pre-mining water quality for these aquifers. No change in water quality during mining operations (as compared to pre-mining) is expected for the following reasons:

- During mining operations, groundwater will be continually extracted from the pit to ensure a safe working environment within the pit. Extraction of groundwater from the pit will create a depression in the potentiometric surface at this location, and groundwater surrounding the mine pit will travel towards this depression. The net movement of groundwater towards the pit during mine operation will prevent the movement of potentially poorer quality water (that may have been impacted by mining) from moving away from the mine operation area and into the surrounding aquifers.
- Aquifers outside of the mine pit area will continue to receive recharge via the same processes that occurred pre-mining.

Groundwater quality data also suggests that groundwater in the alluvial aquifers and basalt are of similar or better quality compared to the Moranbah Coal Measures with respect to major ions and metals. Hence any inadvertent mixing of groundwater (during mining) by downward movement from the upper to lower aquifers is unlikely to result in a deterioration of water quality in either aquifer but lead to an improvement in water quality in the deeper aquifers.

During mine operation, water quality within aquifers surrounding the mine pit will continue to be suitable for the same purposes applicable during the pre-mining period.

A geochemical assessment undertaken for the project site indicates that not only are almost all mineral waste materials (overburden and CHPP rejects) non-acid forming (NAF), but the high acid neutralising capacity (ANC) of many of the samples combined with the very low sulphur concentrations, indicates there would be excess alkalinity to buffer the small quantity of acid that could potentially be produced by a very small proportion of the likely mineral waste materials. As the direction of groundwater flow is expected to be towards the pit, the buffering capacity of the groundwater is expected to neutralise any oxidation products of the coal seams due to mine dewatering, and any potential for the development of acid mine drainage is low.

The geochemical assessment found that the water extracts from all composite samples of mineral waste have soluble metal concentrations below applied ANZECC (2000) values for livestock drinking water. It also found that the electrical conductivity (EC) of the materials is moderate to high, ranging from 388 to 1,970 µS/cm (median 679 µS/cm), and is similar for both overburden and potential rejects. This range of electrical conductivity is comparable to the low end of salinity found in the groundwater monitoring wells (351 to 1,861 µS/cm in the alluvium) and indicates that initial water solubility of these materials with respect to salinity in mineral waste materials from the project may contribute some salt load to the shallow groundwater through seepage from the waste or CHPP.

Other Impacts

Compression of the ground surface associated with the construction of roads and building foundations is not expected to greatly alter the permeability of strata immediately beneath the site, and as such will not markedly hinder the recharge of the underlying aquifers. Subsurface construction can cause groundwater flow to be impeded and pressure heads to build up on the up-gradient area and reduced down-gradient. Pressure head relief engineering solutions will be utilised in subsurface constructions, where required.

During mining, mobile and stationary machinery including excavators, cranes, trucks and other vehicles will be required. There is potential for hydrocarbon contamination of the soil associated with leaks or spills from this machinery (or fuel storage areas for the maintenance of machinery). Dissolved and free-phase hydrocarbon may impact on the shallow aquifers underlying and down-gradient of areas of fuel spillage.

Post Mining

Regional Groundwater Levels

The main features of the final landform after mining ceases will consist of overburden dumps to the west, and final voids in the east. The final voids will collect and accumulate water from groundwater ingress through the walls of the final void and from areas of backfill material, direct rainfall into the void and from overland surface flows from the slopes of the waste dumps draining into the void. Typically, the final void will contain long-term water levels and water quality dependent on a number of inter-related hydrological and geochemical processes.

After mining is completed, the groundwater system will re-adjust to the new aquifer conditions surrounding the mined area. Water levels/pressures within the regional aquifers will over time attain a new equilibrium level. This new equilibrium for the groundwater system will have a different potentiometric surface from that which was present pre-mining owing to the presence of final voids in the east of the mined area and the different hydrogeological parameters of the backfill material.

A preliminary final void study has been undertaken to determine backfill and contouring requirements for the final voids, the hydrological regime of the final voids, and the expected water quality of the final voids. Areas of backfill within the pits will have a higher porosity and permeability than the pre-existing Permian strata, forming unconsolidated and unconfined aquifers. These aquifers will be recharged by rainfall and overland flow, and may interact through lateral flow with the adjacent Permian strata aquifers and the final voids.

This preliminary modelling was conducted for three final void shapes and for various climatic conditions. The assessment shows that even under probable maximum precipitation the risk of the final voids overflowing is negligible due to the large final voids, low mean annual rainfall, high evaporation, limited groundwater ingress due to poor groundwater resources, and limited runoff based on rainfall intensity and duration in study area. Long term predictions from the preliminary modelling indicate that the final void will act as a sink, thus causing a localised drawdown cone around the void. Resultant groundwater gradients will be towards the void thus negating the risk of saline void water migrating into the aquifers and off site.

Groundwater Quality

A rise in the final void water salinities will result from evaporative concentration processes, and from atmospheric weathering of excavated exposed bedrock. Although water quality in the final void is expected to deteriorate over time, this deterioration in water quality is not expected to impact the surrounding aquifers as the voids are expected to operate locally as a groundwater sink so that water within the void will not recharge the groundwater system unless water levels in the void rise above existing groundwater levels in the coal seams. Geochemical analysis in the Moranbah Coal Measures lithology show the overburden, coal rejects, and fine tailings have low acid generation potential, and therefore there is a low risk that metals will be mobilised from overburden and co-disposal dumps. Post-mining water quality within all aquifers surrounding the project site is expected to remain the same as pre-mining water quality.

3.4.3 Environmental Protection Objectives

The environmental protection objectives for water are to:

- Protect the biological integrity of the disturbed surface water aquatic ecosystem;
- Ensure the project does not detrimentally impact on the suitability of surface water for agricultural use; and
- Ensure the project does not detrimentally impact on the availability and suitability of groundwater for agricultural use.

3.4.4 Performance Criteria

The performance criteria for water resources are:

- Compliance with the requirements of the project's environmental authority.
- Groundwater and surface water monitoring in accordance with the control strategies outlined below.
- The number of groundwater or surface water complaints from down gradient land users.

3.4.5 Control Strategies

Surface Water

Construction Activities

Earthworks

The following management and mitigation measures will be implemented to minimise potential impacts on the environmental values of surface water as a result of construction activities:

- The earthworks contractor will be required to prepare and implement a construction environmental management plan (containing a sediment and erosion control plan and water management plan) prior to the commencement of construction.
- Construction activities that will affect existing drainage lines and control measures will only be carried out after suitable stormwater management infrastructure has been installed on site. Temporary fill placed into the creeks for the purpose of construction or operational activities (e.g. dragline crossings) will be removed and the creek rehabilitated to existing condition or better.
- Areas of disturbed or exposed soil will be managed to minimise the loss of sediment, either through revegetation and/or use of other stabilisation techniques to control erosion and increase energy dissipation (e.g. bunding, matting, riprap and gabions). Drains will be protected from scouring where necessary.
- Stormwater controls and upstream water quality treatment with be implemented, such as infiltration devices (e.g. swales and buffer strips) and vegetation filters.
- Work will be concentrated in as small an area as possible and progressively expanded to minimise the amount of land disturbed at any one time.
- Specific construction activities will only be undertaken during the dry season. No clearing or topsoil removal work will be carried out during heavy rainfall.
- Stockpiling of topsoil and other material will be located away from watercourses. Usable topsoil will be stripped and stockpiled away from drainage lines to protect it from erosion.
- Vegetation disturbance will be carried out in accordance with a permit to disturb system and will be minimised, especially riparian vegetation. A minimum number of passes by heavy earth moving equipment will also help to minimise erosion and dispersion of soils by the wind. Additionally, upon completion of works, revegetation using local species will take place wherever possible and as soon as practicable considering seasonal influences.
- Sediment control devices will be routinely inspected.
- Water proposed to be released from sediment basins to receiving waters will be tested for quality and ensured that it meets water quality objectives.
- Ensure there is an adequate supply of water for dust suppression.
- To limit sediment mobilisation, the existing sediment control structures (e.g. farm dams) will be used.
- Vehicle crossings will be adequately designed for a range of flow conditions, including under road drainage. Traffic will be confined to maintained tracks and roads where possible.
- The temporary diversion of watercourses will be either by low flow diversion or coffer dam with pumping.
- Disturbance by heavy earth moving equipment will be minimised in riparian areas.

- All crossings will be in accordance with the DNRW Guideline – Activities in a watercourse, lake or spring carried out by an entity.

A Riverine Protection Permit is required for the Peak Downs Highway and as a minimum will require the following mitigation measures as conditions of the Riverine Protection Permit. Specific management measures and conditions relating to each watercourse will be established by DERM:

- The area of disturbance must be no greater than the minimum area necessary for the purpose.
- The area of bed and banks disturbed by the activities must be stabilised regardless of previous stability.
- The extent and duration of bare surface exposure must be minimised, and protected from weathering, rain drop impact, and water runoff.
- Clean water run-off must be diverted around areas of disturbance where practicable.
- Bed and bank stability must be managed to minimise erosion and reduce sedimentation.
- Where practicable, sediment must be captured and retained on-site.
- Machinery to be used in carrying out the activities must be selected on the basis of a type and size necessary and capable of safe operation to achieve minimal disturbance of the site.
- Constructed drainage and discharge structures must not alter the natural bed and bank profile.

Mobilisation of Contaminants

The potential impacts of mobilisation of contaminants will be mitigated and managed through the following measures:

- Bunded storage areas for contaminants will be installed, with spill cleanup kits in accordance with Australian Standards (AS1940 and AS3780) to prevent the contamination of surrounding surface runoff.
- The storage of hazard materials will be within industrial area facilities near the Coal Preparation Plant and will be above the 1:100 AEP flood level or designed to prevent 1:100 AEP flood ingress into the storage areas.
- All transfers of fuels and chemicals will be controlled and managed to prevent spillage outside bunded areas.
- Any pollution mobilised in surface runoff, within the construction phase drainage network will be contained.
- Any significant leakage/spillage will be immediately reported and appropriate emergency clean-up operations implemented to prevent possible mobilisation of contaminants.
- Any rainfall collected in the bunded areas will be allowed to evaporate or be drained and removed to temporary construction sediment ponds.
- Any contaminants or major spillages of stored material in the bunded areas will be collected by licensed waste collection and transport contractors for disposal off site at a licensed facility.
- Waste water from wash down areas will be directed through oil and grease separators and the water directed to temporary construction ponds for re-use.
- Separated hydrocarbon material will be collected and periodically removed offsite by licensed waste collection and transport contractors to a licensed recycling/disposal facility.

Flooding and Test Water

Where possible, major construction will be avoided during the wet season (November to February), especially within the floodplain. Additionally, stormwater management measures (requirement of the earthworks contractor) such as drainage diversions and bunding will be implemented before works occur. Emergency response procedures and flood forecasting will be incorporated into operating procedures.

The hydrostatic test water will be discharged to either an existing storage or newly constructed storage and reused during the remaining construction activities.

Operational Activities

The erosion and sediment control measures identified for construction activities above will also be implemented during operation of the mine where applicable. In addition, the following management and mitigation measures will be implemented for the operation of the project.

Mine Water Management System

The project will operate a mine water management system designed to contain dirty water and prevent discharge to receiving water environments and provide water supply for reuse within the CHPP, for industrial use and for haul road dust suppression. If there is insufficient water available to meet these demands, or the water available does not meet the water quality requirements of the demand, additional water supply is obtained from the Eungella-Bingegang pipeline. A sewage treatment plant will be constructed to treat wastewater to Class A+ as defined by Queensland Water Recycling Guidelines (December 2005).

The mine water management system will comprise a combination of storages (for water collection and containment) interconnected by open channels, and pumps and pipelines used to transfer mine water between storages, to demands and to dewater mining pits. The mine water management system will be used to:

- Divert clean catchment runoff away from areas disturbed by mining activities;
- Provide water to assist in the progressive rehabilitation of spoil stockpiles;
- Contain runoff from all disturbed areas (e.g. haul roads, MIA); and
- Maximise reuse of water from the mine water management system to meet mine demands, to reduce likelihood of off-site discharge and requirement for external water supply.

The water management within the CHPP area will be as follows:

- Cut off drains upstream of the CHPP pad will allow clean water to bypass the CHPP area;
- Runoff from dirty water falling within the CHPP area will drain to Industrial Area Runoff Dams;
- In case of an emergency discharge from the tailings thickener, the thickener tailings will be pumped to the Process Water Dam(s), which have been sized to contain the contents of the thickener tailings. Recovery of the thickener tailings will be undertaken by pumping/decanting water off the dam(s) and then recovering the settled tailings for removal to the tailings storage facility.

Should the mine water management system fail, the measures presented in Table 3.4.1 will be implemented.

Table 3.4.1 Water Management System Failure Mitigation Measures

Potential Impact	Mitigation Measures
Storage containment failure	Design of water storages has been undertaken using a water balance model which considers all storage inputs and outputs (i.e. rainfall, evaporation, pump transfers, etc) and has been run through a long term period of historic climatic data to test the storage capacity against potential sequences of rainfall events, entire wet seasons and potentially sequences of high rainfall wet seasons across several years. The water storages have been designed in accordance with "Manual for Assessing Hazard Categories and Hydraulic Performance of Dams v1.0" and DME 1995 Technical Guidelines. Monitoring equipment will be installed to monitor storage volume during operation combined with a water management strategy to prevent overfilling.
Storage embankment failure	Design and construction supervision of dam embankments will be undertaken by Registered Professional Engineer of Queensland. Regular dam inspections will be undertaken by Registered Professional Engineer of Queensland.
Water management system infrastructure failure	Regular pipeline, drain, bund and levee inspections and maintenance will be undertaken during operation.

Sedimentation and/or water storage dams will be managed as follows:

- Runoff from disturbed areas will be captured on site in sediment dams, and transferred between these dams and the 12N Dam as part of a water management system designed to use water on site without the need for discharges.
- Sedimentation dams will be constructed at the toe of spoil dumps to remove the bulk of suspended sediment from runoff from disturbed areas prior to any discharge from the site.
- Mine pits will be used to store surplus disturbed area runoff in the event that the capacity of the sediment dams and the 12 N are exceeded.
- Water will be discharged to Cherwell Creek, Nine Mile Creek and Horse Creek only when natural flows are present.
- Sedimentation dams will be designed according to the following criteria:
  - retain the flow from a 10 year ARI (0.1 AEP) 24 hour storm; and
  - maximise the length of the dam relative to the width of the dam to maximise hydraulic retention time and deposition.
- Sediment will be removed from sediment dams periodically to retain design capacity.
- Develop remedial response strategies in the event that releases fail to meet the water quality objectives or environmental protection objectives. These remedial measures may include:
  - conducting rigorous environmental investigations into incidents;
  - repairing any damaged areas;
  - re-establishing the banks if excessive settlement has occurred; and
  - removing sediment if excessive sediment has built up in any area and is causing of damage or excessive downstream sediment loads.

Hazardous Dam Classification

A preliminary hazardous dam assessment has been conducted using the draft "Manual for Assessing Hazard Categories and Hydraulic Performance of Dams Version 1.1 – June 2009".

A summary of the preliminary hazard assessment categories for the proposed Caval Ridge mine water dams is presented in Table 3.4.2.

Table 3.4.2 – Summary Preliminary Hazard Categories

Storages	**Failure to Contain Hazard Category**	**Dam break Hazard Category**
Sed Dam N1 Sed Dam N2 Sed Dam N3 Sed Dam S1 Sed Dam S2 Sed Dam S3	LOW	SIGNIFICANT Preliminary tentative classification subject to detailed design
Catchment Dam North Catchment Dam South	LOW	SIGNIFICANT Preliminary tentative classification subject to detailed design
Mine Water Dam N1 Mine Water Dam N2 Mine Water Dam N3 Mine Water Dam S1	SIGNIFICANT	SIGNIFICANT
12North Dam		
Mine Water Dam 1 Mine Water Dam 2 Mine Water Dam 3 Mine Water Dam 4 Mine Water Dam 4a Mine Water Dam 5	LOW Tentative (refer Section 3.2) subject to contaminant concentrations review with operational monitoring	SIGNIFICANT Preliminary tentative classification subject to detailed design.

Note:The hazard classifications outlined above are preliminary tentative classifications without the benefit of detailed design plans for these dams. In particular the dam break hazard categories for the sediment dams and other smaller dams will be reviewed as detailed design is undertaken. There is potential that the dam break classification could be downgraded to low hazard for dambreak for the smaller mine water dams and sediment dams, in which case an amendment will be sought at, or prior to, the issue of the Environmental Authority.

The required mine water storage will be assessed with further revision of the mine water balance modelling during detailed design taking account of:

- Runoff from all mine area and catchments draining into the integrated mine water management system, including runoff into mine pits;
- Transfers of mine water between storages;
- Re-use of mine water in plant operations and for dust suppression;
- Evaporation losses;
- Controlled releases to the environment complying with proposed controlled release discharge criteria;

- Uncontrolled overflow releases from dams.

The mine water balance will be evaluated with over 100 years of climate data (1900 to 2009) to ensure the water system performance can cater for a wide range of climate variability.

The required total mine water system storage capacity will be determined to ensure the water management performance limits the probability of uncontrolled overflow discharges (to receiving waters) from Significant and High Hazard Dam to less than 1:100 AEP.

Water management system performance will also be evaluated for system failure risks such as failure of a pump, pipeline, or water storage to develop appropriate contingency plans.

The results of the above assessments will be used to refine the Environmental Authority Conditions: Schedule C- Table 6 (Storage design for hazardous dams containing hazardous waste).

Creek Diversions

The creek diversions have been designed in accordance with the Watercourse Diversions – Central Queensland Mining Industry (January 2008), as detailed in Table 3.4.3.

Table 3.4.3 Upper Limit Creek Design Threshold Criteria

Channel Type	Stream Power (W/m^2)	Velocity (m/s)	Shear (N/m^2)
2 year ARI event (no vegetation)	<35	<1.0	<40
2 year ARI event (vegetated)	<60	<1.5	<40
50 year ARI event	<220	<2.5	<80

The creek diversions have been designed in accordance with the following design objectives:

- Comply with DNRW Watercourse Diversions – Central Queensland Mining Industry – Upper Limit Creek Design Threshold Criteria; and
- Minimal ongoing maintenance and modification, achieved through maintaining a constant diversion bed grade and no flow control structures, such as drop structures.

Licences will be required under the *Water Act 2000* to interfere with the flow of water.

Flooding

Flood protection will be provided via the haul road running adjacent to the proposed diversion of Horse Creek and the flood protection levees that will be constructed around the perimeter of Heyford and Horse Pits, excluding the stockpile areas that act as a form of flood protection bund, to prevent pit inundation up to the 1:500 year AEP. Stormwater management measures such as drainage diversions and levees will be regularly inspected and maintained during the operation phase. Inspections will be carried out on a semi-annual basis and after significant storm events to check for erosion, cracking, visible seepage and any other unsuitable conditions. Timely action will be taken to prevent or minimise any actual or potential environmental harm through preventative works. This will aid in the reducing the contributing catchment area to the open cut pits and essential create a turkey nest catchment.

Emergency response procedures (including evacuation procedures) and a flood warning system will be established and incorporated into the site's Health and Safety Environment Plan to protect on-site personnel. Vulnerable infrastructure will be designed with floor levels above the 100 year ARI level or specific secondary defences should be provided (bunding).

Groundwater

The strategies to be implemented for the management of surface water (Section 3.4.5.1) including the mine water management system, will also assist in controlling activities that could potentially lead to the contamination of groundwater.

Seepage

In addition, controls will be implemented to manage seepage. Potential sources of seepage such as sediment basins and water storages will be lined if the natural material is not of sufficiently low permeability to limit seepage. Additional control measures may include installation of cut-off trenches within the foundation along the alignment of the containment embankments, installation of a seepage collection system, and, during construction of the containment embankments, any fracture zones identified will be treated to reduce their permeability. ROM and product stockpiles will be contained within hardstand areas and connected via open channel drains to dedicated sediment basins. Potential seepage from the sediment basins and stockpile areas will be regularly assessed through the installation and monitoring of the monitoring bore network on-site, including down-gradient of all potential contaminant sources. This will include monitoring of water in sediment basins for potential contaminants (refer Section 3.4.6.3).

In the unlikely event of groundwater impact, mitigation strategies will include some or all of the following measures (depending on the specific requirements):

- Investigation of water management system integrity;
- Removal of contaminant source and repair/ redesign of any water management structures as required;
- Installation of and pumping from, groundwater interception wells; and
- Installation of and pumping from groundwater interception trenches.

At mine closure, shaping and rehabilitation of spoil piles and infrastructure footprints will be required to limit infiltration and runoff of potentially poor quality water and to monitor the effectiveness of rehabilitation.

Taking of Water

The taking of water from an aquifer within the Declared Highlands Subartesian Area is regulated by the *Water Act 2000* and *Water Regulation 2002* and requires a licence. Furthermore, construction and development of bores required to extract water from an aquifer under a licence is an assessable development under the *Integrated Planning Act 1997*. If dewatering of the coal measures in advance of mining is required, water licences for the taking of groundwater for the Caval Ridge Mine will be obtained by BMA from DERM. The licences will stipulate a maximum annual take from each relevant aquifer.

Under the *Water Act 2000*, the DERM has authority to direct the licensee to provide and maintain access to alternative water supplies for other water entitlement holders who would be affected by the granting of a licence. Should monitoring (outlined in Section 3.4.5.3) show that operation of Caval Ridge Mine is impacting on groundwater users in the vicinity of the project site, the following control strategies will be implemented as necessary:

- Lower inlet valves of pumps within the bores in order to maintain sufficient head of water above the pump when the pump is operational.
- Install new pumps if existing pumps are not powerful enough to lift groundwater from the increased depth beneath the surface.
- Deepen or relocate bores in order to ensure sufficient long term water supply for stock watering and domestic purposes.

3.4.6 Monitoring

Monitoring of surface water and groundwater will be undertaken to ensure:

- The existing in-stream biological integrity of the aquatic systems are protected;
- There is no discernable change in the water quality downstream of the site as a result of any water discharge from the site;
- Water quality in the receiving environment and at the point of discharge meet licence conditions and any potential impacts are understood; and
- The impacts of groundwater drawdown are minimised through consultation and support of local groundwater users. The groundwater quality within the aquifers surrounding the project site will be monitored to ensure no marked deterioration in groundwater is occurring as a result of the proposed mining activities.

Surface Water Monitoring Program

A surface water monitoring program will be established for the project site. Monitoring will be undertaken at the locations identified in (Figure 3.4.4):

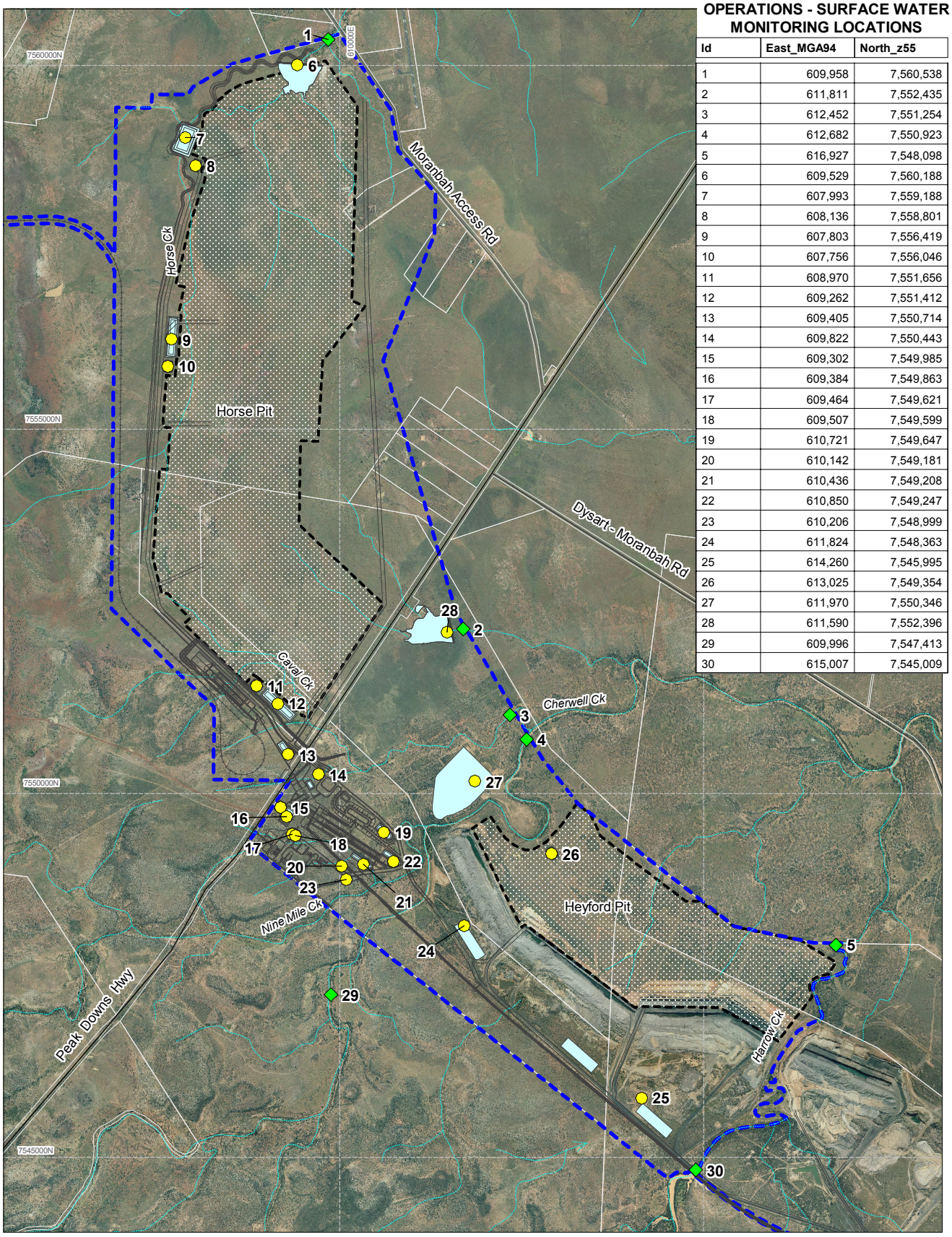
- Permanent water quality and flow monitoring points established upstream and downstream of Cherwell Creek and Harrow Creek and downstream of Horse Creek; and
- Regular sampling at the following locations:
  - Mine Water Storages (12 North Dam, Sediment Dams N1-3, Sediment Dams S1-3, Catchment Dam North, Catchment Dam South, Mine Water Dams N1-N3, Mine Water Dam S1, Mine Water Dams 1- 4, Mine Water Dam 4a, Mine Water Dam 5) .
  - Pit sumps.

Parameters monitored will include EC, pH, total suspended solids (TSS), Sulphate, Fluoride and metals.

Mine Water Management System Releases

In Queensland, effluent discharges to the freshwater environment are regulated by the DERM. When new infrastructure is proposed, a licensing agreement is formed as part of the planning process, to permit offsite discharges. Controlled releases are proposed to occur from 12 North Dam to Cherwell Creek. Uncontrolled releases may also occur under rare circumstances from the mine water storages to:

- Cherwell Creek;
- Nine Mile Creek;
- Horse Creek ;
- Harrow Creek;
- Caval Creek; and
- Cherwell Creek Tributary (Figure 3.4.4).



OPERATIONS - SURFACE WATER MONITORING LOCATIONS

Id	East_MGA94	North_z55
1	609,958	7,560,538
2	611,811	7,552,435
3	612,452	7,551,254
4	612,682	7,550,923
5	616,927	7,548,098
6	609,529	7,560,188
7	607,993	7,559,188
8	608,136	7,558,801
9	607,803	7,556,419
10	607,756	7,556,046
11	608,970	7,551,656
12	609,262	7,551,412
13	609,405	7,550,714
14	609,822	7,550,443
15	609,302	7,549,985
16	609,384	7,549,863
17	609,464	7,549,621
18	609,507	7,549,599
19	610,721	7,549,647
20	610,142	7,549,181
21	610,436	7,549,208
22	610,850	7,549,247
23	610,206	7,548,999
24	611,824	7,548,363
25	614,260	7,545,995
26	613,025	7,549,354
27	611,970	7,550,346
28	611,590	7,552,396
29	609,996	7,547,413
30	615,007	7,545,009

N W E S

0 1.25 2.5km

Scale 1:75 000 (A4)

Datum: AGD84, AMG Zone 55

Project Site

Proposed Pit and Spoil

Surface Water Monitoring Location

Receiving Water Monitoring Location

Source: BMA Supplied Data (November 2007)

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Client: BMA — BHP Billiton Mitsubishi Alliance

URS

Project: CAVAL RIDGE MINE
DRAFT ENVIRONMENTAL MANAGEMENT PLAN

Title: **OPERATIONS SURFACE WATER MONITORING LOCATIONS**

Drawn: VH	Approved: RS	Date: 06-11-2009	Figure: **3.4.4**	Rev:C
Job No: **4262 6420** /6158	File No: 42626158-g-2309.wor			**A4**

Monitoring during Controlled Releases

During controlled releases from 12 North Dam will be monitored within the following limits:

- EC <3,000 µS/cm
- pH 6.5 – 9.0
- TSS <200 mg/L
- Sulphate <2000 mg/L

Receiving waters will be monitored downstream of the release point daily during the release within the following limits

- EC < 1,000 µS/cm
- pH 6 – 8
- TSS <120% of upstream reference site
- Sulphate <1,000 mg/L

Monitoring during Uncontrolled Releases

During uncontrolled releases release waters will be monitored during or as immediately practical after the event within the following limits:

- EC <3,000 µS/cm
- pH 6.5 – 9.0
- TSS <200 mg/L
- Sulphate <2000 mg/L
- Aluminium <100 µg/L
- Arsenic <13 µg/L
- Cadmium <0.2 µg/L
- Chromium <1 µg/L
- Copper <2 µg/L
- Iron <300 µg/L
- Lead <10 µg/L
- Mercury <0.2 µg/L
- Nickel <11 µg/L
- Zinc <8 µg/L
- Boron <370 µg/L
- Cobalt <90 µg/L
- Molybdenum <34 µg/L
- Selenium <10 µg/L
- Silver <1 µg/L
- Uranium <1 µg/L
- Vanadium <10 µg/L
- Nitrate <1100 µg/L

Receiving waters will be monitored downstream of the release locations daily during the release within the following limits

- EC < 1,000 µS/cm
- pH 6 – 8
- TSS <120% of upstream reference site
- Sulphate <1,000 mg/L

The quantity of uncontrolled release water will be estimated by a suitably qualified and experienced person. A written report will be provided to the administering authority within 14 days of the uncontrolled release event providing details of the release, downstream receiving water monitoring results, and an explanation of the cause of the uncontrolled release.

Groundwater Monitoring Program

Groundwater monitoring will be undertaken in the existing groundwater bore network to monitor the potential impacts of drawdown on the local and regional groundwater regime. The following monitoring routine will be undertaken:

- Groundwater levels will be monitored monthly, in the entire monitoring network, for the first two years following the commencement of construction to assess seasonal, natural, groundwater fluctuations;
- Thereafter, groundwater levels will be monitored quarterly, preferably at a similar time of year to eliminate variation from seasonal changes;
- Groundwater sampling will be undertaken on a quarterly basis from all groundwater monitoring bores for analysis of the parameters:- pH, EC, TDS, major cations and anions, nutrients (total N, NOx, ammonia, phosphorous) and selected dissolved metals (boron, chromium, copper, iron, manganese, nickel, selenium and zinc); and
- Measurement of daily precipitation, evaporation and mine dewatering volumes.

In addition, monitoring bores will be installed down-gradient of potential seepage and contaminant sources to enable early detection of any leachate entering the shallow Quaternary alluvial or Tertiary sediment aquifers. The key indicator parameters of seepage will be monitored including (but not restricted to) standing water level, salinity (as TDS), dissolved metals, and major ions initially on a three monthly basis.

An annual review of the monitoring program will be conducted to evaluate the effectiveness of each monitoring location, to assess where new locations and modifications to the monitoring program may be needed, and to evaluate what impacts may be occurring. A special monitoring round will be considered in the event of a significant environmental incident.

Post-mining groundwater monitoring will be subject to detailed closure/relinquishment conditions. It is expected that during the operational phase of the project, the groundwater data collected for the region will be comprehensive enough to accurately predict the long term recovery of the aquifers and the final void water balance and water quality. The level of data required for advanced hydrologic modelling of final voids for the mine cannot practically be obtained at the pre-mining stage. The mining operation will incorporate opportunistic monitoring of temporary pit storages and groundwater within the spoil to assist in the development and calibration of a long-term predictive model. This will also assist in the development

and implementation of the closure strategy and the refinement of post-mining groundwater monitoring programs.

3.4.7 Commitments

- All monitoring and sampling techniques will be consistent with the DERM's Water Quality Sampling Manual and applicable Australian Standards.
- The project will investigate all substantiated water related complaints.
- The project will implement corrective action resulting from complaints investigations as required.

3.4.8 Proposed Environmental Authority Conditions: Schedule C – Water

Release to waters

(C1-1) Contaminants that will, or have the potential to cause environmental harm must not be released directly or indirectly to any waters except as permitted under the conditions of this environmental authority.

(C1-2) The controlled release of contaminants to waters must only occur from the release points specified in Schedule C - Table 1 and must only occur during flow conditions specified in Table 4.

Schedule C – Table 1 (Controlled Contaminant Release Points, Sources and Receiving Waters)

Release Point (RP)	Latitude or northing (GDA94)	Longitude or easting (GDA94)	Contaminant Source and Location	Monitoring Point	Receiving waters description
12North Dam	611,857(*)	7,550,167 (*)	Mine waters stored in 12North dam	Dam outlet used to make controlled releases	Cherwell Creek

Note (*) location to be confirmed after detailed design of the dam outlet.

(C1-3) The controlled release of contaminants to waters must not exceed the release limits stated in Schedule C - Table 2 when measured at the monitoring points specified in Schedule C - Table 1 for each quality characteristic

Schedule C – Table 2 (Controlled Contaminant Release Limits)

Quality Characteristic	Controlled Release Limits	Monitoring frequency
Electrical conductivity (uS/cm)	3000	Daily during release (the first sample must be taken within 2 hours of commencement of release)
pH (pH Unit)	6.5 (minimum) 9.0 (maximum)	
Suspended Solids (mg/L)	200	

Quality Characteristic	Controlled Release Limits	Monitoring frequency
Sulphate (SO42-) (mg/L)	2000	

(C1-4) The release of contaminants to waters from the release points must be monitored at the locations specified in Schedule C – Table 1 for each quality characteristics and at the frequency specified in Schedule C - Table 2 and Schedule C - Table 3.

Schedule C – Table 3 (Controlled Release Contaminant Trigger Investigation Levels)

Quality Characteristic	Trigger Levels (µg/L)	Comment on Trigger Level	Monitoring Frequency
Aluminium	100	For aquatic ecosystem protection, based on LOR for ICPMS	Commencement of release and thereafter daily during release
Arsenic	13	For aquatic ecosystem protection, based on SMD guideline	
Cadmium	0.2	For aquatic ecosystem protection, based on SMD guideline	
Chromium	1	For aquatic ecosystem protection, based on SMD guideline	
Copper	2	For aquatic ecosystem protection, based on LOR for ICPMS	
Iron	300	For aquatic ecosystem protection, based on low reliability guideline	
Lead	10	For aquatic ecosystem protection, based on LOR for ICPMS	
Mercury	0.2	For aquatic ecosystem protection, based on LOR for CV FIMS	
Nickel	11	For aquatic ecosystem protection, based on SMD guideline	
Zinc	8	For aquatic ecosystem protection, based on SMD guideline	
Boron	370	For aquatic ecosystem protection, based on SMD guideline	
Cobalt	90	For aquatic ecosystem protection, based on low reliability guideline	
Molybdenum	34	For aquatic ecosystem protection, based on low reliability guideline	
Selenium	10	For aquatic ecosystem protection, based on LOR for ICPMS	
Silver	1	For aquatic ecosystem protection, based on	

Quality Characteristic	Trigger Levels (µg/L)	Comment on Trigger Level	Monitoring Frequency
		LOR for ICPMS	
Uranium	1	For aquatic ecosystem protection, based on LOR for ICPMS	
Vanadium	10	For aquatic ecosystem protection, based on LOR for ICPMS	
Nitrate	1100	For aquatic ecosystem protection, based on ambient Qld WQ Guidelines (2006) for TN	

Note:

1. All metals and metalloids must be measured as total (unfiltered) and dissolved (filtered). Trigger levels for metal/metalloids apply if dissolved results exceed trigger.

2. The list of quality characteristics required to be monitored as per Table 3 will be reviewed once the results of the monitoring data is gathered for an interim period until 31 December 2012 or an earlier date if the data is, or becomes, available and if it is determined that there is no need to monitor for certain individual quality characteristics these can be removed from Table 3.

3. SMD – slightly moderately disturbed level of protection, guideline refers ANZECC & ARMCANZ (2000).

4. LOR – typical reporting for method stated. ICPMS/CV FIMS – analytical method required to achieve LOR.

Schedule C – Table 4 (Criteria for Controlled Contaminant Release during Flow Events)

Receiving water description	Release Point	Gauging station description	Northing (GDA94)	Easting (GDA94)	Minimum Flow in Receiving Water Required for a Release Event	Flow recording Frequency
Upstream Cherwell Creek Flow	12North Dam	Upstream Cherwell Creek	609610	7547809	> or = 0.05 M3/sec	Daily

(C1-5) If quality characteristics of the controlled release exceed any of the trigger levels specified in Schedule C - Table 3 during a controlled release event, the environmental authority holder must compare the down stream results in the receiving waters (locations specified in Schedule C – Table 8) to the trigger values specified in Schedule C - Table 3 and:

1. where the trigger values are not exceeded then no action is to be taken; or
2. where the down stream results exceed the trigger values specified Table 3 for any quality characteristic, compare the results of the down stream site to the data from background monitoring sites and;

(a) if the result is less than the background monitoring site data, then no action is to be taken; or

(b) if the result is greater than the background monitoring site data, complete an investigation in accordance with the ANZECC & ARMCANZ 2000 methodology, into the potential for environmental harm and provide a written report to the administering authority in the next annual return, outlining:

(i) details of the investigations carried out; and

(ii) actions taken to prevent environmental harm.

Note: Where an exceedance of a trigger level has occurred and is being investigated, in accordance with C1-5 (ii)(b)(ii) of this condition, no further reporting is required for subsequent trigger events for that quality characteristic.

(C1-6) If an exceedance in accordance with condition C1-5 (b)(ii) is identified, the holder of the authority must notify the administering authority within 14 days of receiving the result.

Controlled Contaminant Release Events

(C1-7) The holder must install, operate and maintain a stream flow gauging station to determine and record stream flows at the locations upstream of each controlled Release Point as specified in Schedule C - Table 4 for any receiving water into which a release occurs.

(C1-8) Notwithstanding any other condition of this environmental authority, the controlled release of contaminants to waters must only take place during periods of natural flow events specified as minimum flow in Table 4 for the controlled contaminant release point(s) specified in Schedule C - Table 1.

(C1-9) At all times during the controlled release events, the flow rate released through the controlled release point(s) must not exceed 20% of the upstream flow measured at the location in Schedule C - Table 4 (Contaminant Release during Flow Events). Where variance of the upstream flow (Schedule C – Table 4) during a controlled release event requires variance of the maximum allowable controlled release rate to maintain a maximum of 20% discharge release rate at time intervals of less than the monitoring frequency specified in Schedule C - Table 4, the upstream flow monitoring and release flow monitoring must be recorded at the frequency required to ensure that the maximum discharge rate is 20% of less of the upstream flow at all times during the controlled release events.

(C1-10) The daily quantity of contaminants released from each release point must be measured and recorded at the monitoring points in Schedule C - Table 1.

(C1-11) Releases to waters must be undertaken so as not to cause erosion of the bed and banks of the receiving waters, or cause a material build up of sediment in such waters.

Notification of Controlled Release Event

(C1-12) The authority holder must notify the administering authority as soon as practicable (no later than 6 hours of having commenced controlled releasing of mine affected water to the receiving environment). Notification must include the submission of written verification to the administering authority of the following information:

a) controlled release commencement date/time;
b) expected controlled release cessation date/time;
c) controlled release point/s;
d) controlled release volume (estimated);
e) receiving water/s including the upstream flow rate; and
f) any details (including available data) regarding likely impacts on the receiving water(s).

Note: Notification to the administering authority must be addressed to the Manager and Project Manager of the local Administering Authority via email or facsimile.

(C1-13) The authority holder must notify the administering authority as soon as practicable,(nominally within twenty-four (24) hours after of cessation of a controlled release) of the cessation of a controlled release notified under Condition C1-12 and within 28 days provide the following information in writing:

a) controlled release cessation date/time;
b) upstream flow volume in receiving water;
c) volume of water released;
d) details regarding the compliance of the controlled release with the conditions of Agency Interest: Water of this environmental authority (i.e. contamination limits, natural flow, discharge volume);
e) all in-situ water quality monitoring results; and
f) any other matters pertinent to the controlled water release event.

Notification of Controlled Release Event Exceedance

(C1-14) If the controlled release limits defined in Schedule C - Table 2 are exceeded, the holder of the environmental authority must notify the administering authority within twenty-four (24) hours of receiving the results.

(C1-15) The authority holder must, within twenty-eight (28) days of a controlled release that exceeds the conditions of this authority, provide a report to the administering authority detailing:

a) the reason for the controlled release;
b) the location of the controlled release;
c) all water quality monitoring results;
d) any general observations;
e) all calculations; and
f) any other matters pertinent to the controlled water release event.

Monitoring of Water Storage Quality

(C1-16) Water storages stated in Schedule C - Table 5 which are associated with the integrated mine water management system must be monitored for the water quality characteristics specified in Schedule C - Table 6 at the monitoring locations and at the monitoring frequency specified in Schedule C - Table 5.

Schedule C - Table 5 (Water Storage Monitoring)

Water Storage Description	Latitude or northing (GDA94) (note *)	Longitude or easting (GDA94) (note *)	Monitoring Location	Frequency of Monitoring
12North Mine Dam			Storage mid depth	Monthly
Sed Dam N3			Storage mid depth	Monthly
Sed Dam N2			Storage mid depth	Monthly
Sed Dam N1			Storage mid depth	Monthly
Sed Dam S3			Storage mid depth	Monthly
Sed Dam S2			Storage mid depth	Monthly
Sed Dam S1			Storage mid depth	Monthly
Catchment Dam North			Storage mid depth	Monthly
Catchment Dam South			Storage mid depth	Monthly
Mine Water Dam N3			Storage mid depth	Monthly
Mine Water Dam N2			Storage mid depth	Monthly
Mine Water Dam N1			Storage mid depth	Monthly
Mine Water Dam S1			Storage mid depth	Monthly
Mine Water Dam 5			Storage mid depth	Monthly
Mine Water Dam 4			Storage mid depth	Monthly
Mine Water Dam 4a			Storage mid depth	Monthly
Mine Water Dam 3			Storage mid depth	Monthly

Water Storage Description	Latitude or northing (GDA94) (note *)	Longitude or easting (GDA94) (note *)	Monitoring Location	Frequency of Monitoring
Mine Water Dam 2			Storage mid depth	Monthly
Mine Water Dam 1			Storage mid depth	Monthly

Note to be provided after detailed design*

(C1-17) In the event that waters storages defined in Schedule C - Table 5 exceed the contaminant limits defined in Schedule C - Table 6, the holder of the environmental authority must implement measures to prevent access to waters by all livestock.

Schedule C - Table 6 (Onsite Water Storage Contaminant Limits For Access to Livestock)

Quality Characteristic	Test Value	Contaminant Limit
pH (pH unit)	Range	Greater than 4, less than 92
EC (µS/cm)	Maximum	59701
Sulphate (mg/L)	Maximum	10001
Fluoride (mg/L)	Maximum	21
Aluminium (mg/L)	Maximum	51
Arsenic (mg/L)	Maximum	0.51
Cadmium (mg/L)	Maximum	0.011
Cobalt (mg/L)	Maximum	11
Copper (mg/L)	Maximum	11
Lead (mg/L)	Maximum	0.11
Nickel (mg/L)	Maximum	11
Zinc (mg/L)	Maximum	201

Note:

[1] Contaminant limit based on ANZECC & ARMCANZ (2000) stock water quality guidelines.

[2] Page 4.2-15 of ANZECC & ARMCANZ (2000) "Soil and animal health will not generally be affected by water with pH in the range of 4–9".

Note: Total measurements (unfiltered) must be taken and analysed

Receiving Environment Monitoring and Contaminant Trigger Levels

(C1-18) The quality of the receiving waters must be monitored at the locations and frequency specified in Schedule C -Table 8 for each quality characteristic stated in Schedule C -Table 7.

Schedule C – Table 7 (Receiving Waters Contaminant Trigger Levels)

Quality Characteristic	Trigger Level	Monitoring Frequency
pH	6.5 – 8.0	Daily during the release
Electrical Conductivity (µS/cm)	1000	
Suspended solids (mg/L)	120% of upstream reference site	
Sulphate (SO42-) (mg/L)	1000	

Schedule C – Table 8 (Receiving Water Upstream Background Sites and Down Stream Monitoring Points)

Monitoring Points	Receiving Waters Location Description	Northing (GDA94)	Easting (GDA94)	Monitoring Frequency
Upstream Background Monitoring Points				
Upstream Cherwell Creek	Cherwell Creek at upstream gauging station	609610	7547809	Daily during controlled releases from 12North Dam and Daily during uncontrolled releases from any dam listed in Schedule C Table 5 that overflows to Cherwell Creek
Upstream Harrow Creek	Harrow Creek upstream of Peak Downs Mine 10North Dam	614412	7543440	Daily during uncontrolled releases from any dam listed in Schedule C Table 5 that overflows to Harrow Creek
Downstream Monitoring Points				

Monitoring Points	Receiving Waters Location Description	Northing (GDA94)	Easting (GDA94)	Monitoring Frequency
Downstream Cherwell Creek	Cherwell Creek at downstream gauging station	612309	7550588	Daily during controlled releases from 12North Dam and Daily during uncontrolled releases from any dam listed in Schedule C Table 5 that overflows to Cherwell Creek
Downstream Horse Creek	Downstream Horse Creek	609846	7560358	Daily during uncontrolled releases from any dam listed in Schedule C Table 5 that overflows to Horse Creek
Downstream Harrow Creek	Downstream Harrow Creek	616815	7547919	Daily during uncontrolled releases from any dam listed in Schedule C Table 5 that overflows to Harrow Creek

(C1-19) If quality characteristics of the receiving water at the downstream monitoring points exceed any of the trigger levels specified in Schedule C - Table 7 during a release event the environmental authority holder must compare the down stream results to the upstream results in the receiving waters and:

1. where the downstream result is the same or a lower value than the upstream value for the quality characteristic then no action is to be taken; or
2. where the down stream results exceed the upstream results complete an investigation in accordance with the ANZECC & ARMCANZ 2000 methodology, into the potential for environmental harm and provide a written report to the administering authority in the next annual return, outlining:
    (i) details of the investigations carried out; and
    (ii) actions taken to prevent environmental harm.

Note: Where an exceedance of a trigger level has occurred and is being investigated, in accordance with C1-19 (ii) of this condition, no further reporting is required for subsequent trigger events for that quality characteristic.

Receiving Environment Monitoring Program (REMP)

(C1-20) A REMP must be implemented to monitor and record the effects of the controlled release of contaminants on the receiving environment periodically and whilst contaminants are being discharged from the site, with the aims of identifying and describing the extent of any adverse impacts to local environmental values, and monitoring any changes in the receiving water.

For the purposes of the REMP, the receiving environment is the waters of the Cherwell Creek and connected waterways within 5 km downstream of the release.

(C1-21) The REMP must address, but not necessarily be limited to, the following:

a) Description of potentially affected receiving waters including key communities and background water quality characteristics based on accurate and reliable monitoring data that takes into consideration any temporal variation (e.g. seasonality); and
b) Description of applicable environmental values and water quality objectives to be achieved (i.e. as scheduled pursuant to the Environmental Protection (Water) Policy 1997); and
c) Any relevant reports prepared by other governmental or professional research organisations that relate to the receiving environment within which the REMP is proposed; and
d) Water quality targets within the receiving environment to be achieved, and clarification of contaminant concentrations or levels indicating adverse environmental impacts during the REMP.
e) Monitoring for any potential adverse environmental impacts caused by the release;
f) Monitoring of stream flow and hydrology;
g) Monitoring of toxicants should consider the indicators specified in Table 3 to assess the extent of the compliance of concentrations with water quality objectives and/or the ANZECC & ARMCANZ 2000 guidelines for slightly to moderately disturbed ecosystems;
h) Monitoring of physical chemical parameters as a minimum those specified in Schedule C - Table 2 (in addition to dissolved oxygen saturation and temperature);
i) Monitoring biological indicators (for macroinvertebrates in accordance with the AusRivas methodology) and metals/metalloids in sediments (in accordance with ANZECC & ARMCANZ 2000, BATLEY and/or the most recent version of AS5667.*1 Guidance on Sampling of Bottom Sediments*) for permanent, semi-permanent water holes and water storages;
j) The locations of monitoring points (including the locations specified in Table 8 which are background and downstream impacted sites for each release point);
k) The frequency or scheduling of sampling and analysis sufficient to determine water quality objectives and to derive site specific reference values within 2 years (depending on wet season flows) in accordance with the *Queensland Water Quality Guidelines* 2006. For ephemeral streams, this should include periods of flow irrespective of mine or other discharges;
l) Specify sampling and analysis methods and quality assurance and control;
m) Any historical datasets to be relied upon;
n) Description of the statistical basis on which conclusions are drawn, and
o) Any spatial and temporal controls to exclude potential confounding factors.

(C1-22) The REMP must be prepared and submitted in writing to the administering authority by 1 October 2012.

Water Reuse

(C1-23) Water contaminated by mining activity may be piped or trucked or transferred by some other means that does not contravene the conditions of this authority during periods of dry weather for the purpose of supplying stock water to properties directly adjoining properties owned by the environmental authority holder or a third party and subject to compliance with the quality release limits specified in Schedule C - Table 9.

Schedule C - Table 9 (Stock Water Release Limits)

Quality characteristic	Units	Minimum	Maximum
pH	pH units	6.5	8.5
Electrical Conductivity	µS/cm	N/A	5000

(C1-24) Water contaminated by mining activity may be piped or trucked for the purpose of supplying water to Peak Downs Mine in accordance with the conditions of this environmental authority. The volume, pH and electrical conductivity of water transferred to Peak Downs Mine must be monitored and recorded.

(C1-25) If the responsibility of water contaminated by mining activities (the water) is given or transferred to another person in accordance with conditions C1-23, or C1-24:

a) the responsibility of the water must only be given or transferred in accordance with a written agreement (the third party agreement); and
b) include in the third party agreement a commitment from the person utilising the water to use water in such a way as to prevent environmental harm or public health incidences and specifically make the persons aware of the General Environmental Duty (GED) under section 319 of the *Environmental Protection Act 1994,* environmental sustainability of the water disposal and protection of environmental values of waters.

Uncontrolled Contaminant Releases

(C1-26) The holder of the Environmental Authority must ensure that the probability of an uncontrolled discharge from any dam listed in Schedule C – Table 5 is limited to the AEP probabilities specified in Schedule C - Table 12. The probability of uncontrolled discharges must be managed by ensuring adequate design storage capacity, transfer capacity, and operations, and contingency measures of the integrated mine water management system specified in conditions C1-27, C1-28, C1-29, C1-30, C1-31, C1-32, C1-33, and C1-34.

(C1-27) The holder of the Environmental Authority must develop, calibrate, and maintain a complete mine water balance model (with coupled contaminant balance model) that adequately represents all sources of mine water contributing to all dams that comprise the integrated mine water system, mine pits, and operations of the mine water management system including controlled releases (where applicable). All key assumptions and input parameters of the mine water balance model must be documented and be available for auditing

(C1-28) All key assumptions for mine water operations in the mine water balance model must be documented in Standard Operating Procedures and the mine water management system must be operated in accordance with the procedures.

(C1-29) Assessments utilising the mine water balance model to evaluate water management system capacity and operations in response to rainfall must be undertaken by competent personnel.

(C1-30) The holder of the Environmental Authority must implement and maintain monitoring of actual mine water quantity and quality within the mine water management system to demonstrate, and continually improve the mine water balance model calibration.

(C1-31) On 1 November each year, the holder of the Environmental Authority shall review the mine catchments, storage capacity, current storage volumes, system transfer capacity, and Standard Operating Procedures of all key infrastructure elements of the mine water management system and update the mine water balance model. An assessment of the mine water balance model must be undertaken to ensure that the mine water management system has sufficient storage capacity, transfer capacity, and transfer operations to ensure that the frequency of uncontrolled discharges of mine water is less than or equal to the specified AEP in Schedule C – Table 12.

The assessment must be undertaken with an appropriate period of climate data that includes representation of wet season rainfall events up to the AEP specified in Schedule C – Table 10. The assessment results must be documented and be available for auditing.

(C1-32) The holder of the Environmental Authority must notify the administering authority within 14 days, if the assessment of the mine water management system shows that probability of uncontrolled discharge from any dam within the integrated mine water system is greater than the specified AEP in Schedule C – Table 12.

(C1-33) In the event of failure of any component, or series of components, of the mine water management system, the holder of the Environmental Authority must utilise the mine water balance model to reassess the performance of the mine water management system in its failed state, and notify the administering authority if the assessment of the mine water management system shows that the probability of uncontrolled discharge would be greater than the AEP specified in Schedule C – Table 12.

(C1-34) Notwithstanding the provisions for Mandatory Report Levels in conditions C1-50, the holder of the Environmental Authority must not allow any uncontrolled discharge to be caused by either:

i) failure to stop transferring water to a dam where the transfer into that dam contributes in part, or full, to the overflow (uncontrolled discharge) of that dam; or
ii) failure to start and continue transferring water from a mine water dam, where the Standard Operation Procedures require the water transfer from the dam to prevent overflow (uncontrolled discharges).

(C1-35) Monitoring and Reporting in the event of uncontrolled release

In the event of an uncontrolled release from any component of the integrated mine water system to the receiving environment, the holder of this environmental authority shall:

a) Sample and monitor the uncontrolled release waters during or as immediately practical after the event (recognising that uncontrolled discharges should only occur during extreme rainfall and site may not be accessible) to determine quality characteristics of the

uncontrolled release for parameters specified in Schedule C – Table 2, and Schedule C – Table 3.

b) Sample and monitor the receiving environment monitoring sites listed in Schedule C – Table 8 for sites relevant to the uncontrolled release location.

c) Estimate the quantity of uncontrolled release waters, by a suitably qualified and experienced person.

d) Provide a written report to the administering authority within 14 days of the uncontrolled release event, which shall include as a minimum:

   i) the time and dates of the uncontrolled release event;

   ii) the location of the uncontrolled release;

   iii) the monitoring quality of the uncontrolled release waters; or if not available due to site access constraints in wet weather during the event, the quality of waters in the dam that contributed to the uncontrolled release before the event (from monitoring undertaken as part of condition C-16) and quality in that dam after the release events;

   iv) the estimated quantity of uncontrolled release;

   v) downstream receiving water monitoring results;

   vi) rainfall during, or that contributed to, the uncontrolled release event and dam levels prior to the rainfall event that caused uncontrolled release;

   vii) a determination of whether uncontrolled release was solely caused by rainfall exceeding the design AEP events specified in Schedule C – Table 12;

   viii) a determination of whether the uncontrolled release was cause in part of full, by failure to operate the integrated mine water system in accordance with Standard Operating Procedures for the integrated mine water system, or physical failure of one or more components of the integrated mine water system.

   ix) a determination of whether the uncontrolled release caused environmental harm; and

   x) if determined that the uncontrolled release could have been reasonably prevented, actions that will be taken to ensure uncontrolled releases comply in all respects with this environmental authority.

Dams

(C1-36) The hazard category of each dam must be determined by a suitably qualified and experienced person at least once in each two year period.

(C1-37) Dams having a hazard category determined to be significant or high, must be specifically authorised by an environmental authority.

(C1-38) Where the hazard category of a dam is assessed as Significant or High, the holder of the Environmental Authority must act immediately to ensure:

a) the administering authority is advised of the current details of the dam including:

   i) the assessed hazard category of that dam;

   ii) sufficient coordinates (GDA94) to form a perimeter around that dam and its associated works;

   iii) the maximum surface area, maximum volume, and maximum depth of that dam; and

b) that the dam meets the hydraulic performance criteria required of the assessed hazard category within twelve months of that assessment.

(C1-39) The condition of dams must be monitored for early signs of loss of structural or hydraulic integrity, based on the advice of a suitably qualified and experienced person. The methods of monitoring and frequency of monitoring shall be as assessed by that suitably qualified and experienced person, based on the hazard category and particular circumstances of each dam.

(C1-40) In the event of early signs of loss of structural or hydraulic integrity of any dam, the holder of the environmental authority must immediately take action to prevent or minimize any actual or potential environmental harm, and report in writing the findings and actions taken to the administering authority within 28 days of that event. Minimum actions should include assessment of the performance of the integrated water management system in accordance with conditions C1-33.

(C1-41) The holder of the environmental authority must not abandon any dam and must decommission each dam such that ongoing environmental harm is prevented.

(C1-42) The dams listed in Schedule C – Table 10 and their extents defined by Schedule C – Table 10 are the only regulated dams authorised under this environmental authority.

(C1-43) The regulated dams authorised under this environmental authority must comply with the basic specifications defined in Schedule C – Table 11.

(C1-44) The hydraulic performance of regulated dams and low hazard dams forming part of the integrated mine water management system must comply with:

a) Design Storage Capacity – Probability of uncontrolled discharge must be limited to AEP specified in Schedule C – Table 12 and continually assessed and operated as part of the integrated mine water system in accordance with conditions C1-26, C1-27, C1-28, C1-29, C1-30, C1-31, C1-32, C1-33, and C1-34

b) Spillway Capacity – minimum capacity as defined in Schedule C – Table 12.

Certification and Operation

(C1-45) Documentation required by conditions in this schedule must be kept available for inspection by the administering authority for a period of five years after the conclusion of the environmentally relevant activity in respect of which this environmental authority has been granted.

(C1-46) The holder of the environmental authority must not commence construction of a regulated dam unless:

a) the holder has submitted to the administering authority two copies of a design plan, together with the certification of a suitably qualified and experienced person that the design of the regulated dam is fit for the purpose for the dam stated in that plan, and compliant in all respects with this environmental authority;

b) at least 28 days has passed since the submission of the design plan, or the administering authority has advised that the design plan is compliant with this condition.

(C1-47) When construction or modification of any regulated dam is complete, or within 12 months of the dam becoming a regulated dam by virtue of hazard assessment, the holder of this environmental authority must submit to the administering authority two copies of a set of "as constructed" drawings, together with the certification by a suitably qualified person that the dam "as constructed" is fit for the purpose stated in the hazard assessment and the design plan if the latter exists, and compliant in all respects with this environmental authority.

(C1-48) The holder of the environmental authority must ensure that there is always a current operational plan for each regulated dam, which may form part of the integrated mine water system operations plan.

(C1-49) The operational plan for each regulated dam shall at least cover all matters relevant to the operation and maintenance of the regulated dam so that it is compliant in all respects with this environmental authority.

(C1-50) The holder of the environmental authority must notify the administering authority within 24 hours of the level in any regulated dam reaching the mandatory reporting level (MRL) specified in Schedule C – Table 12, and confirm this in writing within seven days.

(C1-51) The holder of this environmental authority must ensure that the mandatory reporting level (MRL) for each regulated dam is clearly marked in an accessible location at that dam.

(C-52) **Annual Inspection and Report**

The holder of the environmental authority must arrange for each regulated dam to be inspected annually be a suitably qualified and experienced person, in accordance with the following conditions.

(C1-53) At each annual inspection, the condition of each regulated dam must be assessed, including the structural, geotechnical, and hydraulic adequacy of the dam and the adequacy of the works with respect to dam safety, and any recommendations conveyed immediately to the holder of the environmental authority.

(C1-54) The holder of the environmental authority must immediately act upon the recommendations arising from an annual inspection on the condition and adequacy of a regulated dam.

(C1-55) For each annual inspection, two copies of a report certified by a suitably qualified and experienced person, including any recommended actions to be taken to ensure the integrity of each regulated dam, must be provided to the administering authority by 1 December.

Schedule C – Table 10 Location of Regulated Dams

Name of Regulated Dam	Easting GDA 94	Northing GDA 94
12North Dam		
Mine Water Dam N1		
Mine Water Dam N2		
Mine Water Dam N3		
Mine Water Dam S1		

Note: coordinates to be provided after detailed design

Schedule C – Table 11 Basic Specifications of Regulated Dams

Regulated Dam	Maximum Surface Area (ha)	Maximum Volume of Dam (ML)	Maximum Depth of Dam (m)	Purpose of Dam
12North Dam				Collection, storage and management of mine water including pit waters
Mine Water Dam N1				Collection and transfer of pit water
Mine Water Dam N2				Collection and transfer of pit water
Mine Water Dam N3				Collection and transfer of pit water
Mine Water Dam S1				Collection and transfer of pit water

Note: surface area, volume, and depth specifications to be provided after detailed design.

Schedule C – Table 12 Hydraulic Performance Criteria of Regulated Dams and Integrated Mine Water Management System Dams

Regulated Dam	Hazard Category for Failure to Contain	Uncontrolled Discharge AEP	Hazard Category for Dambreak	Spillway Critical Design Storm AEP	Mandatory Reporting Level
Regulated Dams					
12North Dam	Significant	1: 100	Significant	1: 1000	1: 100 AEP 72 hour storm volume below spillway level OR 1:100 AEP wind wave height below spillway level.
Mine Water Dam N1	Significant	1: 100	Significant	1: 1000	
Mine Water Dam N2	Significant	1: 100	Significant	1: 1000	
Mine Water Dam N3	Significant	1: 100	Significant	1: 1000	
Mine Water Dam S1	Significant	1: 100	Significant	1: 1000	
Low Hazard Dams (not Regulated) that form part of the integrated mine water system					
Sed Dam N1	Low	1:10	Significant	1: 1000	Not Applicable
Sed Dam N2	Low	1:10	Significant	1: 1000	
Sed Dam N3	Low	1:10	Significant	1: 1000	
Sed Dam S1	Low	1:10	Significant	1: 1000	
Sed Dam S2	Low	1:10	Significant	1: 1000	
Sed Dam S3	Low	1:10	Significant	1: 1000	
Catchment Dam North	Low	1:10	Significant	1: 1000	
Catchment Dam South	Low	1:10	Significant	1: 1000	
Mine Water Dam 1	Low	1:10	Significant	1: 1000	
Mine Water Dam 2	Low	1:10	Significant	1: 1000	
Mine Water Dam 3	Low	1:10	Significant	1: 1000	
Mine Water Dam 4	Low	1:10	Significant	1: 1000	
Mine Water Dam 4a	Low	1:10	Significant	1: 1000	
Mine Water Dam 5	Low	1:10	Significant	1: 1000	

Water General

(C1-56) All determinations of water quality must be:

a) performed by a person or body possessing appropriate experience and qualifications to perform the required measurements;
b) made in accordance with methods prescribed in the latest edition of the Environment Protection Agency Water Quality Sampling Manual;
c) collected from the monitoring locations identified within this environmental authority, within 2 hours of each other where possible; and
d) carried out on representative samples.

(C1-57) The release of contaminants directly or indirectly to waters:

a) must not produce any visible discolouration of receiving waters; nor
b) must not produce any slick or other visible or odorous evidence of oil, grease or petrochemicals nor contain visible floating oil, grease, scum, litter or other objectionable matter.

Annual Water Monitoring Reporting

(C1-58) The following information must be recorded in relation to all water monitoring required under the conditions of this environmental authority and submitted to the administering authority in the specified format with each annual return:

a) the date on which the sample was taken;
b) the time at which the sample was taken;
c) the monitoring point at which the sample was taken;
d) the measured or estimated daily quantity of the contaminants released from all release points;
e) the release flow rate at the time of sampling for each release point;
f) the results of all monitoring and details of any exceedences with the conditions of this environmental authority; and
g) water quality monitoring data must be provided to the administering authority in the specified electronic format upon request.

Temporary Interference with waterways

(C1-59) Temporarily destroying native vegetation, excavating, or placing fill in a watercourse, lake or spring necessary for and associated with mining operations must be undertaken in accordance with Department of Natural Resources and Water Guideline - Activities in a Watercourse, Lake or Spring associated with Mining Activities.

Water Management Plan

(C1-60) A Water Management Plan must be developed and implemented by xx/xx/xxxx that provides for the proper and effective management of the actual and potential environmental impacts resulting from the mining activity and to ensure compliance with the conditions of this environmental authority.

(C1-61) The Water Management Plan must be developed in accordance with DERM Guideline for

Preparing a Water Management Plan 2009 or any updates that become available from time to time and must include at least the following components:

a) Contaminant Source Study;
b) Site Water Balance and Model;
c) Water Management System;
d) Saline Drainage Prevention and Management Measures;
e) Acid Rock Drainage Prevention and Management Measures (if applicable);
f) Emergency and Contingency Planning;
g) Monitoring and Review.

(C1-62) Each year the holder of the environmental authority must undertake a review of the Water Management Plan prior to the wet season (i.e. by 1 November) and a further review following the wet season (i.e. by 1 May the following year) to ensure that proper and effective measures, practices or procedures are in place so that the mine is operated in accordance with the conditions of this environmental authority and that environmental harm is prevented or minimised.

(C1-63) A copy of the Water Management Plan and/or a review of the Water Management Plan must be provided to the administering authority on request.

Saline Drainage

(C1-64) The holder of this environmental authority must ensure proper and effective measures are taken to avoid or otherwise minimise the generation and/or release of saline drainage.

Stormwater and Water sediment controls

(C1-65) An Erosion and Sediment Control Plan must be developed by a suitably qualified person and implemented for all stages of the mining activities on the site to minimise erosion and the release of sediment to waters and contamination of storm water.

(C1-66) The maintenance and cleaning of any vehicles, plant or equipment must not be carried out in areas from which contaminants can be released into any waters.

(C1-67) Any spillage of wastes, contaminants or other materials must be cleaned up as quickly as practicable to minimise the release of wastes, contaminants or materials to any stormwater drainage system or waters.

Definitions:
"controlled release" means an active discharge where deliberate action was taken to discharge water either by pumping or opening of gates, or breach of a drain or embankment.

"uncontrolled release " means a discharge which is entirely passive. This means that no action was taken by the EA holder that caused the discharge, and no action could have been taken by the EA holder to prevent the discharge. An example of this is where a dam overflows to the environment due to runoff into a dam from a large rainfall event over the catchment to the dam that exceeded the design AEP storm event for that element of the mine water management system. An exception would be if a dam overflows due to runoff from a rainfall event and where the EA holder failed to switch on a pump (if this would have prevented the discharge), in which case the EA holder could have taken action to prevent the discharge

Groundwater

(C2-1) Groundwater standing level and quality must be monitored during exploration activities ahead of mining and any necessary management strategy implemented to manage predicted impacts.

END OF CONDITIONS FOR SCHEDULE C

3.5 Noise and Vibration

3.5.1 Background

The project has the potential to generate noise and vibration impacts on nearby sensitive receivers. Activities at the project vary in location and nature throughout the mine life. Therefore noise levels at sensitive receivers will also vary throughout the mine life. The closest sensitive receptors to the project are 23 residences located within a distance of approximately 5 km of the project site boundary. These residences comprise:

- 12 residences located within a distance of approximately 3 km of the project site boundary; and
- 11 residences located within a distance of approximately 3 to 5 km of the project site boundary.

Moranbah, at its closest point, is located approximately 6 km to the north of the project site boundary and includes the monitoring location 66 Jackson Avenue as a representative location. There are three other noise sensitive receptors located between 5 and 12 km of the site boundary that are remote from Moranbah. Locations of sensitive receptors in relation to the project site are shown in Figure 3.5.1.

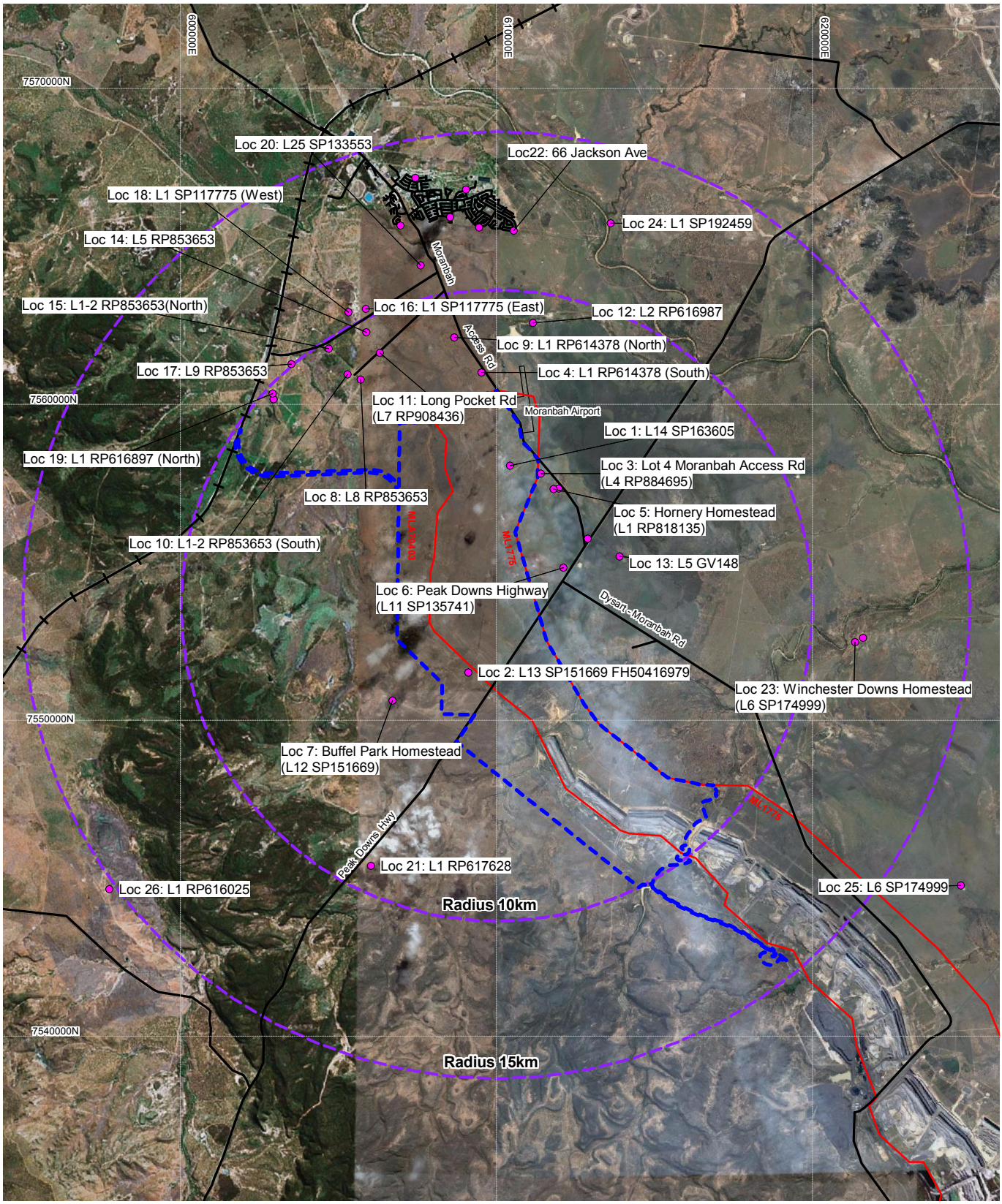
Attended and Unattended Background Noise Monitoring

Attended and unattended background noise monitoring was undertaken for the project at locations shown in Figure 3.5.2. The noise loggers were programmed to continuously record A-weighted fast response noise levels over 15 minute sampling intervals. The LA90 value represents the level exceeded for 90% of the interval period and is referred to as the background noise level. The LAeq value is the equivalent continuous noise level defined as the level of noise equivalent to the energy average of noise levels occurring over a measurement period.

Noise logging was undertaken at Locations 1 to 5 from 28 November to 6 December, 2007, and at Locations 6 and 7 from 10 to 17 March, 2008. Noise logging was also undertaken at locations 6 and 7 from 7 February to 21 February 2008. The unattended ambient noise measurements collected at each monitoring location (Table 3.5.1) were used to determine the Rating Background Level (RBL) for daytime (7.00 am to 6.00 pm), evening (6.00 pm to 10.00 pm) and night-time (10.00 pm to 7.00 am) periods at each location (Table 3.5.2). RBLs at the various monitoring locations ranged from 31 dBA to 40 dBA during the daytime, 33 dBA to 42 dBA during the evening and were 20 dBA to 36 dBA during the night time. The measured background noise levels were typical of those of a rural environment with natural noise sources and some transportation noise contributions associated with Peak Downs Highway, Moranbah Access Road and Dysart-Moranbah Road (Table 3.5.1). Operator attended noise surveys of 15 minutes duration, conducted at the noise logging locations between 28 November 2007 and 11 March 2008, indicated that the logged noise levels were representative of the background noise environment at all residences.

Vibration

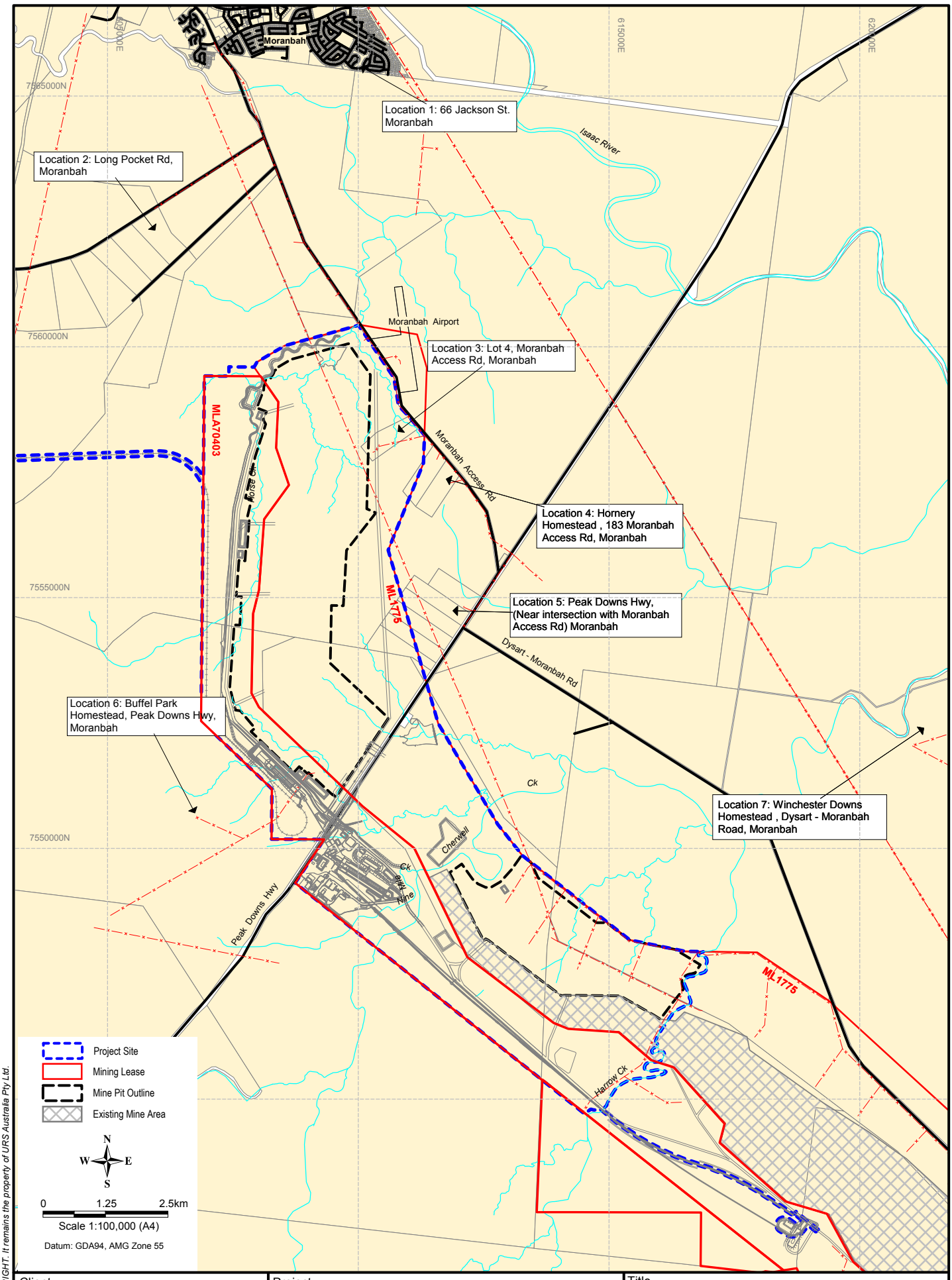
Vibration was measured at three locations (Locations 3, 4 and 5) from 28 November to 6 December 2007, and at two additional locations (Locations 6 and 7) from 10 to 17 March 2008 to determine existing baseline vibration levels, particularly from blasting (Figure 3.5.2). None of the recorded vibration events (highest recorded peak component particle velocity) correlated on a time basis with blasts from Peak Downs Mine (Table 3.5.2).



Source: Imagery from Google, 2009

Client: BHP Billiton Mitsubishi Alliance (BMA)	Project: CAVAL RIDGE MINE DRAFT ENVIRONMENTAL MANAGEMENT PLAN	Title: **LOCATION OF NOISE SENSITIVE RECEPTORS IN RELATION TO THE PROJECT SITE**
URS	Drawn: VH · Approved: RS · Date: 30-10-2009 Job No: **4262 6420** /6158 · File No: 42626158-g-2310.wor	Figure: **3.5.1** · Rev:B · **A4**

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Client: BHP Billiton Mitsubishi Alliance

Project: CAVAL RIDGE MINE
DRAFT ENVIRONMENTAL MANAGEMENT PLAN

Title: **NOISE AND VIBRATION MONITORING LOCATIONS**

Drawn: VH	Approved: RS	Date: 30-10-2009
Job No: **4262 6420** /6158	File No: 42626158-g-2311.wor	

Figure: **3.5.2**

Rev:B

A4

Table 3.5.1 Summary of (Unattended) Noise Logging Results

Locations	Description	Background Noise Levels minLA90 (dBA)1			Maximum Hourly SPL LAeq (1hour) (PNL)		
		Day 7am-6pm	Evening 6pm-10pm	Night 10pm-7am	Day 7am-6pm	Evening 6pm-10pm	Night 10pm-7am
1. 66 Jackson Ave, Moranbah	Back yard of detached two storey dwelling backing onto vacant land at southern end of Moranbah	35	382	362	57	572	532
2. Long Pocket Road, Moranbah	Side yard of detached two storey dwelling bordering northern side of project boundary	33	372	342	59	552	532
3. Lot 4, Moranbah Access Road, Moranbah	Back yard of detached single story dwelling facing Moranbah Access Rd	40	41	272	64	63	572
4. Hornery Homestead – 183 Goonyella Road, Moranbah	Back yard of detached single storey homestead bordering eastern side of project boundary	32	362	282	55	422	392
5. Peak Downs Highway (near intersection with Moranbah Access Road), Moranbah	Representative location north of single storey dwelling bordering southern side of project boundary	31	332	262	48	472	472
6. Buffel Park Homestead, Peak Downs Highway, Moranbah	Representative location north of single storey dwelling bordering southern side of project boundary	33	342	242	69	612	482
7. Winchester Downs Homestead, Dysart-Moranbah Road, Moranbah	Representative location west of double storey dwelling bordering eastern side of project boundary	40	422	202	56	54	442

Note 1: The LA90 represents the level exceeded for 90% of the interval period and is referred to as the background noise level.

The LAeq is the equivalent continuous noise level defined as the level of noise equivalent to the energy average of noise levels occurring over a measurement period.

Note 2: Values have been adjusted downward to remove the (tonal) influence of insects as it is expected that insect noise would not be present during winter months.

Table 3.5.2 Summary of Vibration Measurements

Location	Date-Time	Highest Peak Component Particle Velocity (mm/s)
3 Lot 7, Moranbah Access Rd, Moranbah	28/11/07 9:55	0.23
4 Hornery Homestead- 183 Goonyella Rd (Moranbah Access Rd)	29/11/07 7:21	1.47
5 Peak Downs Hwy (Near intersection with Moranbah Access Rd)	5/12/07 12:29	1.21
6 Buffel Park Homestead- Peak Downs Highway	11/3/08 16:08	1.86
7. Winchester Downs Homestead- Peak Downs Mine Road	11/03/08 08:55	0.79

3.5.2 Environmental Value

The environmental values to be enhanced or protected are:

- The acoustic qualities suitable for the wellbeing of a community, including its social and economic amenity; and
- The wellbeing of the individual, including the individual's opportunities to sleep, relax and converse without unreasonable interference from intrusive noise or vibration.

3.5.3 Potential Impacts on the Environmental Value

Open cut mining at the project will involve overburden removal and strip mining of coal. Overburden removal will occur during the pre-strip process and will utilise a truck and shovel fleet, as well as draglines in both Heyford Pit and Horse Pit. The exposed coal will be loaded by excavators and front end loaders into trucks for hauling either to the field coal stockpiles or to the ROM stockpiles for screening, crushing and processing. The mine will operate on a 24 hour schedule, seven days a week during construction and operational phases with blasting limited to the daytime period only (between 7.00 am and 6.00 pm) each day. Noise from these activities as well as vibration from blasting has the potential to impact on sensitive receptors.

Construction

Criteria

For construction work occurring during normal daytime hours, provided all mechanical powered plant is fitted with appropriate mufflers, specific noise limits are generally not warranted. The Queensland Environmental Protection (Noise) Policy 2008 (EPP (Noise)) does not include construction noise limits other than those which apply to blasting.

Noise impacts are usually minimised by limiting the hours of operation and, in particular circumstances, scheduling the noisiest activities to occur at times when they would generate least disruption. In accordance with the EP Act, where construction noise may affect adjacent residential premises or other residential accommodation, it is recommended to limit the hours of operation to 6.30 am to 6.30 pm, Monday to Saturday. For construction works extending outside normal working hours, particular noise limits should be applied. The most important amenity issue for surrounding residents during the

evenings/night-time period is sleep preservation. The World Health Organisation (WHO) recommends for quality sleep, maximum noise levels should not exceed 45 dBA. This guideline is recommended for construction work outside the recommended hours identified above. Based on a conservative building façade noise reduction of 5 dBA through an open window, an LAmax (external) of 50 dBA is recommended for sleep disturbance, assessable at 4 m from the building facade:

Noise Levels

Modelling based on noise monitoring data indicates that no properties will experience noise levels that exceed the recommended construction noise criterion as a result of construction of the project. The predicted maximum (Lmax) construction noise levels for neutral and weather conditions for properties located within 12 km of the project site boundary are shown in Table 3.5.3, as is worst case weather predictions for those properties to the west and north-west of the mine, based on the parameters stipulated in the EPA's Planning for Noise Control guideline and annual weather data (e.g. frequency of temperature inversions and wind roses). BMA will undertake a further study to assess the likely noise levels at the proposed construction accommodation village (just south of Location 1) and design buildings appropriately to address any adverse impacts on staff.

Table 3.5.3 Predicted Construction Noise Levels – Neutral and Worst Case Weather Conditions

Location	Property Reference	Predicted Lmax Noise Level (dBA)	
		Neutral Weather Conditions	Worst Case Weather Conditions
1	L14 SP 163605	28	-
2	SP 151669 FH 50416979	50	-
3	Lot 4 Moranbah Access Road, Moranbah	28	-
4	L1 RP 614378 (South Property)	27	-
5	Hornery Homestead – 183 Moranbah Access Road, Moranbah	29	-
6	Peak Downs Highway (near intersection with Moranbah Access Road), Moranbah	36	-
7	Buffel Park Homestead, Peak Downs Highway, Moranbah	44	48
8	L8 RP 853653	23	27
9	L1 RP 614378 (North Property)	23	-
10	L1-2 RP 853653 (South Property)	25	29
11	Long Pocket Road, Moranbah	15	19
12	L2 RP 616987	25	-
13	GV 148	31	-
14	L5 RP853653	22	26
15	L1-2 RP 853653 (North Property)	22	26

Location	Property Reference	Predicted Lmax Noise Level (dBA)	
		Neutral Weather Conditions	Worst Case Weather Conditions
16	L1 SP117775 (East Property)	22	26
17	L9 RP 853653	22	26
18	L1 SP 117775 (West Property)	24	28
19	L1 RP 616897 (North Property)	21	25
20	L25 RP 133553	21	-
21	L3 RP617628	35	-
22	66 Jackson Avenue, Moranbah	22	-
23	Winchester Downs Homestead – Dysart-Moranbah Road, Moranbah	26	-
24	L3 GV252	23	-
25	L6 SP174999	21	-
26	L1 RP616025	10	-

Note: Bold figures indicate an exceedence of the (evening/night) sleep disturbance limit of 50 dBA.

Operations

Criteria

Operational noise levels emitted by the project are assessable in accordance with three DERM Ecoaccess guidelines: Planning for Noise Control; Noise and Vibration from Blasting; and Assessment of Low Frequency Noise. Ecoaccess Planning for Noise Control assessment process takes into account four factors:

- Control and prevention of background creep;
- Determination of planning noise levels;
- Containment of variable and short term noise emissions by setting specific (intrusive) noise levels; and
- Sleep disturbance.

The guideline recommends that the lower of the two levels derived from bullet points 2 and 3 be used for assessment purposes as they are both based on the Leq parameter. The resultant background creep criterion at each monitoring location is shown in Table 3.5.4.

Table 3.5.4 Background Creep Criteria

Location	Criteria minLA90, 1hour (dBA)		
	Day	Evening	Night
1 66 Jackson Ave, Moranbah	38	28	26
2 Long Pocket Road, Moranbah	30	27	25
3 Lot 4, Moranbah Access Road, Moranbah	30	31	25

Location	Criteria minLA90, 1hour (dBA)		
	Day	Evening	Night
4 Hornery Homestead – 183 Goonyella Road, Moranbah	32	26	25
5 Peak Downs Highway (near intersection with Moranbah Access Road), Moranbah	33	25	25
6 Buffel Park Homestead, Peak Downs Highway, Moranbah	30	25	25
7 Winchester Downs Homestead, Dysart-Moranbah Road, Moranbah	30	32	25

The Specific Noise Level is determined from the existing RBL (from ambient attended and unattended noise monitoring) and is shown in Table 3.5.5.

Table 3.5.5 Specific (Intrusive) Noise Level Criteria

Location	Criteria LAeq, (1hour) (SNL)		
	Day	Evening	Night
1. 66 Jackson Ave, Moranbah	38	41	39
2. Long Pocket Road, Moranbah	36	40	37
3. Lot 4, Moranbah Access Road, Moranbah	43	44	30
4. Hornery Homestead – 183 Goonyella Road, Moranbah	35	39	31
5. Peak Downs Highway (near intersection with Moranbah Access Road), Moranbah	34	36	29
6. Buffel Park Homestead, Peak Downs Highway, Moranbah	36	37	28
7. Winchester Downs Homestead, Dysart-Moranbah Road, Moranbah	43	45	28

Note: The guideline sets a floor on Specific Noise Levels of 28 dBA (e.g. background creep floor of 25 dBA plus 3 dBA).

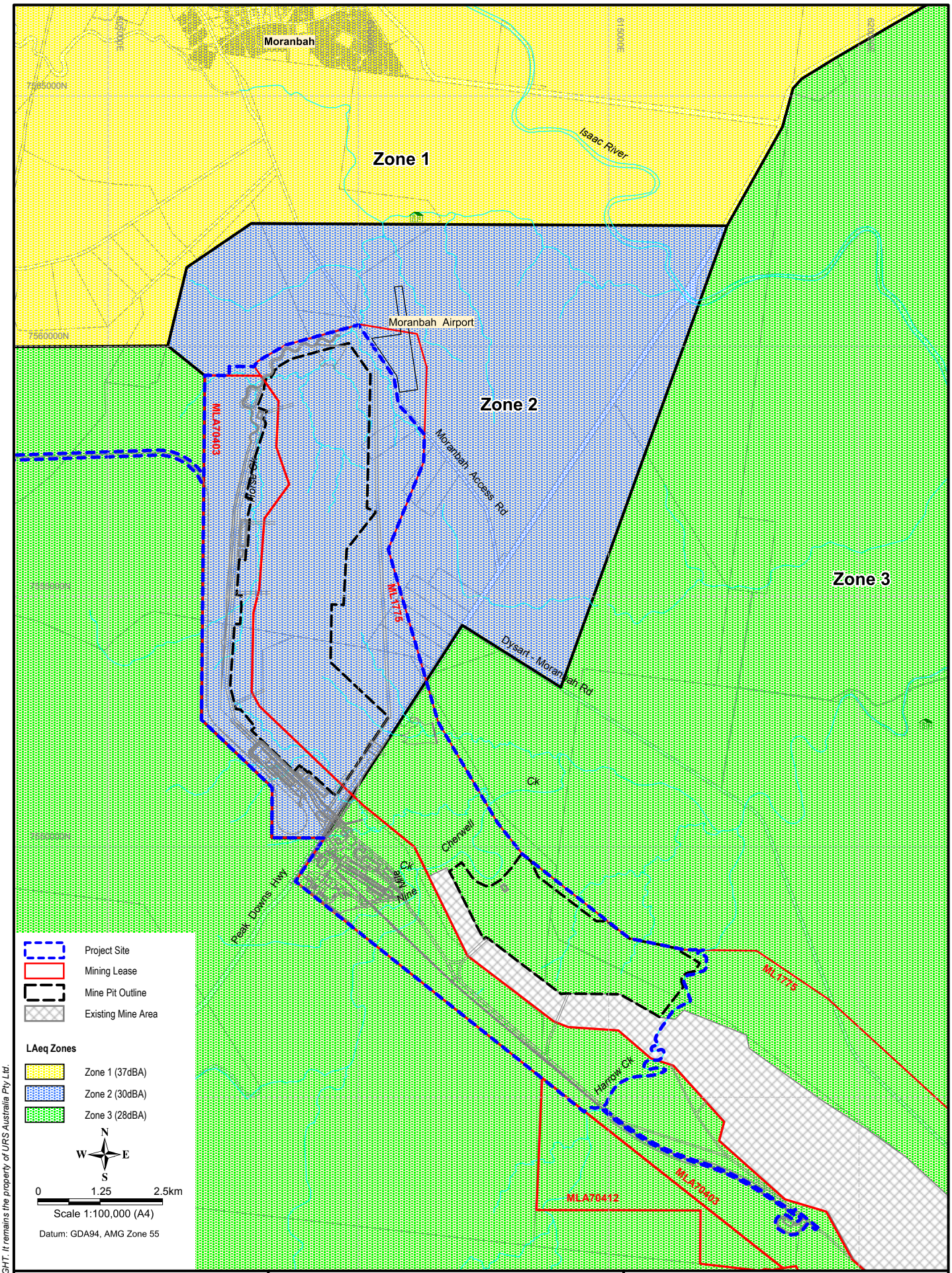
The specific noise levels have been used to form the basis of the limiting LAeq criteria for the Caval Ridge Mine as they are more stringent than the Planning Noise Level criteria. To manage the LAeq criteria effectively for every noise sensitive receiver, not just the noise monitoring locations, three different criteria zones have been identified (Figure 3.5.3):

Zone 1 (37 dBA) Moranbah and northern properties (noise measurement locations at 66 Jackson Avenue, Moranbah, and Long Pocket Road, Moranbah).

Zone 2 (30 dBA) South Moranbah Access Road and surrounding properties (noise measurement locations at Lot 4, Moranbah Access Road, Moranbah and Hornery Homestead – 183 Goonyella Road, Moranbah).

Zone 3 (28 dBA) South, west and remote from project site properties (measurement locations at Buffel Park Homestead and Winchester Downs Homestead, Moranbah).

The guideline recommends that in order to achieve a good night's sleep, internal noise levels should not exceed LAmax 45 dBA more than 10 to 15 times per night. Based on a conservative attenuation of 5 dBA through a facade with open windows, an LAmax (external) of 50 dBA is recommended, assessable 4 m from the façade and during the night-time period only.



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Client: BHP Billiton Mitsubishi Alliance

Project: CAVAL RIDGE MINE
DRAFT ENVIRONMENTAL MANAGEMENT PLAN

Title: **LAeq**
NOISE ASSESSMENT ZONES

Drawn: VH	Approved: RS	Date: 30-10-2009	Figure: **3.5.3**	Rev:B
Job No: **4262 6420** /6158	File No: 42626158-g-2312.wor			**A4**

Predicted L90 noise level contributions from the project's fixed plant operations for neutral and worst-case (where applicable) weather conditions are presented in Tables 3.5.6 and 3.5.7 respectively. These predictions are based on the output from SoundPLAN noise modelling undertaken for the project and on DERM noise emissions criteria. Eleven operational mining scenarios (covering the full life of the mine) were modelled assuming all plant items were operating concurrently in order to simulate the overall maximum potential noise emission. The criteria are predicted to be exceeded under neutral weather conditions at three locations by up to 22 dBA. Under worst-case weather conditions, the criteria are predicted to be exceeded at one location (Location 7), where the predicted exceedence increases (above the neutral weather prediction) by 6 dBA.

Table 3.5.6 Predicted LA90 Operational Noise Levels – Neutral Weather

Location	Property Reference	LA90 Criteria (dBA)	LA90 Predicted Noise Level (dBA)
1	L14 SP 163605	25	19
2	SP 151669 FH 50416979	25	47
3	Lot 4 Moranbah Access Road, Moranbah	25	18
4	L1 RP 614378 (South Property)	25	17
5	Hornery Homestead – 183 Moranbah Access Road, Moranbah	25	20
6	Peak Downs Highway (near intersection with Moranbah Access Road), Moranbah	25	27
7	Buffel Park Homestead, Peak Downs Highway, Moranbah	25	37
8	L8 RP 853653	25	14
9	L1 RP 614378 (North Property)	25	13
10	L1-2 RP 853653 (South Property)	25	16
11	Long Pocket Road, Moranbah	25	11
12	L2 RP 616987	25	15
13	GV 148	25	21
14	L5 RP853653	25	13
15	L1-2 RP 853653 (North Property)	25	13
16	L1 SP117775 (East Property)	25	12
17	L9 RP 853653	25	13
18	L1 SP 117775 (West Property)	25	14
19	L1 RP 616897 (North Property)	25	12
20	L25 RP 133553	25	11
21	L3 RP617628	25	25
22	66 Jackson Avenue, Moranbah	25	10
23	Winchester Downs Homestead – Dysart-Moranbah Road, Moranbah	25	18
24	L3 GV252	25	12

Location	Property Reference	LA90 Criteria (dBA)	LA90 Predicted Noise Level (dBA)
25	L6 SP174999	25	24
26	L1 RP616025	25	0

Note: Levels in bold indicate an exceedence of the 25 dBA LA90 noise criterion

Table 3.5.7 Predicted LA90 Operational Noise Levels – Worst Case Weather

Location	Property Reference	LA90 Criteria (dBA)	LA90 Predicted Noise Level (dBA)
7	Buffel Park Homestead, Peak Downs Highway, Moranbah	25	43
8	L8 RP 853653	25	18
10	L1-2 RP 853653 (South Property)	25	20
11	Long Pocket Road, Moranbah	25	15
14	L5 RP853653	25	17
15	L1-2 RP 853653 (North Property)	25	17
16	L1 SP117775 (East Property)	25	16
17	L9 RP 853653	25	16
18	L1 SP 117775 (West Property)	25	18
19	L1 RP 616897 (North Property)	25	16

Note: Levels in bold indicate an exceedence of the 25 dBA LA90 noise criterion

The highest LAeq noise level contributions from the proposed mine operations for neutral (Table 3.5.8) and worst-case (Table 3.5.9) for applicable weather conditions were also predicted. In the tables the overall noise level is shown as the above value with the noise level excluding train movements shown below in brackets. In all except seven locations, the mobile mechanical plant dominates the LAeq emissions from the project. At the other seven locations, both the steady state fixed plant and the mobile mechanical plant predictions have been logarithmically added to predict the overall level.

The criteria are predicted to be exceeded under neutral weather conditions at nine locations by up to 37 dBA. Under worst-case weather conditions, the exceedence at one location (7) increased by 5 dBA and three additional properties (Locations 8, 10, and 11) are predicted to have minor (up to 3 dBA) exceedences. The exceedances occur in scenarios when mobile operating plant is nearest to the receiver. The results indicate that the LAeq operational noise levels from the project could increase by 2 to 3 dBA under worst-case weather conditions, relative to neutral conditions, at the closest (e.g. worst case) distance to the properties.

It should also be noted that whilst the highest predicted noise level from rail operations (31 dBA LAeq) is above the levels recommended in Ecoaccess Planning for Noise Control, this predicted level is 34 dBA below the 65 dBA LAeq (24 hour) criteria contained in QR's Code of Practice – Railway Noise Management (which is used to assess rail noise emissions elsewhere on the Queensland rail network).

The low frequency noise criterion is 9 dBA lower for the LAeq criterion for Zone 1 locations. Of the 13 locations that fall within the Zone 1 area, none were above the LAeq criterion based on Ecoaccess Planning for Noise Control, for the neutral weather scenario. However, 10 locations will exceed the low frequency noise limit in the neutral weather scenario, by up to 9 dBA. Of these 10 locations, two contain insignificant exceedances only (i.e. 1 or 2 dBA over the low frequency criteria). Of the same 13 locations that fall within the Zone 1 area, there were three locations that exceeded the LAeq criterion for the worst-case weather scenario. A further eight locations are expected to exceed the low frequency noise limit in the worst-case weather scenario, by up to 12 dBA. Of these eight locations, one contains insignificant exceedences only (i.e. 1 dBA over the low frequency criterion).

Table 3.5.8 Predicted Operational Noise Levels – Operation Scenarios 1-11 Neutral Weather Conditions

Location	Property Reference	LAeq Predicted Noise Level (dBA)											LAeq Criteria (dBA)	Maximum Criteria Exceedance (dBA)
		Scenario												
		1	2	3	4	5	6	7	8	9	10	11		
1	L14 SP 163605	29 (23)	40 (39)	30 (26)	42 (41)	43 (43)	33 (32)	43 (43)	48 (48)	31 (29)	50 (50)	55 (55)	30	+25
2	SP 151669 FH 504169791	67 (67)	47 (47)	57 (57)	51 (51)	51 (51)	51 (51)	50 (50)	47 (47)	51 (51)	53 (54)	51 (51)	30	+37
3	Lot 4 Moranbah Access Road, Moranbah	27 (23)	34 (34)	27 (25)	36 (36)	36 (36)	29 (27)	38 (38)	39 (39)	28 (26)	42 (42)	41 (41)	30	+12
4	L1 RP 614378 (South Property)	27 (21)	43 (43)	28 (25)	33 (32)	45 (45)	27 (23)	33 (33)	48 (48)	30 (29)	34 (34)	45 (45)	30	+18
5	Hornery Homestead – 183 Moranbah Access Road, Moranbah	28 (24)	33 (32)	29 (26)	36 (36)	35 (34)	29 (27)	38 (38)	37 (37)	30 (28)	42 (42)	39 (39)	30	+12
6	Peak Downs Highway (near1 intersection with Moranbah Access Road), Moranbah	34 (34)	31 (30)	36 (36)	35 (35)	33 (33)	37 (37)	37 (37)	33 (33)	37 (37)	37 (37)	34 (34)	30	+7
7	Buffel Park Homestead, Peak1 Downs Highway, Moranbah	40 (40)	38 (37)	40 (40)	40 (39)	39 (39)	40 (39)	39 (39)	39 (38)	39 (39)	39 (39)	39 (39)	28	+12
8	L8 RP 853653	28 (18)	37 (36)	29 (23)	32 (29)	35 (34)	28 (19)	30 (26)	32 (31)	29 (20)	30 (26)	30 (26)	37	NIL
9	L1 RP 614378 (North Property)	25 (17)	37 (37)	26 (21)	30 (29)	38 (38)	26 (19)	30 (28)	36 (36)	27 (23)	29 (28)	32 (31)	30	+8
10	L1-2 RP 853653 (South Property)	28 (20)	37 (36)	28 (22)	30 (28)	33 (32)	27 (19)	29 (25)	31 (29)	27 (19)	30 (27)	30 (27)	37	NIL
11	Long Pocket Road, Moranbah	22 (15)	35 (35)	23 (19)	29 (28)	34 (33)	22 (16)	26 (24)	31 (31)	23 (18)	26 (24)	27 (26)	37	NIL
12	L2 RP 616987	24	32	24	26	31	24	26	31	23	28	31	37	NIL

Location	Property Reference	LAeq Predicted Noise Level (dBA)											LAeq Criteria (dBA)	Maximum Criteria Exceedance (dBA)
		Scenario												
		1	2	3	4	5	6	7	8	9	10	11		
		(19)	(32)	(20)	(24)	(30)	(20)	(24)	(31)	(18)	(27)	(30)		
13	GV 1481	29 (28)	29 (28)	29 (29)	30 (29)	29 (28)	30 (29)	31 (31)	29 (28)	31 (31)	31 (30)	29 (29)	30	+1
14	L5 RP853653	26 (17)	33 (32)	27 (20)	29 (26)	32 (31)	26 (18)	28 (24)	30 (28)	26 (18)	28 (24)	28 (24)	37	NIL
15	L1-2 RP 853653 (North Property)	25 (12)	31 (30)	26 (20)	28 (25)	30 (28)	26 (18)	27 (23)	28 (26)	26 (18)	27 (23)	27 (23)	37	NIL
16	L1 SP117775 (East Property)	22 (16)	31 (30)	23 (19)	26 (25)	29 (29)	22 (17)	25 (23)	29 (28)	23 (20)	19 (18)	19 (18)	37	NIL
17	L9 RP 853653	24 (16)	29 (28)	25 (20)	26 (24)	28 (27)	24 (17)	26 (23)	26 (24)	24 (18)	25 (22)	25 (23)	37	NIL
18	L1 SP 117775 (West Property)	22 (18)	31 (31)	22 (19)	25 (24)	28 (27)	22 (17)	24 (22)	27 (26)	22 (17)	28 (21)	28 (21)	37	NIL
19	L1 RP 616897 (North Property)	26 (15)	29 (27)	26 (19)	27 (23)	28 (26)	25 (16)	27 (22)	27 (23)	25 (16)	25 (24)	26 (24)	37	NIL
20	L25 RP 133553	17 (15)	27 (27)	19 (17)	23 (22)	27 (27)	18 (16)	23 (23)	25 (25)	19 (18)	26 (20)	26 (20)	37	NIL
21	L3 RP6176281	28 (28)	27 (27)	28 (28)	28 (28)	28 (27)	28 (28)	28 (28)	27 (27)	28 (28)	27 (27)	27 (27)	28	NIL
22	66 Jackson Avenue, Moranbah	23 (15)	26 (24)	23 (17)	24 (20)	27 (25)	23 (15)	24 (21)	26 (25)	23 (18)	24 (24)	24 (23)	37	NIL
23	Winchester Downs Homestead – Dysart-Moranbah Road, Moranbah1	25 (24)	25 (24)	24 (24)	24 (23)	24 (23)	24 (24)	24 (24)	24 (231)	25 (24)	25 (22)	25 (23)	28	NIL
24	L3 GV252	21 (17)	24 (23)	20 (16)	21 (18)	23 (21)	20 (15)	22 (19)	23 (21)	20 (14)	23 (22)	22 (21)	37	NIL
25	L6 SP1749991	25	25	25	25	25	25	25	25	25	26	27	28	NIL

Location	Property Reference	LAeq Predicted Noise Level (dBA)											LAeq Criteria (dBA)	Maximum Criteria Exceedance (dBA)
		Scenario												
		1	2	3	4	5	6	7	8	9	10	11		
		(25)	(25)	(25)	(25)	(25)	(25)	(25)	(25)	(25)	(25)	(26)		
26	L1 RP616025	5 (3)	4 (1)	5 (4)	5 (3)	4 (2)	5 (3)	14 (13)	4 (2)	5 (3)	4 (2)	4 (2)	28	NIL

Table 3.5.9 Predicted Operational Noise Levels – Operation Scenarios 1-11 Worst-Case Weather Conditions

Location	Property Reference	LAeq Predicted Noise Level (dBA)											LAeq Criteria (dBA)	Maximum Criteria Exceedance (dBA)
		Scenario												
		1	2	3	4	5	6	7	8	9	10	11		
7	Buffel Park Homestead, Peak Downs Highway, Moranbah1	45 (45)	43 (43)	45 (45)	45 (45)	44 (44)	44 (45)	44 (44)	44 (44)	44 (44)	44 (44)	44 (44)	28	+17
8	L8 RP 853653	29 (22)	40 (40)	30 (27)	34 (33)	38 (37)	29 (24)	31 (29)	35 (34)	29 (24)	32 (30)	32 (30)	37	+3
10	L1-2 RP 853653 (South Property)	29 (24)	40 (40)	29 (26)	32 (31)	36 (36)	28 (23)	30 (28)	34 (33)	28 (23)	32 (21)	33 (31)	37	+3
11	Long Pocket Road, Moranbah	24 (20)	39 (39)	25 (23)	32 (31)	37 (37)	24 (20)	28 (27)	35 (35)	24 (22)	29 (28)	31 (30)	37	+2
	L5 RP853653	27 (21)	37 (37)	28 (24)	31 (30)	35 (34)	27 (22)	29 (27)	33 (32)	27 (23)	30 (28)	30 (29)	37	NIL
15	L1-2 RP 853653 (North Property)	27 (21)	35 (34)	28 (24)	31 (29)	33 (32)	27 (22)	29 (26)	31 (30)	27 (22)	29 (27)	29 (27)	37	NIL
16	L1 SP117775 (East Property)	24 (20)	34 (34)	25 (23)	29 (28)	33 (32)	24 (21)	27 (26)	32 (32)	26 (24)	22 (22)	22 (22)	37	NIL
17	L9 RP 853653	25	33	27	29	32	25	27	29	25	27	27	37	NIL

Location	Property Reference	LAeq Predicted Noise Level (dBA)											LAeq Criteria (dBA)	Maximum Criteria Exceedance (dBA)
		Scenario												
		1	2	3	4	5	6	7	8	9	10	11		
		(21)	(32)	(24)	(28)	(31)	(22)	(26)	(28)	(22)	(25)	(25)		
18	L1 SP 117775 (West Property)	25 (23)	35 (35)	25 (23)	28 (28)	31 (31)	23 (21)	26 (25)	30 (29)	24 (21)	29 (26)	29 (25)	37	NIL
19	L1 RP 616897 (North Property)	26 (19)	32 (31)	27 (23)	29 (27)	31 (30)	26 (20)	28 (25)	29 (27)	26 (20)	29 (28)	29 (28)	37	NIL
20	L25 RP 133553	20 (19)	31 (31)	22 (22)	26 (26)	30 (30)	21 (20)	26 (26)	29 (29)	23 (22)	25 (28)	27 (24)	37	NIL

The highest predicted LAmax noise level contributions from the project for neutral and worst-case (where appropriate) weather conditions are shown in Tables 3.5.10 and 3.5.11 respectively. The criteria are predicted to be exceeded under neutral weather conditions at three locations (1, 2 and 4) by up to 25 dBA. Under worst-case weather conditions, no additional properties are adversely affected.

Whilst the highest predicted LAmax noise level from rail operations (57 dBA LAmax) is above the levels recommended in Ecoaccess Planning for Noise Control, it is 30 dBA below the 87 dBA LAmax criteria contained in EPP (Noise) and QR's Code of Practice – Railway Noise Management.

Mining Cumulative Noise Impacts

The cumulative noise impacts are inherently assessed through the background creep (L90) and specific/intrusive (Leq) criteria contained in the DERM's Planning for Noise Control guideline. Both criteria take into account the existing ambient noise level in an area from all existing industry and other noise sources such as road and railway traffic.

The DERM's Planning for Noise Control assessment methodology is based on the existing ambient noise monitoring (undertaken at seven locations surrounding the project) and comparison to recommended ambient noise levels. The cumulative effect of the existing industry and other noise sources, together with the project, is assessed to not exceed the recommended ambient noise levels. If the existing noise level is already above the recommended noise levels, the associated noise levels of the project are set between 8 and 10 dBA below the existing ambient noise level so as the cumulative effects of existing and proposed industry should not increase above existing noise levels.

Table 3.5.10 Predicted LAMax Operational Noise Levels – Operation Scenarios 1-11 Neutral Weather Conditions

Location Number	Property Reference	LAMax Predicted Noise Level (dBA)											LAMax Criteria (dBA)	Maximum Criteria Exceedance (dBA)
		Scenario												
		1	2	3	4	5	6	7	8	9	10	11		
1	L14 SP 163605	31 (31)	47 (47)	43 (34)	49 (49)	51 (51)	43 (40)	51 (51)	56 (56)	43 (37)	58 (58)	63 (63)		
2	SP 151669 FH 504169791	75 (75)	57 (41)	65 (65)	57 (57)	56 (56)	56 (56)	55 (55)	54 (42)	56 (56)	59 (59)	57 (57)	50	+13
3	Lot 4 Moranbah Access Road, Moranbah	44 (31)	44 (42)	40 (33)	44 (44)	44 (44)	40 (35)	46 (46)	47 (47)	40 (34)	50 (50)	49 (49)	50	+25
4	L1 RP 614378 (South Property)	45 (29)	51 (51)	41 (33)	41 (40)	53 (53)	41 (31)	41 (41)	56 (56)	41 (37)	42 (42)	53 (53)	50	NIL
5	Hornery Homestead – 183 Moranbah Access Road, Moranbah	44 (32)	44 (40)	40 (34)	44 (44)	42 (42)	40 (35)	46 (46)	45 (45)	40 (36)	50 (50)	47 (47)	50	+6
6	Peak Downs Highway (near1 intersection with Moranbah Access Road), Moranbah	42 (41)	42 (37)	43 (43)	42 (42)	39 (39)	45 (45)	44 (44)	40 (40)	45 (45)	45 (45)	41 (41)	50	NIL
7	Buffel Park Homestead, Peak1 Downs Highway, Moranbah	50 (44)	50 (35)	46 (44)	46 3)	46 (41)	46 (43)	46 (42)	46 (39)	46 (41)	46 (41)	46 (41)	50	NIL
8	L8 RP 853653	46 (26)	46 (44)	43 (31)	43 (37)	43 (42)	43 (27)	43 (34)	43 (39)	43 (28)	43 (34)	43 (34)	50	NIL
9	L1 RP 614378 (North Property)	42 (25)	45 (45)	39 (29)	39 (37)	46 (46)	39 (27)	39 (36)	44 (44)	39 (31)	36 (39)	39 (39)	50	NIL
10	L1-2 RP 853653 (South Property)	46 (28)	46 (44)	43 (30)	43 (36)	43 (40)	43 (27)	43 (33)	43 (37)	43 (27)	43 (35)	43 (35)	50	NIL
11	Long Pocket Road, Moranbah	40 (23)	43 (43)	37 (27)	37 (36)	41 (41)	37 (24)	37 (32)	39 (39)	37 (26)	37 (32)	38 (38)	50	NIL

Location Number	Property Reference	LAMax Predicted Noise Level (dBA)											LAMax Criteria (dBA)	Maximum Criteria Exceedance (dBA)
		Scenario												
		1	2	3	4	5	6	7	8	9	10	11		
12	L2 RP 616987	39 (27)	40 (40)	36 (28)	36 (32)	38 (38)	36 (28)	36 (32)	39 (39)	36 (26)	36 (35)	38 (38)	50	NIL
13	GV 1481	39 (35)	39 (35)	36 (36)	36 (36)	35 (35)	36 (36)	38 (38)	35 (35)	37 (37)	38 (38)	36 (36)	50	NIL
14	L5 RP853653	42 (25)	42 (40)	39 (28)	39 (34)	39 (39)	39 (26)	39 (32)	39 (36)	39 (26)	39 (32)	39 (32)	50	NIL
15	L1-2 RP 853653 (North Property)	44 (25)	44 (38)	41 (28)	41 (33)	41 (36)	41 (26)	41 (31)	41 (34)	41 (26)	41 (31)	41 (31)	50	NIL
16	L1 SP117775 (East Property)	38 (24)	38 (38)	35 (27)	35 (33)	37 (37)	35 (25)	35 (31)	36 (36)	35 (28)	35 (30)	35 (31)	50	NIL
17	L9 RP 853653	44 (24)	44 (36)	40 (28)	40 (32)	40 (35)	40 (25)	40 (31)	40 (32)	40 (26)	40 (29)	40 (29)	50	NIL
18	L1 SP 117775 (West Property)	42 (26)	42 (39)	39 (27)	39 (32)	39 (35)	39 (25)	39 (30)	39 (34)	39 (25)	39 (32)	39 (32)	50	NIL
19	L1 RP 616897 (North Property)	49 (23)	49 (35)	46 (27)	46 (31)	46 (34)	46 (24)	46 (30)	46 (31)	46 (24)	46 (28)	46 (28)	50	NIL
20	L25 RP 133553	30 (23)	35 (35)	26 (25)	30 (30)	35 (35)	26 (24)	31 (31)	33 (33)	26 (26)	29 (29)	30 (30)	50	NIL
21	L3 RP6176281	41 (32)	41 (29)	38 (33)	38 (32)	38 (31)	38 (33)	38 (32)	38 (31)	38 (32)	38 (32)	38 (31)	50	NIL
22	66 Jackson Avenue, Moranbah	38 (23)	38 (32)	35 (25)	35 (28)	35 (33)	35 (23)	35 (29)	35 (33)	35 (26)	35 (28)	35 (29)	50	NIL
23	Winchester Downs Homestead – Dysart-Moranbah Road, Moranbah1	36 (31)	36 (31)	33 (30)	33 (29)	33 (29)	33 (30)	33 (30)	33 (29)	33 (31)	33 (30)	33 (29)	50	NIL
24	L3 GV252	35	35	32	32	32	32	32	32	32	32	32	50	NIL

Location Number	Property Reference	LAMax Predicted Noise Level (dBA)											LAMax Criteria (dBA)	Maximum Criteria Exceedance (dBA)
		Scenario												
		1	2	3	4	5	6	7	8	9	10	11		
		(25)	(31)	(24)	(26)	(29)	(23)	(27)	(29)	(22)	(28)	(29)		
25	L6 SP1749991	27 (25)	27 (24)	27 (27)	26 (26)	25 (25)	27 (27)	26 (26)	26 (26)	27 (27)	26 (26)	26 (26)	50	NIL
26	L1 RP616025	15 (11)	15 (9)	12 (12)	11 (11)	11 (10)	11 (11)	21 (21)	11 (10)	11 (11)	11 (10)	11 (10)	50	NIL

Note: Levels in bold indicate an exceedence of the applicable criterion. Levels in brackets denote noise level excluding rail noise.

Table 3.5.11 Predicted L_{AMax} Operational Noise Levels – Operation Scenarios 1-11 'Worst-Case' Weather Conditions

Location Number	Property Reference	LAMax Predicted Noise Level (dBA)											LAMax Criteria (dBA)	Maximum Criteria Exceedance (dBA)
		Scenario												
		1	2	3	4	5	6	7	8	9	10	11		
7	Buffel Park Homestead, Peak Downs Highway, Moranbah	50 (48)	50 (39)	48 (48)	47 (47)	46 (45)	47 (47)	46 (46)	46 (43)	46 (45)	46 (45)	46 (45)	50	NIL
8	L8 RP 853653	46 (30)	48 (48)	43 (35)	43 (41)	43 (45)	43 (32)	43 (37)	43 (42)	43 (32)	43 (38)	43 (38)	50	NIL
10	L1-2 RP 853653 (South Property)	46 (32)	48 (48)	43 (34)	43 (39)	44 (44)	43 (31)	43 (36)	43 (41)	43 (31)	43 (39)	43 (39)	50	NIL
11	Long Pocket Road, Moranbah	40 (28)	47 (47)	37 (31)	39 (39)	45 (45)	37 (28)	37 (35)	43 (43)	37 (30)	37 (36)	38 (38)	50	NIL
14	L5 RP853653	42 (29)	45 (45)	39 (32)	39 (38)	42 (42)	39 (30)	39 (35)	40 (40)	39 (31)	39 (36)	39 (37)	50	NIL
15	L1-2 RP 853653 (North Property)	44 (29)	44 (42)	41 (32)	41 (37)	41 (40)	41 (30)	41 (34)	41 (38)	41 (30)	41 (35)	41 (35)	50	NIL
16	L1 SP117775 (East Property)	38 (28)	42 (42)	35 (31)	36 (36)	40 (40)	35 (29)	35 (34)	40 (40)	35 (32)	35 (34)	35 (35)	50	NIL
17	L9 RP 853653	44 (29)	44 (40)	40 (32)	40 (36)	40 (39)	40 (30)	40 (34)	40 (36)	40 (30)	40 (33)	40 (33)	50	NIL
18	L1 SP 117775 (West Property)	42 (31)	43 (43)	39 (31)	39 (36)	39 (39)	39 (29)	39 (33)	39 (37)	39 (29)	39 (36)	39 (36)	50	NIL
19	L1 RP 616897 (North Property)	49 (27)	49 (39)	46 (31)	46 (35)	46 (38)	46 (28)	46 (33)	46 (35)	46 (28)	46 (32)	46 (32)	50	NIL
20	L25 RP 133553	30 (27)	39 (39)	30 (30)	34 (34)	38 (38)	28 (28)	34 (34)	37 (37)	30 (30)	33 (33)	34 (34)	50	NIL

Note: Levels in bold indicate an exceedence of the applicable criterion. Levels in brackets denote noise level excluding rail noise.

Road Traffic Noise

As changes in noise levels of less than 2 dBA are unnoticeable to the humar ear, no adverse impact is anticipated.

Table 3.5.12 shows the expected increase in road traffic noise levels associated with construction and operation activities for the project. As changes in noise levels of less than 2 dBA are unnoticeable to the human ear, no adverse impact is anticipated.

Table 3.5.12Increase in Road Traffic Noise Levels due to Construction and Operational Vehicles

Road Segment	Predicted Increase in LA10(18hour) Noise Level (dBA)	
	Construction Phase	Operational Phase
Moranbah Access Road	+0.1	+0.1
Dysart-Moranbah Road	+0.1	+0.1
Peak Downs Highway (Ch 88.180-100.900)	+0.3	+0.1

Vibration Impact from Operational Blasting

Blasting site laws have been developed from a combination of the proposed blast design parameters and blast emission data obtained from BMA's nearby Peak Downs Mine (ground vibration only) and ICI's Handbook of Blasting Tables. The predicted levels of Peak Vector Sum (PVS) ground vibration velocity and peak airblast at the nearest potentially affected properties to the mine blasting are presented in Table 3.5.13. The frequency of blast ground vibrations at distance from the mine are predicted to be below 35 Hz, therefore the applicable vibration criterion is 10 mm/s (not 25 mm/s).

Based on the predicted levels of blast emissions, the predicted levels of ground vibration at all but six nearby residences will comply with the DERM's criteria. The predicted levels of peak airblast at all but six residences will comply with the DERM's criteria. There are no known underground pipelines within 510 m of the pit area (e.g. where blasting will occur) so no adverse effects on pipelines are predicted as a result of the project.

Table 3.5.13Predicted Levels of Blast Emissions for the Range of 500 kg - 1000 kg MIC

Location	Distance from Blasting	PVS Ground Vibration	Peak Airblast[1]
1 - L14 SP 163605	0 km	391.5 - 681.6 mm/s	139 - 142 dB Linear
2 - SP 151669 FH 50416979	0 km	391.5 – 681.6 mm/s	139 - 142 dB Linear
3 - Lot 4 Moranbah Access Road, Moranbah	0.3 km	67.5 – 117.5 mm/s	128 – 130 dB Linear
4 - L1 RP 614378 (South Property)	0.6 km	22.3 – 38.8 mm/s	121 – 123 dB Linear
5 - Hornery Homestead – 183 Moranbah Access Road, Moranbah	0.7 km	17.4 - 30.3 mm/s	119 - 122 dB Linear
6 - Peak Downs Highway (near intersection with Moranbah Access	1.2 km	7.3 – 12.8 mm/s	114 – 116 dB Linear

Location	Distance from Blasting	PVS Ground Vibration	Peak Airblast[1]
Road), Moranbah			
7 - Buffel Park Homestead, Peak Downs Highway, Moranbah	1.5 km	5.1 – 8.9 mm/s	111 -114 dB Linear
8 - L8 RP 853653	1.8 km	3.8 – 6.7 mm/s	109 - 112 dB Linear
9 - L1 RP 614378 (North Property)	2 km	3.2 – 5.6 mm/s	108 - 111 dB Linear
10 - L1-2 RP 853653 (South Property)	2.2 km	2.8. – 4.8 mm/s	107 - 110 dB Linear
11 - Long Pocket Road, Moranbah	2.3 km	2.6 – 4.5 mm/s	107 - 109 dB Linear
12 - L2 RP 616987	2.3 km	2.6 – 4.5 mm/s	107 - 109 dB Linear
13 - GV 148	3 km	1.7 – 3.0 mm/s	104 - 106 dB Linear
14 - L5 RP853653	3.1 km	0.6 – 2.8 mm/s	104 - 106 dB Linear
15 - L1-2 RP 853653 (North Property)	3.2 km	1.5 – 2.7 mm/s	103 - 106 dB Linear
16 - L1 SP117775 (East Property)	3.8 km	1.2 – 2.0 mm/s	101 - 104 dB Linear
17 - L9 RP 853653	3.9 km	1.1 – 1.9 mm/s	101 - 104 dB Linear
18 - L1 SP 117775 (West Property)	4 km	1.1 – 1.9 mm/s	101 - 103 dB Linear
19 - L1 RP 616897 (North Property)	4.1 km	1.0 – 1.8 mm/s	101 - 103 dB Linear
20 - L25 RP 133553	4.4 km	0.9 – 1.6 mm/s	100 - 102 dB Linear
21 - L3 RP617628	4.8 km	0.8 – 1.4 mm/s	99 - 101 dB Linear
22 - 66 Jackson Avenue, Moranbah	5 km	0.7 – 1.3 mm/s	99 - 101 dB Linear
23 - Winchester Downs Homestead – Dysart-Moranbah Road, Moranbah	6 km	0.6 – 1.0 mm/s	97 - 99 dB Linear
24 - L3 GV252	6 km	0.6 – 1.0 mm/s	97 - 99 dB Linear
25 - L6 SP174999	6 km	0.6 – 1.0 mm/s	97 - 99 dB Linear
26 - L1 RP616025	10.1 km	0.2 – 0.4 mm/s	91 - 94 dB Linear

Note 1 Predictions for 20% exceedence therefore criterion is 115 dB Lin. These are presented in bold.

Noise and Vibration Impact on Wildlife

Apart from the possibility of noise from blasting startling birds and therefore over time possibly changing where they nest, no adverse impacts on animals are predicted for the project. Given that there is no conclusive information available to confirm that should birds be startled they will change where they nest, noise impacts on animal life surrounding the proposed mine is considered acceptable.

3.5.4 Environmental Protection Objective

The environmental protection objectives for noise and vibration are:

- To avoid causing nuisance noise levels at sensitive receivers; and
- To avoid causing nuisance airblast overpressure and ground vibration impacts at sensitive receivers.

3.5.5 Performance Criteria

The performance criteria for noise and vibration are:

- Compliance with the requirements of the project's environmental authority.

- Noise and vibration monitoring in accordance with the control strategies outlined below.
- The number of substantiated noise or vibration complaints from the community.

3.5.6 Control Strategies

Construction

No adverse construction noise levels are predicted except at Location 2 which sits within the ultimate pit design. Therefore, specific construction noise mitigation measures for the project are not warranted.

Operations

Receptor-Specific Strategies

Of the three noise criteria stipulated in DERM's Ecoaccess Planning for Noise Control document – Background Creep (LA90), Planning/Intrusive (LAeq) and Sleep Disturbance (Lmax) – the Planning/Intrusive (LAeq) predicted noise levels were found to be worst-case.

Twelve properties exceed the Leq criterion for either neutral or worst case weather conditions. No mitigation measures will be adopted for those properties owned by BMA (Locations 1 to 3, 5 and 6), as BMA has the ability to control the occupancy of these properties to meet their operational/environmental requirements.

For the remaining properties, mitigation measures include:

- Low and Super Low noise idlers for the overland conveyor;
- Partial and full enclosure of the overland conveyor;
- Building façade upgrades (e.g. double glazing) for mitigating internal maximum noise levels only; and/or
- Property resumption.

Location 4 – Lot 1/RP614378 (Anglo owned)

A combination of both noise bunds and upgraded silencing of equipment would not achieve compliance with the noise criterion at this property and therefore the possible resumption of this property, or entering into an agreement with the neighbour, are options that will require further discussion.

Location 7 – Buffel Park

A combination of both super low noise idlers and a full enclosure of the overland conveyor would not achieve compliance with the L90 (steady state) noise criterion at this property. A combination of mitigation measures would not achieve compliance with the Leq noise criterion at this property. Therefore the possible resumption of this property will require further discussion.

Location 8 – Lot 8/RP853653

Compliance with the noise criterion is achievable with either bund walls (up to 20 m high) or upgraded silencing of mobile plant (albeit the bund wall results in a negligible 1 dBA exceedence). A comprehensive noise monitoring program will be implemented before undertaking any mitigation measures as the exceedence of 3 dBA (before mitigation is implemented) is commonly accepted in the acoustic industry as

minor. Given the accuracy of environmental noise prediction of +/- 2 dBA, monitoring validation of actual noise emissions will be undertaken.

Location 9 – Lot 1/RP614378 (Anglo owned)

Compliance with the noise criterion is close to achievable with either noise bunds (up to 20 m high) or upgraded silencing of mobile plant and certainly achievable with a combination of both measures. However, possible resumption of this property, or entering into an agreement with Anglo, may require further discussion.

Location 10 – Lots 1 and 2/RP853653

Compliance with the noise criterion is achievable with either noise bunds (up to 20 m high) or upgraded silencing of mobile plant (albeit the bund wall results in a negligible 1 dBA exceedence). A comprehensive noise monitoring program will be implemented before undertaking any mitigation measures as the exceedence of 3 dBA (before mitigation is implemented) is commonly accepted in the acoustic industry as minor. Given the accuracy of environmental noise prediction of +/- 2 dBA, monitoring validation of actual noise emissions will be undertaken.

Location 11 – Long Pocket Road

Compliance with the noise criterion is achievable with either noise bunds (up to 20 m high) or upgraded silencing of mobile plant. A comprehensive noise monitoring program will be implemented before undertaking any mitigation measures as the exceedence of 3 dBA (before mitigation is implemented) is commonly accepted in the acoustic industry as minor. Given the accuracy of environmental noise prediction of +/- 2 dBA, monitoring validation of actual noise emissions will be undertaken.

Location 13 – GV148

Compliance with the noise criterion is achievable with either noise bunds (up to 20 m high) or upgraded silencing of mobile plant. A comprehensive noise monitoring program will be implemented before undertaking any mitigation measures as the exceedence of 3 dBA (before mitigation is implemented) is commonly accepted in the acoustic industry as minor. Given the accuracy of environmental noise prediction of +/- 2 dBA, monitoring validation of actual noise emissions will be undertaken.

General Strategies

The following general control strategies for noise will be implemented:

- Self adjusting volume or broad-band buzzer type reversing alarms will be utilised to avoid additional noise annoyance to sensitive receptors. Should only traditional constant volume beeping type reversing alarms be used, then the Leq noise measurements for mobile mechanical plant will be penalised a further 2 dBA for the added tonal annoyance.
- Implement maintenance and operation procedures to minimise nuisance noise emissions from equipment, including servicing and maintenance of exhaust systems on mine equipment.
- Investigate complaints to determine the source of the nuisance noise.
- Maintain a register that details noise complaints and corrective actions relating to the complaint.
- Limit the speed of heavy vehicle traffic on haul roads.
- Plan to design haul roads and manage noisy equipment within pits to minimise impacts on sensitive receivers.

- Consider noise control technologies on mining equipment and haul trucks during procurement.
- Apply noise mitigation technologies on individual equipment where necessary.
- Implement a noise monitoring program as discussed below.

The following control strategies for blasting will be implemented:

- Carry out blasting only during daylight hours, generally during the hours of 8.00 am to 5.00 pm, Monday to Sunday.
- Plan to blast during the middle of the day, where practical, when background noise levels are higher than at other times of day.
- Where monitoring or complaints indicate airblast overpressure or ground vibration levels of impact consistently above the environmental protection objectives, the following mitigations measures will be considered:
  - Reducing the maximum instantaneous charge (MIC) by using delays, reduced hole diameter and/or deck loading.
  - Changing the burden and spacing by altering the drilling pattern and/or delay layout, or altering the hole inclination.
  - Ensuring stemming depth and type is adequate.
  - Restricting blasts to favourable weather conditions.

3.5.7 Monitoring

Ongoing Monitoring Program

A combination of permanent and short term annual noise and vibration monitoring will be undertaken as outlined below at the locations identified in Tables 3.5.14 and 3.5.15.

Table 3.5.14 Recommended Permanent Monitoring Locations

Location
Hornery Homestead- 183 Goonyella Rd (Moranbah Access Rd)
Long Pocket Rd, Moranbah
Winchester Downs Homestead- Peak Downs Mine Road
Buffel Park Homestead- Peak Downs Highway
'The Bucket' Park, Moranbah Access Rd[1]

Note [1] - A permanent noise and vibration monitoring system may be installed at 'The Bucket' Park, though additional housing or security measures may be required to protect the monitoring equipment due to public accessibility.

One of the permanent sites will utilise a trailer mounted station. This would need to be located at a somewhat secure site (e.g. Buffel Park) for on-going security reasons. This approach allows the flexibility of temporarily relocating the permanent site to a complainant's property without the need for an acoustic professional to visit the site.

Table 3.5.15 Recommended Non-Permanent Monitoring Locations

Location
Lot 7, Moranbah Access Road
Peak Downs Highway (near intersection with Moranbah Access Road)
66 Jackson Street, Moranbah

A noise and vibration logger will be placed at the locations in Table 3.5.15 along with 15-minute operator-attended noise and vibration measurements (carried out during day, evening and night periods), over a 48 hour period each year. The combination of permanent and short-term annual noise monitoring will ensure that a comprehensive monitoring program for continuous noise and vibration is achieved.

Complaints Based Monitoring

In the event of a community member registering a complaint regarding excessive noise or vibration levels, a two-phase response regime will be implemented:

- First complaint: Remote Response - Data from the nearest permanent monitoring site will be interrogated remotely to determine justification of the complaint. Should the trailer option be implemented, a variation on this "Remote Response" would be to drive the trailer to the complainant's property and then interrogate the data remotely.
- Second complaint: Site Response - An acoustic professional will visit the area where the complaint was registered for a 48-hour period to undertake continuous logging as well as short-term noise and/or vibration monitoring to determine impacts.

3.5.8 Commitments

- On-going noise and vibration monitoring will continue to be carried out in accordance with the requirements of Environmental Protection Act 1994, the Environmental Protection (Noise) Policy 2008, Environmental Protection Regulation 2008, and the DERM's Noise Measurement Manual .
- The project will investigate all substantiated noise and vibration related complaints.
- The project will implement corrective action resulting from complaints investigations as required.

3.5.9 Proposed Environmental Authority Conditions - Schedule D – Noise and Vibration

Noise nuisance

(D1-1) Noise from the mining activity must not cause a noise nuisance at any sensitive place.

(D1-2) All noise from the mining activity must not exceed the levels specified in Schedule D- Table 1 at any noise affected place.

(D1-3) Noise is not considered to be a nuisance under condition (D1-1) if monitoring shows that noise from the mining activity does not exceed the following levels in the time periods specified in Schedule D- Table 1 (noise limits);

Schedule D-Table 1 Noise Limits (Noise Sensitive Place)

Noise Level dB(A) measured as	**Monday to Sunday**		
	7am – 6pm	**6pm – 10pm**	**10pm – 7am**
Noise Level dB(A) measured as	Noise measured at a 'Noise Sensitive Place'		
LAeq, adj 15 mins[1]	RBL_3 + 3	RBL3 + [3]	RBL_3 + 3
LA_1, 15 mins[2]	45	45	45

Note [1] External noise limit

Note [2] Internal noise limit

Note [3] Rated Background Level (RBL) as defined in the DERM's Ecoaccess *Planning for Noise Control* Guideline

3.5.10 Noise monitoring

(D2-1) When requested by the administering authority, noise monitoring must be undertaken within a reasonable and practicable timeframe nominated by the administering authority to investigate any complaint (which is neither frivolous nor vexatious nor based on mistaken belief in the opinion of the authorised officer) of noise nuisance at any sensitive place, and the results must be notified within 14 days to the administering authority following completion of monitoring. Monitoring must include:

a) $L_{A\ eq,\ adj,}$ 15 mins

b) $L_{A\ 1,}$ 15 mins (internal – or a measured external noise level and calculation of corresponding internal noise level)

c) the level and frequency of occurrence of impulsive or tonal noise;

d) atmospheric conditions including wind speed and direction;

e) effects due to extraneous factors such as traffic noise; and

f) location date and time of recording.

(D2-2) The method of measurement and reporting of noise levels must comply with the current edition of the Department of Environment and Resource Management's *Noise Measurement Manual* and any subsequent versions

(D2-3) If monitoring indicates exceedance of the relevant limits in Condition (D1-3), then the environmental authority holder must:

a) address the complaint including the use of appropriate dispute resolution if required; and

b) immediately implement noise abatement measures so that emissions of noise from the activity do not result in further environmental nuisance.

3.5.11 Vibration nuisance

(D3-1) Subject to Conditions (D8) and (D9), vibration from the mining activity must not cause an environmental nuisance, at any sensitive or commercial place.

(D3-2) If the Environmental Authority holder can provide evidence through monitoring that the limits defined in Schedule D- Table 2 are not being exceeded then the holder is not in breach of (D2-1).

(D3-3) If monitoring indicates exceedance of the relevant limits in Schedule D – Table 2 (peak particle velocity), then the environmental authority holder must:

a) address the complaint including the use of appropriate dispute resolution if required; and

b) immediately implement vibration abatement measures so that vibration from the activity do not result in further environmental nuisance.

Schedule D-Table 2 Airblast Overpressure and Peak Particle Velocity Levels

Blast Noise and Vibration Parameter	**Monday to Sunday - 8am to 5pm**
Airblast overpressure level (dB linear peak)	115 db (linear peak) for 4 out of any 5 consecutive blasts regardless of interval between blasts. Any single blast must not exceed 120 db (linear peak).
Peak particle velocity (mm/s)	For vibrations of more than 35 Hz – more than 25 mm/s ground vibration For vibrations of no more than 35 Hz – more than 10 mm/s ground vibration

(D3-4) When requested by the administering authority, vibration monitoring must be undertaken within a reasonable and practicable timeframe nominated by the administering authority to investigate any complaint (which is neither frivolous nor vexatious nor based on mistaken belief in the opinion of the authorised officer) of environmental nuisance at any sensitive or commercial place, and the results must be notified within 14 days to the administering authority following completion of monitoring.

(D3-5) The method of measurement and reporting of vibration levels must comply with the current edition of the Department of Environment and Resource Management's *Noise Measurement Manual* and any subsequent versions

3.5.12 Airblast overpressure nuisance

(D4-1) Subject to Conditions (4-2) and (4-3), airblast overpressure level from blasting operations must not cause an environmental nuisance, at any sensitive or commercial place.

(D4-2) If the Environmental Authority holder can provide evidence through monitoring that the limits defined in Schedule D – Table 2 (airblast over pressure) are not being exceeded then the holder is not in breach of (D4-1).

(D4-3) If monitoring indicates exceedance of the relevant limits in Schedule D – Table 2 (Airblast overpressure level), then the environmental authority holder must:

a) address the complaint including the use of appropriate dispute resolution if required; and

b) immediately implement airblast overpressure abatement measures so that airblast overpressure from the activity do not result in further environmental nuisance.

(D4-4) When requested by the administering authority, airblast overpressure monitoring must be undertaken within a reasonable and practicable timeframe nominated by the administering

authority to investigate any complaint (which is neither frivolous nor vexatious nor based on mistaken belief in the opinion of the authorised officer) of environmental nuisance at any sensitive or commercial place, and the results must be notified within 14 days to the administering authority following completion of monitoring.

(D4-5) Airblast overpressure monitoring must include the following descriptors, characteristics and conditions:

a) location of the blast(s) within the mining area (including which bench level);

b) atmospheric conditions including temperature, relative humidity and wind speed and direction;

c) location, date and time of recording.

(D4-6) The method of measurement and reporting of airblast overpressure levels must comply with the current edition of the Department of Environment and Resource Management's *Noise Measurement Manual* and any subsequent versions.

END OF CONDITIONS FOR SCHEDULE D

3.6 Waste Management

3.6.1 Background

Regulatory Framework

In Queensland, the management of waste (non-mineral) is governed by a number of pieces of legislation. As a generator of waste, BMA will ensure that it meets its obligations under the *Environmental Protection Act 1994* (EP Act), *Environmental Protection (Waste Management) Policy 2000* (EPP Waste), *Environmental Protection (Waste Management) Regulation 2000* and the *National Environmental Protection (Movement of controlled Wastes between States and Territories*) Measure during construction and operation of the open cut mine. Description of waste

Definition of Waste

The EP Act defines waste as anything that is:

- Left over, or an unwanted by-product, from an industrial, commercial, domestic or other activity; or
- Surplus to the industrial, commercial, domestic or other activity generating wastes.

The EP (Waste) Regulation defines general waste as waste other than regulated waste. Regulated wastes are defined in Schedule 1 of the EP (Waste) Regulation as non-domestic waste (which is defined in Schedule 7 of the Regulation). The EPP (Waste) defines regulated waste, as any waste:

- That contains a significant quantity and concentration of a hazardous contaminant; or
- Where the hazardous contaminant exhibits hazardous characteristics because of its toxicity, carcinogenicity, mutagenicity, teratogenicity, flammability, corrosivity, reactivity, ignitability or infectiousness, through its physical, chemical or biological characteristics; or
- That may cause environmental harm if improperly transported, treated, stored, disposed or otherwise managed.

Waste Management Principles and Hierarchies

The EPP (Waste) provides guidance for waste management through waste management principles and hierarchies. The principles are:

- Polluter pays principle – all costs associated with waste management should, where possible, be borne by the waste generator;
- User pay principle – all costs associated with the use of a resource should, where possible, be included in the price of goods and services developed from the resource; and
- Product stewardship principle – the producer or importer of a product should take all reasonable steps to minimise environmental harm from the production, use and disposal of the product.

The above three principles form a hierarchy and provide a basis for waste management programs for Environmentally Relevant Activities (ERAs). Waste should be managed following the hierarchy below (in order of priority) (EPA, 2005):

- Waste avoidance.
- Waste reuse.

- Waste recycling.
- Energy recovery.
- Waste disposal.

Waste Generated by the Project

The project will generate non-mineral waste during the construction and the operational phases. These sources include:

- Regulated waste including hydrocarbon waste (i.e. waste oil, oily water, oily sludge, grease, coolant, oil rags, oil filters, drums, detergents, solvents, batteries, tyres, paints and resins);
- General waste including food waste, packaging and food containers;
- Recyclable waste including paper, cardboard, plastics, glass and aluminium cans;
- Wood waste including timber, pallets, and off-cuts;
- Tyres including light vehicle tyres and mine truck tyres;
- Scrap metal and off-cuts from the water supply pipeline and mine infrastructure areas including drums, cans, scrap, containers, nails, screws; and
- Sewage effluent and sludge.

Construction Waste

The wastes generated by mine and infrastructure construction activities are shown in Table 3.6.1. Quantities of waste were estimated based on information from other coal mine sites in Central Queensland.

Table 3.6.1 Waste Generation during Construction Phase

Waste Type	Source(s)	Management Method	Approximate Quantity
Cleared vegetation.	Mine, water pipeline, site infrastructure including dams, diversion, levee and sewage treatment plant	Reuse vegetation waste on-site for rehabilitation, landscaping and erosion control where possible.	Small amounts of vegetation
Excavated waste.	Access roads, site infrastructure and site fencing.	Refill any excavations and spread any excess soil over the nearby area and revegetate.	All used as fill on site
Concrete.	Site infrastructure area and water supply pipeline.	Minimise waste by producing/procuring only the amount required. Excess waste will be disposed of in the Heyford Pit spoil dump on-site.	<2 t
Steel/metal off-cuts.	Site infrastructure area and water pipeline.	Minimise waste by producing/procuring only the amount required. Segregation and collection on-site. Transportation off-site by a waste contractor for off-site recycling.	4 tonnes

Waste Type	Source(s)	Management Method	Approximate Quantity
Timber pallets and off-cuts.	Site infrastructure area and workshop.	Minimise waste by producing/procuring only the amount required. Any undamaged pallets will be returned to the supplier for reuse. Excess waste will be chipped and reused on-site as mulch for landscaping and erosion control where practical. Left over waste will be disposed of in the Heyford Pit spoil dump on-site.	4 tonnes
Paints and resins.	Site infrastructure area, workshop and water supply pipeline	Minimise waste by producing/procuring only the amount required. Collection on-site and storage in a segregated area. Transportation off-site by licensed regulated waste transporter, and disposal at a licensed facility.	Minor amounts.
General wastes including food waste, packaging materials etc	Construction offices and workshop.	General waste will be taken off-site for disposal at the Moranbah town landfill. Collection and segregation of recyclable waste on-site. Transportation by a waste contractor for off-site recycling.	50 tonnes
Grease trap wastes.	Workshop.	Wastes will be collected and taken by licensed regulated waste transporter to a licensed facility for recycling.	1,650 litres
Waste oil and containers.	Workshop.	Collected and stored on-site in a bunded tank. Transported off-site by a licensed regulated waste transporter, to a licensed facility for recycling.	45 t
Oily water.	Workshop.	Oil will be separated from water. The resulting oil will be collected and transported off-site by a licensed regulated waste transporter to a licensed facility for recycling. The separated water will be disposed of through the Sewage Treatment Plant system.	4 t
Tyres.	Workshop.	Light vehicle tyres will be stored on-site and transported off-site by a licensed regulated waste transporter to a licensed facility for recycling or disposal.	60
Sewage Treatment Plant (STP) waste and residues (sewage sludge).	Administration offices, workshops.	Disposed of in an appropriate facility by a licensed contractor.	15 t/ annum

The estimated volumes of each waste type (apart from waste rock and tailings) likely to be generated during operational phase of the mine are shown in Table 3.6.2. Waste volumes at the neighbouring Peak Downs Mine (a similar sized mine) were used to estimate waste quantities.

Table 3.6.2 Waste Generated during Operations

Waste Type	Source(s)	Management Method	Approximate Quantity (per annum)
Oily sludge, absorbent, degreaser, grease, oily rags, oil filters.	Workshop and mobile service vehicles.	Collected on-site then transported off-site by a licensed regulated waste transporter, to a licensed facility for recycling or treatment and disposal.	Oil sludge 7,000 litres; Grease 43,500 litres; Oil Filters 30,500 kg, 2 tonnes.
Waste oil containers.	Workshop and mobile service vehicles.	Drained on-site. Drums will be transported off-site by waste contractor for off-site reuse, recycling or disposal.	121,000 litres 200 units
Scrap metal, drums.	Site Infrastructure Area, including administration, workshops.	Segregation and collection on-site. Transportation off-site by a waste contractor for off-site recycling.	91 tonnes
General wastes including putrescible and organic (food waste), some plastics and paper not suitable for recycling.	Workshop, office.	Collection on-site and storage in segregated area. Transportation off-site to Moranbah Town landfill.	4,000 m^3 149 tonnes
Recyclable waste including paper and cardboard, plastics, and glass.	Workshop, office.	Segregation and collection on-site. Transportation by a waste contractor for off-site recycling.	2,040 m^3 28 tonnes
Hazardous waste-paints and resins.	Workshop.	Collected on-site and stored in a segregated area. Then transported off-site by a licensed regulated waste transporter, to a licensed facility for treatment and disposal.	<2 tonnes

Waste Type	Source(s)	Management Method	Approximate Quantity (per annum)
Timber pallets and off-cuts.	Site Infrastructure Area, including administration, workshops.	Minimise waste by producing/procuring only the amount required. Any undamaged pallets will be returned to the supplier for reuse. Excess waste will be chipped and reused on-site as mulch for landscaping and erosion control where practical. Left over waste will be disposed of in the Heyford pit spoil dump.	3 tonnes
Tyres.	Workshop.	Light vehicle tyres will be stored on-site and transported off-site by a licensed regulated waste transporter to a licensed facility for recycling or disposal. Mine truck tyres will be buried on-site, the locations of which will need to be recorded in accordance with EPA requirements.	50
Vehicle batteries.	Site Infrastructure Area including administration, workshops.	Collected on-site in a segregated area. Then transported off-site by a licensed regulated waste transporter to a licensed facility for recycling.	3 tonnes
Regulated waste-sewage waste and residues (sewage sludge).	Sewage Treatment Plant.	Wastes will be transported and disposed of by licensed contractor at a licensed facility.	45 ML/Annum (based on 495 EP) Volume will vary depending on number of people on site

3.6.2 Environmental Value

Environmental values at the project site that may potentially be impacted upon by non-mineral waste include:

- The life, health and wellbeing of people;
- The biological integrity and diversity of ecosystems and processes surrounding the mine;
- The integrity of receiving environments such as land, air, surface water and groundwater (including the suitability of water for agricultural use);
- The stability of disturbed land and ensuring it is non-polluting;
- The suitability of land for beneficial post mining land use; and
- Visual amenity.

3.6.3 Potential Impacts on the Environmental Value

Environmental harm could occur in an around the project site if wastes are not managed properly. Sensitive receptors including residences and ecosystems sounding the project site could be detrimentally impacted if

waste streams entered waterways and groundwater systems and flowed off-site. Similar, air emissions have the potential to impact sensitive receptors off-site. The following waste streams from the project have the potential to impact on the above mentioned environmental values:

- Solid waste (other than mineral waste) including regulated waste, general waste and sewage;
- Waste water from the mining operations and processing plant; and
- Air emissions including particulates, fumes and odour from the project during construction and operation.

3.6.4 Environmental Protection Objective

The environmental protection objectives for waste are:

- To avoid contaminating land, surface water or groundwater through poor waste management practices.
- To manage waste through the use of licensed contractors, transporters and disposal facilities.
- To minimise the generation of waste in accordance with the waste management hierarchy listed in the *Environmental Protection (Waste Management) Policy 2000* which involves:
  - implementation of the waste minimisation hierarchy with these waste management options:
    a) waste avoidance;
    b) waste re-use; and
    c) waste recycling.
  - compliance with national and state waste management policies, the EP Act and associated regulatory instruments as a minimum; and
  - effective waste disposal (as a last option).

3.6.5 Performance Criteria

The performance criteria for waste management are:

- Prevent adverse environmental impacts from waste management during the construction phase.
- Adherence to waste minimisation principles.
- Adhere to waste management hierarchy by:
  - minimising waste generation;
  - maximising water and materials reuse and recycling; and
  - safely treating and disposing of all non-reusable and non-recyclable materials.

3.6.6 Control Strategies

General Waste Management Strategies

Waste Avoidance

Waste avoidance is the first hierarchical step in reducing the amount of waste produced. The generation of waste can be avoided by substituting inputs for those that generate waste, increasing efficiency in the use of raw materials, energy, water or land, redesigning processes or products, and/or improving maintenance and operation of equipment. Careful project planning will ensure that the amount of material brought on-site for the construction and operating of the open cut mine is minimised, resulting in a cost saving and reducing the

volume of waste generated. Any excess materials and used chemical containers will, where practical, be returned to the supplier or other local users. BMA will also consider packaging issues when purchasing resources for the project and will encourage bulk purchasing to reduce the amount of packaging waste.

Waste Reuse/Recycling

The appropriate management and storage of wastes will prevent on-site and off-site pollution and enhance opportunities for reuse. Waste will be sent for disposal to landfill only once other options have been exhausted. Waste streams will be assessed for potential reuse, prior to transport to an approved disposal facility. Wastes will be reused or recycled where possible:

- Vegetation wastes from site clearing will be used on site in rehabilitation and landscaping.
- Topsoil from disturbed areas will be used in rehabilitation activities on-site;
- Where possible, recyclable materials will be purchased for use throughout the project;
- Solvents, metals and oil will be recovered and re-used;
- Recyclable wastes will be collected separately and reused or recycled, such as:
  - Timber from concrete formwork;
  - Scrap steel and off-cuts;
  - Pallets;
  - Plastics;
  - Paper and cardboard; and
  - Oils.

Waste Separation

Waste, where practicable and taking into account health and hygiene issues, will be segregated and collected on-site and stored in suitable containers for removal to approved facilities as agreed with the relevant local council prior to construction. It is anticipated that a portion of all construction materials will be recycled. Adequate separation of components of the waste stream at the point of generation will be practiced by the project, for example, steel, glass, paper, cardboard and aluminium cans will be segregated from general waste. Waste separation at the source will be achieved by providing bins for reusable or recyclable materials. A number of locations will be allocated within the mine area for the collection of large quantities of waste to enable segregation of wastes for recycling. Some of these materials collected will have a market demand. There are likely to be opportunities to reuse and recycle aluminium cans, some containers such as glass bottles, paper, cardboard, pallets, drums, timber, oils, and scrap metal. The project will review the marketability of its waste for recycling and reuse on a regular basis should sufficient amounts of reusable/recyclable waste be produced as a result of construction and operation.

Waste Disposal

Wastes generated by the project will be disposed of in a way that causes the least harm to the environment. Operational and construction solid wastes that cannot be recycled or reused will be disposed of at an appropriate facility, depending on the waste type. Facilities in the region include:

- Moranbah landfill on Goonyella Road;
- Licensed regulated waste facilities (Mackay, Townsville and Narangba);
- Material Recycling Facility in Mackay; and

- Transfer stations at Nebo and at Coppabella.

Specific Waste Management Methods

Construction Waste

Wastes generated by project construction activities will be managed as shown in Table 3.6.3 and in accordance with the Caval Ridge Waste Management Plan and other requirements discussed below.

Table 3.6.3 Waste Management for the Construction Phase

Waste Type	Source(s)	Management Method
Cleared vegetation.	Mine footprint, water pipeline, site infrastructure including dams, diversion, levee and sewage treatment plant.	Reuse vegetation waste on-site for rehabilitation, landscaping and erosion control where possible.
Excavated soil.	Access roads, site infrastructure and site fencing.	Refill any excavations and spread any excess soil over the nearby area and revegetate.
Concrete.	Site infrastructure area and water supply pipeline.	Minimise waste by producing/procuring only the amount required. Excess waste will be disposed of in the Heyford Pit spoil dump on-site.
Steel/metal off-cuts.	Site infrastructure area and water pipeline.	Minimise waste by producing/procuring only the amount required. Segregation and collection on-site. Transportation off-site by a waste contractor for off-site recycling.
Timber pallets and off-cuts.	Site infrastructure area and workshop.	Minimise waste by producing/procuring only the amount required. Any undamaged pallets will be returned to the supplier for reuse. Excess waste will be chipped and reused on-site as mulch for landscaping and erosion control where practical. Left over waste will be disposed of in the Heyford Pit spoil dump on-site.
Paints and resins.	Site infrastructure area, workshop and water supply pipeline	Minimise waste by producing/procuring only the amount required. Collection on-site and storage in a segregated area. Transportation off-site by licensed regulated waste transporter, and disposal at a licensed facility.
General wastes including food waste, packaging materials some plastics and paper.	Construction offices and workshop.	General waste will be taken off-site for disposal at the Moranbah town landfill.
Recyclable wastes including paper and cardboard, plastics, glass, aluminium cans.	Construction offices.	Collection and segregation on-site. Transportation by a waste contractor for off-site recycling.

Waste Type	Source(s)	Management Method
Grease trap wastes.	Workshop.	Wastes will be collected and taken by licensed regulated waste transporter to a licensed facility for recycling.
Waste oil and containers.	Workshop.	Collected and stored on-site in a bunded tank. Transported off-site by a licensed regulated waste transporter, to a licensed facility for recycling.
Oily water.	Workshop.	Oil will be separated from water. The resulting oil will be collected and transported off-site by a licensed regulated waste transporter to a licensed facility for recycling. The separated water will be disposed of through the Sewage Treatment Plant system.
Tyres.	Workshop.	Light vehicle tyres will be stored on-site and transported off-site by a licensed regulated waste transporter to a licensed facility for recycling or disposal.
Sewage Treatment Plant (STP) and residues (sewage sludge).	Administration offices, workshops.	Disposed of in an appropriate facility by a licensed contractor.
Sewage Treatment Plant (STP) effluent.	Construction and administration offices	STP effluent to be discharged to 12 N Dam.
Water Treatment Plant (WTP) residues.	Construction and administration offices	Blackflush water from the WTP will be discharged to the 12 N Dam. Residue will accumulate in the ponds and the ponds will be remediated at the end of the mine life.

Operational Waste

The management method for each waste type (other than mineral wastes) likely to be generated during operational phase of the mine is shown in Table 3.6.4. Waste generated during the operational phase of the project will be managed in accordance with the Caval Ridge Waste Management Plan.

Table 3.6.4 Waste Management: Operation Phase

Waste Type	Source(s)	Management Method
Oily sludge, absorbent, degreaser, grease, oily rags, oil filters.	Workshop and mobile service vehicles.	Collected on-site then transported off-site by a licensed regulated waste transporter, to a licensed facility for recycling or treatment and disposal.
Waste oil containers.	Workshop and mobile service vehicles.	Drained on-site. Drums will be transported off-site by waste contractor for off-site reuse, recycling or disposal.
Scrap metal, drums.	Site Infrastructure Area, including administration, workshops.	Segregation and collection on-site. Transportation off-site by a waste contractor for off-site recycling.

Waste Type	Source(s)	Management Method
General wastes including putrescible and organic (food waste), some plastics and paper not suitable for recycling.	Workshop, office.	Collection on-site and storage in segregated area. Transportation off-site to Moranbah Town landfill.
Recyclable waste including paper and cardboard, plastics, and glass.	Workshop, office.	Segregation and collection on-site. Transportation by a waste contractor for off-site recycling.
Hazardous waste-paints and resins.	Workshop.	Collected on-site and stored in a segregated area. Then transported off-site by a licensed regulated waste transporter, to a licensed facility for treatment and disposal.
Timber pallets and off-cuts.	Site Infrastructure Area, including administration, workshops.	Minimise waste by producing/procuring only the amount required. Any undamaged pallets will be returned to the supplier for reuse. Excess waste will be chipped and reused on-site as mulch for landscaping and erosion control where practical. Left over waste will be disposed of in the Heyford pit spoil dump.
Tyres.	Workshop.	Light vehicle tyres will be stored on-site and transported off-site by a licensed regulated waste transporter to a licensed facility for recycling or disposal. Mine truck tyres will be buried on-site, the locations of which will need to be recorded in accordance with DERM requirements.
Vehicle batteries.	Site Infrastructure Area including administration, workshops.	Collected on-site in a segregated area. Then transported off-site by a licensed regulated waste transporter to a licensed facility for recycling.
Regulated waste-sewage waste and residues (sewage sludge).	Sewage Treatment Plant.	Wastes will be transported and disposed of by licensed contractor at a licensed facility.
Regulated waste-sewage wastewater discharge from the STP.	Sewage Treatment Plant.	STP effluent to be discharged to 12 N Dam.
Process plant water.	Process plant	Process plant water will be recycled to minimise raw water make-up requirements for the site.
Water Treatment Plant (WTP) residues.	Water Treatment Plant.	Backflush water from the WTP will be discharged to the 12 N Dam and evaporate. Residue will accumulate in the ponds and the ponds will be remediated at the end of the mine life.
Stormwater runoff.	Workshop and offices.	Clean stormwater runoff will be collected and contained by a drainage system and directed to on-site retention dams. The water will be reused as a source of water for the CHPP on-site. Surplus water will only be released if there is no storage capacity available and there are no further reuse options available for the site.

Waste Management Procedures

The Environmental Management System (EMS) for the project will address waste management with an aim to minimising the quantity of waste generated and improving on the waste disposal and management techniques adopted. The principles for waste minimisation and management for the project are as follows:

- The overarching principle for waste management for the project is:
  - Programs are in place to ensure that wastes are eliminated (or where possible avoided), reduced, reused, recycled, treated, or properly disposed of. Records are kept to ensure that all wastes can be tracked from source to disposal, and waste receiving facilities are audited to ensure conformance to appropriate waste standards.
- The sub-principles for waste minimisation and management for the project are:
  - Initiatives are identified and implemented to use raw materials and natural resources efficiently.
  - Initiatives are identified and implemented to reduce the environmental impact of operations. Programs are implemented to protect, manage and, where appropriate, enhance biodiversity values.
  - Existing and new products and services are assessed for their potential to provide Health, Safety, Environment and Community (HSEC) benefits or cause adverse HSEC impacts over their lifecycle.
  - Opportunities are sought to conduct or support research and innovation that promotes the use of products and technologies that are safe and efficient in their use of energy, natural resources and other materials.
  - Advice is made available to employees, contractors, distributors, customers and the community regarding the possible HSEC impacts associated with the production, transport, storage, use, recycling and disposal of BHP Billiton products.
  - Systems are in place to identify, evaluate and respond to HSEC related external influences (e.g. customer needs and expectations, regulations, voluntary standards and competitor initiatives) that could impact on BHP Billiton products and business activities.
- All waste generated on-site during the construction and operation phase will be disposed of in accordance with a Waste Management Plan (WMP), which will provide for:
  - Waste stream characterisation and separation; and
  - Assessment of waste reduction opportunities for identified waste.
- Management of waste in accordance with the waste management hierarchy as identified in the overarching principle for waste management.

Waste Management Plan

A WMP will be implemented for the project. The intent of the WMP is to:

- Maintain due diligence to ensure compliance with legislation;
- Support waste minimisation through an ‘avoid, reduce, reuse and recycle’ approach;
- Facilitate good housekeeping practices thereby removing potential health and safety hazards;
- Ensure efficient removal of regulated wastes off-site and ensure that the disposal facilities receiving the waste are regularly audited;

- Ensure records are made of waste stream volumes, thus enabling the setting and measurement of waste management performance objectives and targets;
- Ensure that employees, contractors, distributors and customers understand their obligations under the WMP;
- Provide for continual improvement in waste management practices and processes; and
- Minimise impact to future rehabilitation of the mine site as well as prevention of land, air and water contamination (both on-site and off-site).

Wastes will be managed to avoid adverse impacts on environmental values including the life, health and wellbeing of people and the diversity of ecological processes and associated ecosystems surrounding the mine.

Corporate HSEC Objectives and Targets

Measurable HSEC goals are set by BHP Billiton on an annual basis for its existing mines (BMA, 2005a) and will apply to the Caval Ridge Mine project. The goals and associated performance indicators are consistent with the BHP Billiton-wide HSEC targets, which take into account the significant HSEC risks, legal and other requirements, technological options, business requirements and the interests of stakeholders.

Waste management objectives and time-bound targets will be established and performance indicators documented, communicated, monitored and reviewed. The progress of actions will be monitored and reported by the Waste Management Coordinator on a monthly basis to site management. Where trends indicate failure to achieve targets, the Waste Management Coordinator will initiate investigations and identify corrective actions to enable targets to be achieved.

The following are specific BHP Billiton waste management key performance indicators (KPIs) relevant to the project:

- Storage and Disposal of Waste and Hazardous Substances:
  - 98% correctly disposed of in accordance with procedures (tracked in contamination reports).
  - All hazardous substances disposed of according to the relevant Australian Standard or BMA standard.
- Waste minimisation which is defined relative to a base year – waste to be considered include:
  - Waste to landfill.
  - Volume of coolant and degreaser.
  - Diesel spills.
  - Air filter usage.

Additional waste management objectives for the project include:

- Development of mine departmental recycling targets based on information on department waste streams and volumes.
- Investigation of potential reuse of certain streams of regulated waste like the use of waste oil in on-site operations.
- Enhancement of workforce knowledge on correct segregation of general and recyclable waste streams.

Risk Assessment

The WMP will include a risk assessment process to be used to identify the potential risk of various wastes on surrounding sensitive receptors. This will allow contractors during construction and BMA (during operation) to focus resources on the high risk issues.

Roles and Responsibilities

The roles, responsibilities and authorities for effectively and continually improving the waste management system for the project will be detailed in the Caval Ridge WMP.

Employee and Contractor Training and Awareness

All waste management contractors will have the necessary qualifications to remove waste from site. This will include attendance at generic inductions, obtaining appropriate licenses, being classed as Queensland Coal Board competent, and undergoing a Queensland Coal Board medical examination. All site personnel and contractors must implement the site waste management standards and procedures.

Emergency Preparedness

BMA's current hazard and emergency response protocol will be amended and implemented to enable appropriate response to emergency situations and potential incidents so that impacts on environment, employees and surrounding communities are minimised. The protocol is contained within the Emergency Management Plan and the procedures for spill response. Standard procedures for the storage, handling, disposal and spill response for potentially hazardous waste materials will be adopted. Sites that become contaminated will be investigated, managed and remediated in consultation with the DERM and in accordance with the requirements of the contaminated land provisions of the EP Act.

Monitoring

Monitoring of waste management at the project site under the WMP will be undertaken regularly. This will enable BMA to:

- Compile and analyse waste data to enable continuous improvement of waste avoidance, reduction and management measures throughout all components of the project;
- Monitor and, if required, initiate actions to fulfil waste objectives and targets;
- Assess actual waste management results and compare with predicted impacts and mitigation measures;
- Monitor potential environmental impacts; and
- Enable positive actions to be taken in the event of incidents or accidents.

Waste Tracking and Reporting

The movement of regulated waste in Queensland is subject to a waste tracking system under the EP (Waste) Regulation. All waste movement from the site will be tracked in accordance with the requirements of Schedule 2 of the EP (Waste) Regulation, as detailed in the WMP. This will include the completion of Waste Transport Certificates for the collection, transport and management of regulated wastes from the project.

If the waste is regulated and is listed as trackable under the EP (Waste) Regulation, all waste handlers (generators, transporters, and receivers) need to complete their part of a Waste Transport Certificate. The purpose of the document is for reference information for the DERM. With this document the DERM can than

follow the waste from the point of origin, transportation route and final destination. The waste properties and characteristics will be known to make sure the waste has been properly handled, treated, stored, transported and disposed of correctly by appropriate licensed personnel and facilities.

The Waste Transport Certificate is available from DERM offices. A copy of the certificate will travel with the waste from the loading point to the delivery of the waste at the final disposal facility. Each document is numbered. The document number then becomes the waste load reference number. Two versions of the Waste Transport Certificate are available, one for intrastate waste transport and one for interstate waste transport. These documents are required to be kept for minimum 5 years. If the waste contains asbestos, the documents will be kept for 40 years. The waste tracking documents will remain on-site for six months after the waste was transported off-site. After the six months the documents will be forwarded to head office and archived after two years.

Specifically, the Waste Transport Certificate will be used to record the following information:

- Name, address, local government area and contact details of generator.
- Name, address, contact details and environmental authority number of receiver.
- Name, address, contact details and environmental authority number of transporter.
- The day and time the waste is given to the transporter.
- The load number.
- Registration number of the vehicle transporting the load
- If the waste is a dangerous good:
  - The type and number of containers in which the waste is contained.
  - Its UN number.
  - Its packing group designator.
  - Its dangerous goods class and any subsidiary risk.
- The following details of the waste:
  - The type of waste.
  - Amount expressed in kilograms or litres.
  - Its physical nature (solid, liquid, paste or gas).
  - Its waste code.
- The waste origin code for the activity that generated the waste.

If the waste is regulated but not trackable then only the following needs to be documented:

- Date of transport
- Type and quantity of waste
- Waste Transport Certificate Number (if required)
- Transporters company name
- Selected route of transport
- Final destination/facility
- Accepted by (transporters signature)

- Records of any incidents that may have occurred en route.

The reports for regulated wastes and DERM Waste Transport Certificates will be forwarded to the BMA Waste Management Coordinator. Waste contractors will also be required to provide BMA with monthly reports which outline different waste types, their disposal methods and tracking.

In addition, the treatment, storage and transport of regulated waste require an Environmental Authority under the EP Act. Where BMA and/or a contractor carries out these activities, BMA and/or the contractor will be required to hold the appropriate approvals. These requirements will be incorporated into the Caval Ridge WMP.

Auditing, Reporting and Investigation

The WMP will be subject to regular internal and external audits. The findings of these audits will be used to develop methodologies aimed at improving waste reuse, recycling and minimisation. The targets and progress of actions will be monitored and reported by the project's Waste Management Coordinator on a monthly basis to mine management. Where trends indicate failure to achieve targets, the Waste Management Coordinator will initiate investigations and identify corrective actions to enable targets to be achieved. The DERM may also audit any aspect of the Caval Ridge WMP at any time.

The mine will maintain a HSEC process to ensure appropriate management of unplanned incidents, including reporting, notification, investigation, analysis, corrective and preventive action, follow up and incident closure. Incidents related to waste management will be handled in accordance with the Corporate HSEC. Where appropriate, recommendations made through this system will be incorporated into the Caval Ridge WMP.

3.6.7 Commitments

- A register of all chemicals stored on the Caval Ridge Mine site will be maintained.
- The storage and handling of flammable and combustible liquids will be in accordance with AS 1940 – Storage and Handling of Flammable and Combustible Liquids.
- All regulated waste will be appropriately disposed of to a facility licensed to receive such wastes and, where required, be tracked.
- As part of the staff awareness and induction program, re-use and recycling will be encouraged.

3.6.8 Proposed Environmental Authority Conditions: Schedule E – Waste Management

Storage of tyres

(E1-1) Scrap tyres stored awaiting disposal or transport for take-back and recycling, or waste-to-energy options must be stored in stable stacks less than 3 m high, and at least 10 m from any other scrap tyre storage area, or combustible or flammable material, including vegetation.

(E1-2) All reasonable and practicable fire prevention measures must be implemented, including removal of grass and other materials within a 10 m radius of the scrap tyre storage area.

Disposal of tyres

(E3-1) Disposing of scrap tyres resulting from the authorised activities in spoil emplacements is acceptable, provided tyres are placed as deep in the spoil as reasonably practicable. A record must be kept of the number and location for tyres disposed

Waste Management

(E4-1) A Waste Management Plan, in accordance with the Environmental Protection (Waste Management) Policy 2000, must be implemented and must cover:

a) how the environmental authority holder will recognise and apply the waste management hierarchy;

b) identify characterisations of wastes generated from the project and general volume trends over the past 5 years;

d) waste commitments with auditable targets to reduce, reuse and recycle;

e) waste management control strategies including:

I. the type of wastes;
II. segregation of the wastes;
III. storage of the wastes;
IV. transport of the wastes;
V. monitoring and reporting matters concerning the waste;
VI. emergency response planning; and
VII. disposal, reused and recycling options;

f) identify the potential adverse and beneficial impacts of the wastes generated;

g) hazardous characteristics of the wastes generated including:

I. disposal procedures for hazardous wastes;
II. processes to be implemented to allow for continuous improvement of the waste management systems;
III. identification of responsible staff (positions) for implementing, managing and reporting the Waste Management Plan; and
IV. staff awareness and induction programs that encourage re-use and recycling.

(E4-2) Records of trade and regulated wastes or material leaving the mining lease for recycling or disposal, including the final destination and method of treatment, must be in accordance with the Environmental Protection (Waste Management) Policy 2000.

Other wastes

(E5-1) The only wastes (other than spoil, tyres, and coarse and fine dewatered coal rejects and tailings) that can be disposed of on site are construction and demolition waste.

END OF CONDITIONS FOR SCHEDULE E

3.7 Land Management

3.7.1 Background

Land Use

The project site and adjoining areas have historically and are currently used for cattle grazing, extractive industries (coal mining) and commercial uses. These land uses are consistent with the predominant land uses in Isaac Regional Council area. Grazing activities occur north of Cherwell Creek on partially cleared land of native and buffel grass pastures. The properties adjoining the project site are predominantly large rural holdings used for grazing cattle on freehold and leasehold land. One cottage and one homestead are located within the project site. Other land uses within the project site include a light industrial trucking workshop (the Kalari Workshop), bushland, 66 kV powerline, the Peak Downs Highway, farming infrastructure (access tracks, fences, stockyards and sheds), and a small quarry. These features are shown on Figure 3.7.1.

The town of Moranbah is located 6.2 km north of the most northern point of the project site. Moranbah is a purpose-built mining town in the northern part of the Isaac Regional Council Area, with a population of approximately 7,432 people (ABS 2007). The Isaac Regional Council was formed after the amalgamation of the Belyando, Broadsound and Nebo Shires in March 2008.

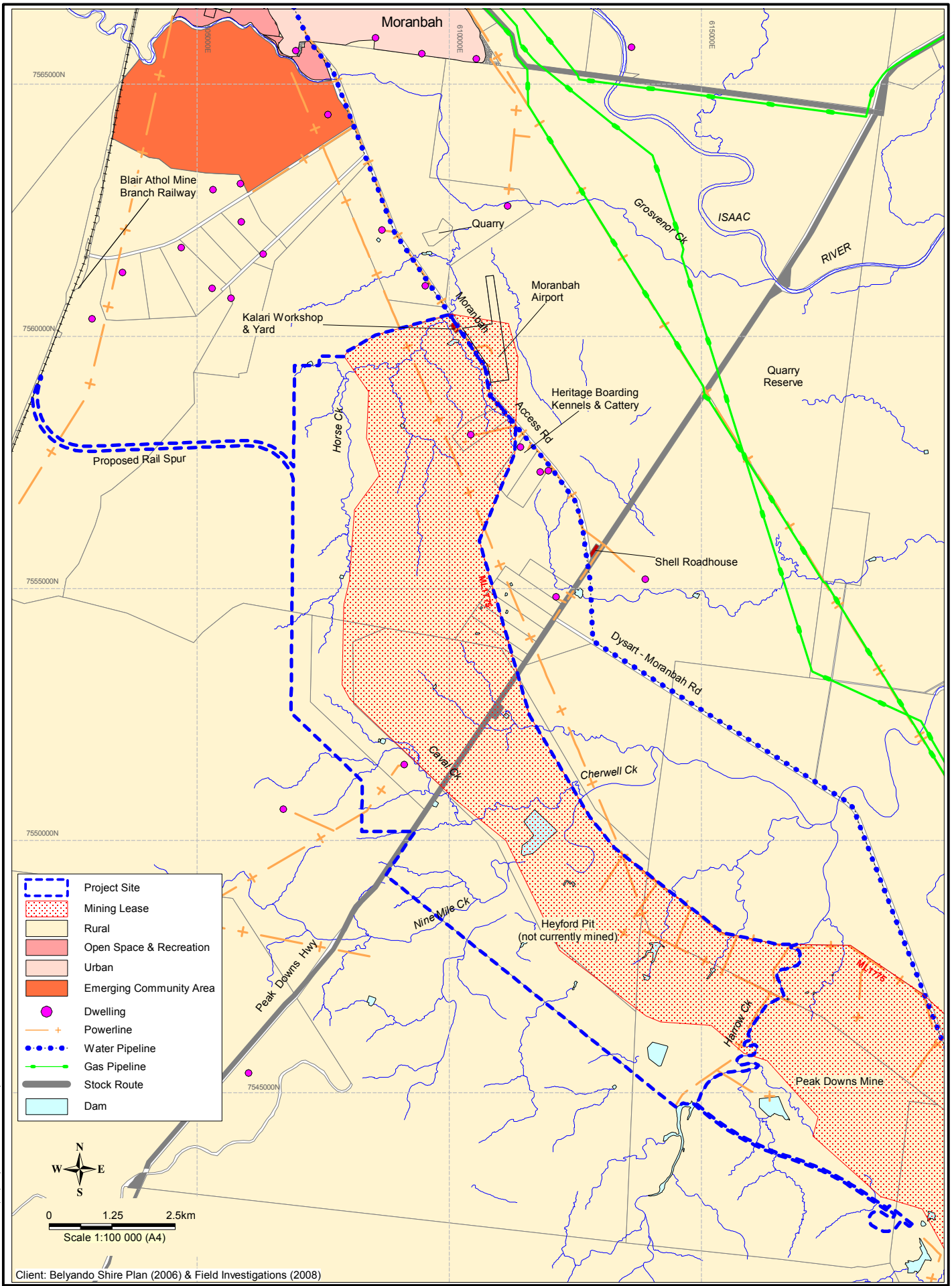
The draft Belyando Planning Scheme (local planning scheme) (October 2006) still applies in the area that was previously the Belyando Shire. The project site is zoned as rural under the planning scheme. The intent of this zone is to protect agricultural or grazing areas surrounding Moranbah from undesirable urban development and to ensure their retention for rural purposes. Within the rural zone, extractive industry (the definition that applies to the proposed project) is an appropriate land use where it is located and operated so as to ensure no unacceptable detrimental impact on surrounding uses or on the environment.

Soils

The following soil units were identified within the project site, as presented on Figure 3.7.2.

- Uniform Clays: This soil unit occurs on the undulating plains which include minor areas of linear gilgai. This soil unit generally consist of yellowish and reddish brown to light brownish and reddish yellow uniform clays which display little textural change down the profile. This soil unit is associated in the north-western areas of the project site and encompasses approximately 41% of the project site.
- Yellow Duplex Soils: This soil unit is associated with the floodplain areas, and encompasses some 10% of the project site. The soil is characterised by dark yellow sandy and clay loam of varying depths.
- Brigalow Clays: The soil unit occurs on the lowlands and plains (up to 1% slope). These areas contain melanhole and normal gilgai. The soil is characterised by brown light to medium clays throughout the profile. The unit encompasses some 6% of the project site
- Skeletal Soils: This soil unit is characterised by shallow reddish brown stony clay soils associated with the steeper eroded side slopes and ridgelines throughout the project site. The soil unit encompasses some 3% of the project site.
- Shallow Heavy Clays: Shallow dark cracking clays occur on undulating plains and low hills within the project site and encompasses some 9% of the project site.

- Dark Heavy Clays: The dark heavy clays consist of heavy dark uniform clays, with a fine mulched surface layer, Given that the unit is a uniform soil, very little textural change down the profile occurs. The soil unit represents 26% of the project site.
- Red Brown Duplex Soils, Shallow Sandy Soils and Deep Sandy Loams have also been identified in previous reports.



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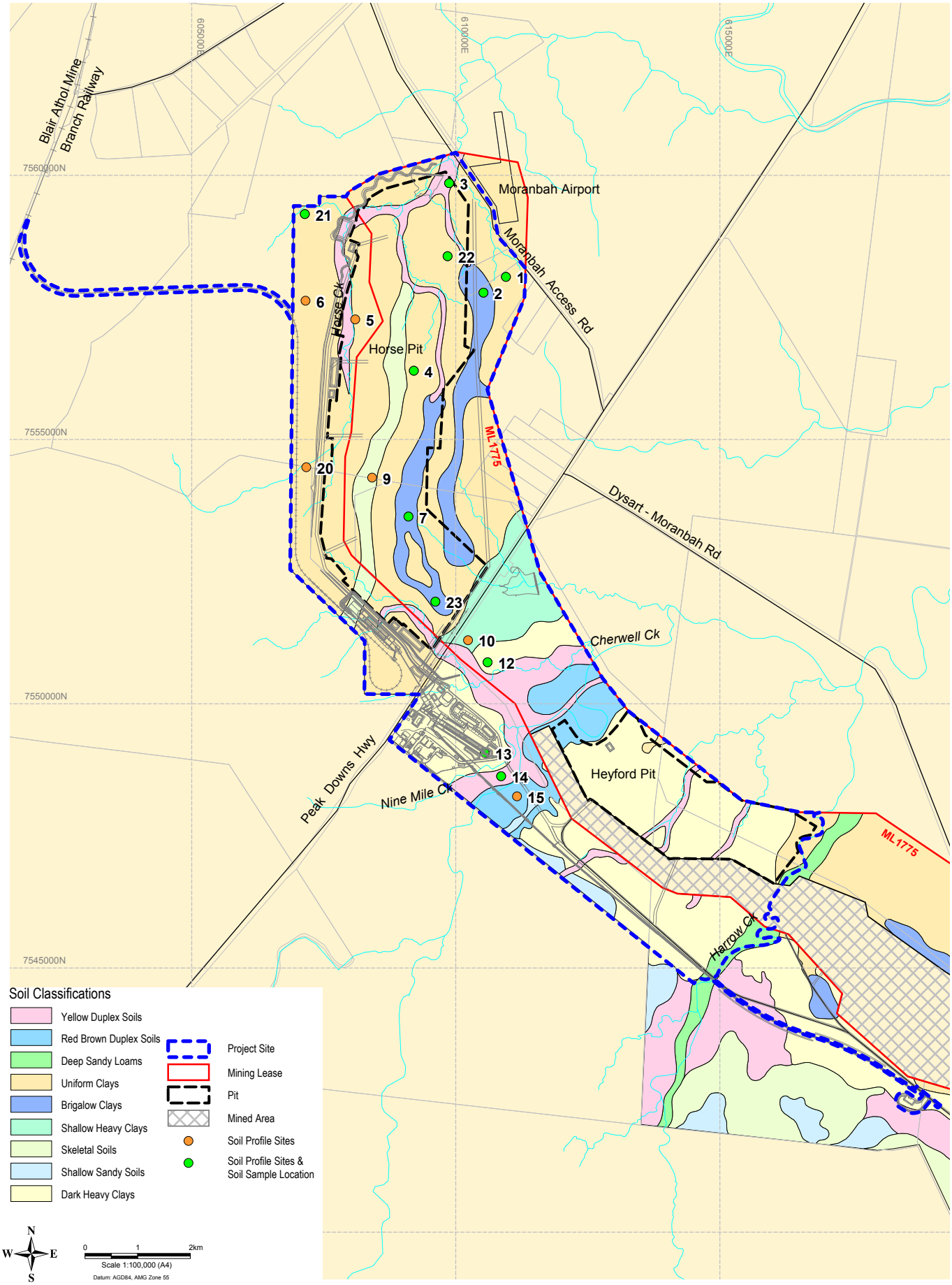
Client: BMA — BHP Billiton Mitsubishi Alliance

URS

Project: CAVAL RIDGE PROJECT
DRAFT ENVIRONMENTAL MANAGEMENT PLAN

Title: **EXISTING LOCAL LAND USE**

Drawn: VH	Approved: RS	Date: 30-10-2009	Figure: **3.7.1**	Rev:B
Job No: **4262 6420** /6158	File No: 42626158-g-2313.wor			**A4**



Source: DCDB Oct2008; 250th Geodata; Graham Tuck (May 2000) & GSS Environmental 2008

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Client: BHP Billiton Mitsubishi Alliance	Project: CAVAL RIDGE MINE DRAFT ENVIRONMENTAL MANAGEMENT PLAN		Title: **SOIL CLASSIFICATION AND SAMPLING LOCATIONS**
URS	Drawn: VH	Approved: RS	Date: 30-10-2009
	Job No: **4262 6420** /6158	File No: 42626158-g-2315.wor	Figure: **3.7.2**
			Rev:B **A4**

Land Capability and Suitability

Suitability

Agricultural land suitability of the project site was assessed using criteria provided in the Guidelines for agricultural land evaluation in Queensland (Queensland Department of Primary Industries, Land Resources Branch, 1990). The classification indicates the potential of the land for such uses as crop production, pasture improvement and grazing based on factors including soils, climate, and topography. The system allows for land to be allocated into five possible classes (with land suitability decreasing progressively from Class 1 to Class 5 based on severity of limitations) on the basis of a specified land use that allows optimum production with minimal degradation to the land resource in the long term.

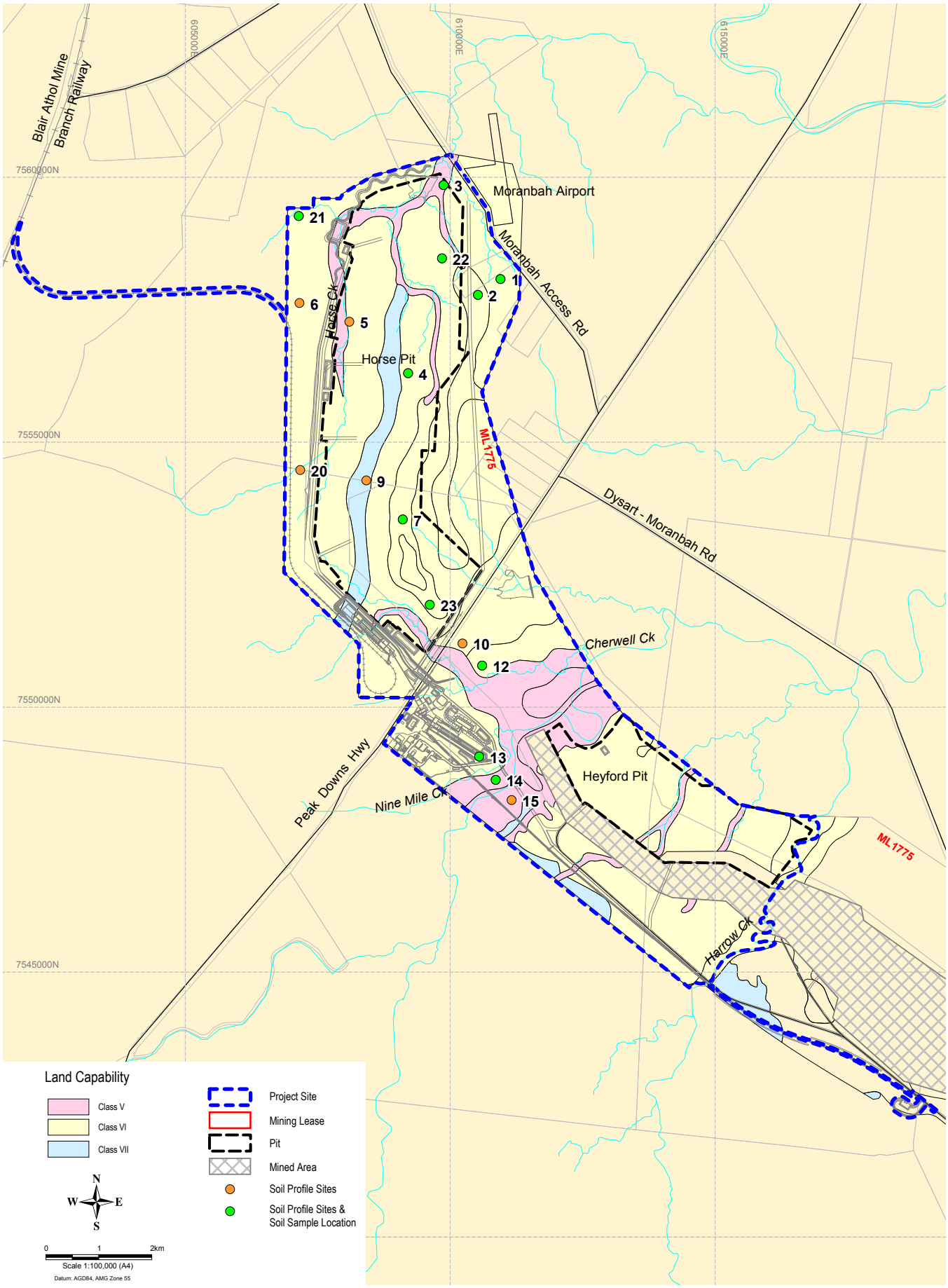
The project site is currently used for low intensity cattle grazing and has been extensively cleared of trees. The majority of land within the project site is Class 5 land, unsuitable for cropping. Some duplex soils in the vicinity of the north end of the existing Heyford Pit are Class 4 lands that are extremely marginal for cropping. This includes the well drained areas of flat to gently sloping duplex soils. The lands are Class 2 land with respect to grazing which is suitable for low intensity grazing, with minor limitations that lower production or require management practices. The remainder of the project site is Class 2 and 4 land with respect to grazing potential and is land that has either moderate limitations or is marginal grazing land.

Capability

The project site was assessed in accordance with Rosser et al (1974) for pre-mining land capability. The system comprises eight possible classifications and refers to the overall agricultural potential of the land. Classes I to IV are suitable for cultivation with increasing level of management input required, Classes V to VII are not suitable for cultivation with decreasing suitability for grazing, and Class VIII land is not suitable for grazing. The majority of the project site has a Class VI land capability – not suitable for cultivation and is moderately susceptible to degradation requiring proper management to sustain the land use. Some Class V land (high quality grazing land) occurs adjacent to Cherwell and Caval Creeks. The land surrounding Horse Creek and its tributaries and two smaller creeks in the southern section of the project site were identified as Class V land capability. The rocky hills and ridgelines, along with highly eroded soils and skeletal soils, are considered to be Class VII - land that is highly susceptible to degradation requiring severe restrictions for use. Grazing may be conducted with rigorous management inputs required to prevent degradation. The distribution of these land capability classes within the project site can be found in Figure 3.7.3, for the project site.

Good Quality Agricultural Land

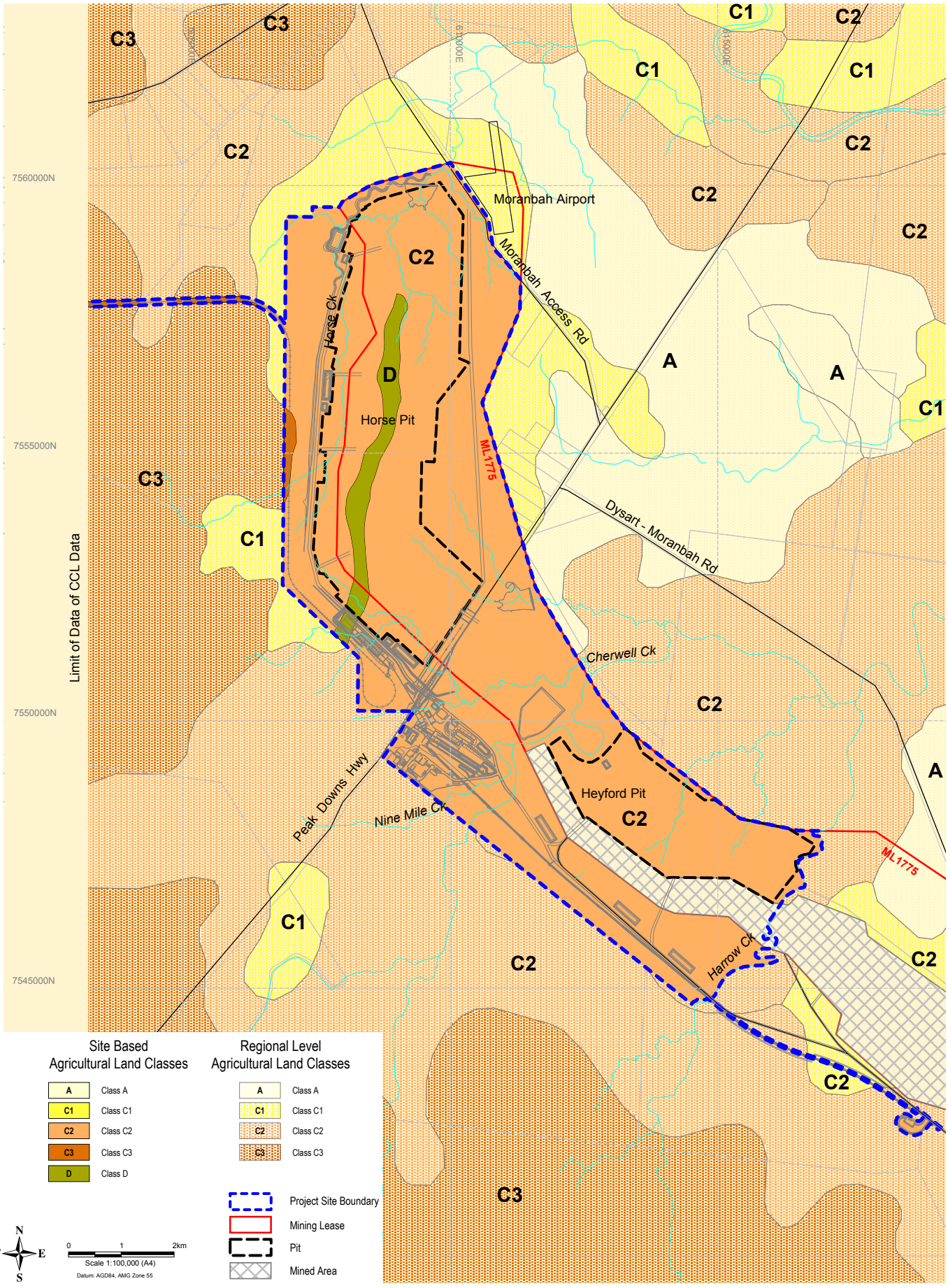
The project site and immediate surrounds, was assessed to identify potential Good Quality Agricultural Land (GQAL) (Qld DPI & DHLG&P, 1993). Agricultural land is defined as land used for crop or animal production, but excluding intensive animal uses (i.e. feedlots and piggeries). GQAL is land which is capable of sustainable use for agriculture, with a reasonable level of input, and without causing degradation of land or other natural resources. The categories of GQAL range from Class A (classified as crop land with no to moderate limitations) to Class D (land not suitable for agricultural uses due to extreme limitations). Based on site surveys, the project site is classed as C2 and D. Therefore there is no GQAL on the project site Figure 3.7.4 shows Good Quality Agricultural Land within the project site.



Source: DCDB Feb2009; 250th Geodata; Graham Tuck (May 2000) & GSS Environmental 2008

Client: BHP Billiton Mitsubishi Alliance	Project: CAVAL RIDGE PROJECT DRAFT ENVIRONMENTAL MANAGEMENT PLAN		Title: **LAND CAPABILITY**
URS	Drawn: VH	Approved: RS	Date: 30-10-2009
	Job No: **4262 6420** /6158	File No: 42626158-g-2326.wor	Figure: **3.7.3**
			Rev:B **A4**

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Source: Qld Dept. NRW, Land Resources & Evaluation of the Capricornia Coastal Lands (CCL), 31/12/1995.

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Client: BHP Billiton Mitsubishi Alliance (BMA)	Project: CAVAL RIDGE PROJECT DRAFT ENVIRONMENTAL MANAGEMENT PLAN		Title: **GOOD QUALITY AGRICULTURAL LAND**
URS	Drawn: VH	Approved: RS	Date: 30-10-2009
	Job No: **4262 6420** /6158	File No: 42626158-g-2327.wor	Figure: **3.7.4**
			Rev:B **A4**

Sensitive Environmental Areas

Land Subject to Treaty

There is no known land subject to treaties within or adjacent the project site.

International Treaties (Ramsar Convention, JAMBA, CAMBA, or Bonn Convention)

The Convention on Wetlands, signed in Ramsar, Iran, in 1971, is an intergovernmental treaty which provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources (Ramsar, 1996-2008).The nearest Ramsar Wetland is approximately 80 km north of Rockhampton (Shoalwater and Corio Bays) and approximately 250 km east of the project site. Although the project is within the same catchment of this wetland due to the nature of the project and the distance to Shoalwater and Corio Bays, it is unlikely that the project will have a significant impact on Ramsar Wetlands. The Japan-Australia Migratory Bird Agreement (JAMBA) and China-Australia Migratory Bird Agreement (CAMBA) agreements list terrestrial, water and shorebird species which migrate between Australia and the respective countries. In both cases the majority of listed species are shorebirds (EPA 2008). The Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA) formalises Australia's relationship with the Republic of Korea in respect to migratory bird conservation and provides a basis for collaboration on the protection of migratory shorebirds and their habitat (EPA 2008). The Convention on the Conservation of Migratory Species of Wild Animals (also known as CMS or Bonn Convention) came into force in 1983, Australia has been a party since 1 September 1991. The Bonn convention aims to conserve terrestrial, marine and avian migratory species throughout their range. Table 3.7.1 identifies species currently listed under the BONN Convention, JAMBA, CAMBA and ROKAMBA.

A search of the project site on the Commonwealth DEWHA matters of national environmental significance (NES) database identified a number of migratory bird species listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). In addition, the Queensland *Nature Conservation Act 1994* (NC Act) identifies some treaty species as threatened. These species as present on the project site are listed in Table 3.7.1.

Protected Estate, National Parks, Conservation Areas, Wilderness Areas or Scientific Reserve

An Ecomap search was carried out to identify any environmentally sensitive areas near the project site, as determined by the DERM. The DERM ecomap (refer Appendix K) indicates that there are no category A environmentally sensitive areas. Ecomapping indicates the presence of endangered regional ecosystems (“category B” environmentally sensitive areas) within and around the southern boundary of the project site (refer Section 3.8 below). The only National Parks, State Forests, reserves and conservation area within a 50 km radius of the project site is the Peak Range Area (place identification number 8886). The Peak Range National Park incorporates a number of conservation areas. This Area was registered on the Register of National Estate in 21/10/1980. A large quarry reserve is located to the east of the project site within the 50 km radius, another small quarry is located to the north-east of the project site.

Table 3.7.1 Species Listed under International Migratory Treaties

Genus Species	Common Name	BONN Convention	JAMBA	CAMBA	ROKAMBA	NC Act[1]	EPBC Act[2]
Nettapus coromandelianus	Cotton Pygmy-goose					R	M
Ephippiorhynchus asiaticus	Black-necked Stork					R	Not Listed
Ardea alba	Great Egret		x	x		S	M
Bubulcus ibis	Cattle Egret		x	x		S	M
Haliaeetus leucogaster	White-bellied Sea-Eagle			x		S	M
Rostratula australis	Australian Painted Snipe			x		V	V
Gallinago hardwickii	Latham's Snipe		x	x	X	S	M
Numenius minutes	Little Curlew		x	x	X	S	M
Tringa stagnatilis	Marsh Sandpiper	x	x	x	X	S	M
Actitis hypoleucos	Common Sandpiper	x	x	x	X	S	M
Calidris ruficollis	Red-necked Stint	x	x	x	X	S	M
Calidris acuminate	Sharp-tailed Sandpiper	x	x	x	X	S	M
Sterna caspia	Caspian Tern		x	x		S	M
Hirundapus caudacutus	White-throated Needletail		x	x	X	S	M
Apus pacificus	Fork-tailed Swift		x	x	X	S	M
Merops ornatus	Rainbow Bee-eater		x			S	M
Rhipidura rufifrons	Rufous Fantail	x				S	M
Monarcha melanopsis	Black-faced Monarch	x				S	M
Myiagra cyanoleuca	Satin Flycatcher	x				S	M
Acrocephalus australis	Australian Reed-Warbler	x				Not Lis-ted	Not Listed

N.B 1Qld NC Act: E = Endangered, V = Vulnerable, R = Rare, S = Special Least Concern (Migratory), CS = Least Concern (Culturally Significant), C = Least Concern wildlife.
2Commonwealth EPBC Act: E = Endangered, V = Vulnerable, M = Migratory Species

Declared Fish Habitats or Aquatic Reserves

A declared fish habitat area (FHA) is an area that is an area protected against physical disturbance from coastal development. Although the project site is not located within an FHA, the creeks that flow through the project site flow into the Isaac River. The Isaac Rover is a tributary of the Mackenzie River which forms the Fitzroy River. The Fitzroy River is a declared fish habitat.

Heritage, Historic or Cultural Areas or Items

The DEWHA online Australian heritage database (08 October 2008 - http://www.environment.gov.au/cgi-bin/ahdb/search.pl) was searched for Register of National Estates, Commonwealth Heritage List, National

Heritage List and World Heritage List within the Belyando local government area. No places were identified within a 50 km radius of the project site. Cultural heritage is discussed in Section 3.10 below.

An EPBC protected matters search was conducted for the project site and surrounds (11 July 2008). The search did not identify any world heritage properties or places within or adjacent the project site.

Contaminated Land

A contaminated land preliminary site investigation (PSI) was carried out at the project site to determine if any previous or current land uses have resulted in possible contamination issues. Activities identified as being likely to cause contamination are listed as notifiable activities under Schedule 2 of the *Environmental Protection Act 1994* (EP Act). It is a requirement of the EP Act that the DERM be informed of any area that has been utilised for a notifiable activity or contaminated by a hazardous contaminant. Notifiable activities under Schedule 2 of the EP Act include, but are not limited to, petroleum product or oil storage, cattle dips, landfills, abrasive blasting, chemical storage, mineral processing and disposal of mine wastes. The DERM maintains the EMR and CLR. Table 3.7.2 presents the results of searches performed on the EMR and CLR for lots within the project site.

Table 3.7.2 Results of EMR and CLR Register Searches

Lot	Plan	EMR listed	CLR Listed
16	SP163605	No	No
4	RP884695	No	No
13	SP151669	No	No
7	RP615467	No	No
8	RP615467	No	No
9	RP615467	No	No
10	RP615467	No	No
13	GV225	No	No
14	SP163605	No	No
14	GV116	Yes	No
18	GV135	Yes	No
4	SP174999	No	No
47	GV226	No	No
4	RP818135	No	No
5	SP135741.	No	No
4	RP616987	No	No
10	GV303	No	No
10	SP137499	Yes	No
1	RP616897	No	No

Environmental Management Register

The EMR is a land use planning and management register. It records properties that have been used for a notifiable activity (i.e. activities that may cause land contamination). The EMR provides information on historic and current land uses registered with the DERM. Generally, sites registered on the EMR pose a low

risk to human health and the environment. The listing of a site on the EMR does not automatically mean the land must be remediated or that the current land use must cease. The following lots are currently listed on the EMR:

- Lot 18/GV135 for the notifiable activity of Petroleum Product or Oil storage;
- Lot 14/GV116 for the notifiable activity of Petroleum Product or Oil storage; and
- Lot 10/SP137499 for the following notifiable activities:
  - Chemical Manufacture or Formulation;
  - Chemical Storage;
  - Explosives Production or Storage;
  - Waste storage Treatment or Disposal;
  - Petroleum product or Oil Storage; and
  - Mine Wastes.

Lot 18/GV135 is within the mining lease held by BMA. Various mobile petroleum storage activities take place at the project site, including mobile refuelling of plant and vehicles. There are no fixed locations for this activity, however, this is the likely reason for the registration. Lot 14/GV116 is listed for the notifiable activity of Petroleum Product or Oil Storage, however the location of this storage activity is unknown.

Lot 10/SP137499 is part of the operating Peak Downs Mine. The project site contains a very small part (15.53 ha) of the northern section of this lot, which is used for storage and formulation of explosives used at PDM, the coal rejects stockpile, and mechanical workshops for water pumps for the mine. The area affected by the project does not contain any of these activities and is located some distance from any infrastructure associated with these activities.

Contaminated Land Register

The CLR is a register of Risk sites. If it has been scientifically proven that a site is contaminated, the site is registered on the CLR and action is required to either remediate or manage the site to reduce the risk of potentially serious harm to the environment and human health. None of the lots forming part of the project site are currently listed on the CLR.

Mineral Wastes

Mineral waste is generated through mining in the form of overburden and interburden, and through coal processing as rejects and tailings. The total mined overburden and interburden volumes from the Horse and Heyford Pits combined are expected to approximate over 1,600 million bulk cubic metres (Mbcm) over a 30-year mine life (*i.e.* approximately 55 Mbcm per year). This equates to over 2,000 million tonnes (Mt) over the mine life based on an assumed overburden/interburden (sandstone/siltstone) excavated density of 1.3 to 1.4.

In addition to this coal reject material will be generated by the project and will comprise primarily coal seam roof and coal seam floor material from the P, Harrow and Dysart seams, and also ROM coal from Peak Downs Mine (PDM), which will be processed at Caval Ridge Mine. Approximately 161 Mt of coarse rejects and 54 Mt of fine rejects (215 Mt of rejects in total) are expected to be produced from the CHPP at Caval Ridge Mine over a 30-year life (*i.e.* about 7 Mtpa). Coarse rejects will comprise approximately 80% of the

total reject volume and the remainder will be fine dewatered tailings. Rejects (coarse and fine) will comprise in the order of 10% of all geological waste produced by the project.

Overburden and interburden will be predominantly disposed of into the mined Horse and Heyford Pits, behind the operating strip, however an out of pit overburden dump will be constructed along the western edge of the Horse Pit box-cut, between the box-cut and the haul road, for the first year of mining. This out-of-pit spoil will comprise approximately 28 Mbcm of overburden (less than 2% of the total) mined from the box-cut and will cover an area of approximately 340 ha.

The rejects materials from the CHPP will consist of coarse reject, spiral tailings and flotation tailings generated from Caval Ridge Northern and Southern ROMs. The rejects and tailings material will be analysed in the early stages of the project to determine their geochemical characteristics, specific disposal requirements, and implications for site rehabilitation. These materials will be managed as follows:

- Coarse rejects will be dewatered and discharged onto the CHPP rejects conveyor, which reports to the rejects bin;
- Fine reject from the spirals will be thickened and dewatered before being discharged onto the coarse rejects conveyor;
- The flotation tailings will also be thickened before reporting to belt press filters; and
- The solids discharged from the belt press filters (tailings paste) will be discharged onto the coarse rejects conveyor.

All rejects (coarse and dewatered tailings) from the CHPP (approximately 20% moisture) will be combined and truck-dumped into the Horse and Heyford Pits where they will be co-disposed with spoil material. It is planned that there will be no disposal of coal rejects or fine coal tailings outside of the pits; instead these wastes will be disposed of as dewatered solids within the in-pit spoil dumps.

3.7.2 Environmental Values

The environmental values of the land at the project site that are to be protected or enhanced are:

- The integrity of undisturbed land and ecosystems on the project site;
- The integrity of topsoil as a resource to be used in rehabilitation;
- The stability of disturbed land and ensuring it is non-polluting; and
- The suitability of land to support beneficial post mining land uses such as agriculture and native ecosystems.

3.7.3 Potential Impacts on Environmental Values

Site activities with potential to impact on the land environmental values are:

- Land disturbance (vegetation clearance, topsoil stripping, stockpile management) causing erosion and degradation of topsoil resources;
- Land disturbance resulting in a reduction in agricultural land capability and suitability, and capacity to support native ecosystems;
- Construction of spoil dumps and potential acid mine drainage generation;
- Construction of access tracks, haul roads and pits;
- Disposal of coarse and fine dewatered rejects and tailings;

- Creation of final voids; and
- Potential land contamination from the inadequate management of hazardous materials including fuels, oils and chemicals.

Land Use

The Caval Ridge Mine lease area is used for broad scale cattle grazing. Much of the area is either uncleared or partially cleared. No areas are suitable for forage or cash cropping uses. Post-mining, rehabilitation of the Caval Ridge Mine will return a stable landform capable of uses similar to those prior to disturbance. To achieve this, the nominated post-mine land use for the site is a mosaic of bushland and grassland. The mosaic will link remnant native vegetation where possible and will aim to return some conservation values (refer Section 3.7.5.2 below).

Soils

Topsoil Suitability

The major land disturbance at the project site will result from excavation of the open cut pit, placement of out-of-pit overburden dumps and haul road construction. Topsoil will be recovered in these areas of disturbance. Structural and textural properties of subsoils are the most significant limiting factors in determining depth of soil suitability for re-use, however, salinity levels, pH and dispersion potential are also limiting factors in some soils in the project site. Recommended topsoil stripping depths for each soil unit are provided in Section 3.7.5.1 below.

Erosion Potential

Some of the uniform clay sites have indicated a moderate erosion potential with Emerson Aggregate Test ratings of 2 to 3, which indicates a moderate potential for dispersion and surface hardsettingness. Once this material is disturbed, the potential for erosion may be increased. If this disturbance occurs within the vicinity of a drainage line, this could impact on the health of downstream watercourses, through an increase in the sediment load. These soils will not be disturbed without suitable erosion and sediment controls being implemented, including the construction of structural soil conservation works (e.g. contour, graded and diversion banks and drop structures together with sediment control basins). Cover crops and/or organic ameliorants will be used to reduce soil dispersion and surface crusting thereby reducing runoff and increasing infiltration which will subsequently reduce erosion and sedimentation.

Potential Acid Generating Material

The potential for acid generation from regolith material (topsoil and subsoil) within the project site is low. This does not include acid generation potential within the overburden material (consolidated bedrock below 2 to 3 m depth), which was not assessed during this survey. Acid Sulphate Soils (ASS), which are the main cause of acid generation within the soil mantle, are commonly found less than 5 m above sea level, particularly in low-lying coastal areas such as mangroves, salt marshes, floodplains, swamps, wetlands, estuaries, and brackish or tidal lakes. The project site is located within the Central Highlands region (which is located approximately 150 km from the coast at > 260 m AHD). There has been little history of acid generation from regolith material with this region.

Land Suitability

The proposed post-mining land use for the project site is expected to be low intensity grazing, with minor areas of native habitat. In terms of soil conservation and agricultural land suitability, the proposed post-mining land use of low density cattle grazing is considered achievable for those areas not subject to significant landscape modification (open cut pit and out-of-pit spoil dumps). In the areas impacted by significant landscape modification, agricultural suitability class may be altered. In areas where mining impacts land with a land suitability Class 2 or Class 3, a greater level of management will be required to prevent land degradation and change in suitability class.

In order to sustain the desired land use without degradation, it is important that the post-mining land only be used in accordance with the limits of the agricultural suitability class. Soil conservation practices such as stocking rate control and establishment or re-establishment of permanent pasture are recommended for areas of mining impact. The overriding principle is to maintain the most beneficial future use of land that can be sustained in view of the range of limiting factors. The proposed post-mining land must provide and sustain a sufficient bulk of nutritious forage in addition to the following management considerations:

- The ability to access and manage livestock;
- Flood free and relatively dry ground conditions;
- Adequate stock drinking water and shelter; and,
- Stock routes throughout the land.

Provided that environmental controls such as structural soil conservation works and appropriate revegetation are in place and operating properly during mine construction, operation and closure, there should be no adverse effects to the project site or the surrounding grazing land.

Sensitive Environmental Areas

There is no known land subject treaties within or adjacent the project site. Due to the nature of the project and the distance from the project to any of the protected estates, national parks, conservation areas, wilderness reserves or scientific areas, declared fish habitats, GBRWHA, RAMSAR wetland, it is unlikely that the project will have an impact on these areas.

Although migratory species that are listed under JAMBA, CAMBA, ROKAMBA and the BONN Convention are likely to be present on the project site there is little evidence to suggest that the site supports an 'ecologically significant' proportion of a population of these migratory species. Given their migratory habits, the ephemeral nature of important food and habitat resources and the extent of similar and comparable habitat throughout the range of these species, it is likely that the habitats on the project site would be utilised infrequently and on a transitory basis only (refer Section 3.8).

No National Estates, Commonwealth Heritage List, National Heritage List and World Heritage List were identified within a 50 km radius of the project. No sites, places or objects of significant cultural heritage significance were identified during recent investigations. It is unlikely that the project will have an impact on the non indigenous cultural heritage values of the area.

Contaminated Land

Inspections of the project site carried out in November/December 2007 and March 2008 identified several areas as having potential to be contaminated as follows (Figure 3.7.5):

- Potential soil/groundwater impact from an in-ground oily water tank and minor impacts from petroleum product spills at the Kalari Workshop Trucking Yards;
- Potential residual pesticide impact at the cattle yards on Lot 13/SP151669 (it is understood that in the 1990s DPI issued a remediation order to have the top 300 to 500 mm of soil excavated and disposed of, and clean fill be laid. The excavated soil is believed to have been stockpiled elsewhere on Lot 12 on SP151669 (Buffel Park), which is located outside the project site);
- Potential lead residues in the soil at the rifle range site in the centre of the Horse Creek property;
- Potential soils impact as a result of chemical storage at the occupied homesteads;
- Potential contamination associated with petroleum product or oil storage on Lot 14/GV116 (exact location unknown);
- Potential soil contamination from leaks and spills of mobile transformer lubricants, winding oils and fuels on the operating Peak Downs Mine; and
- Potential soil contamination from fuels storage and transfer at mobile fuel tanks on Peak Downs Mine (including Lot 18/GV135).

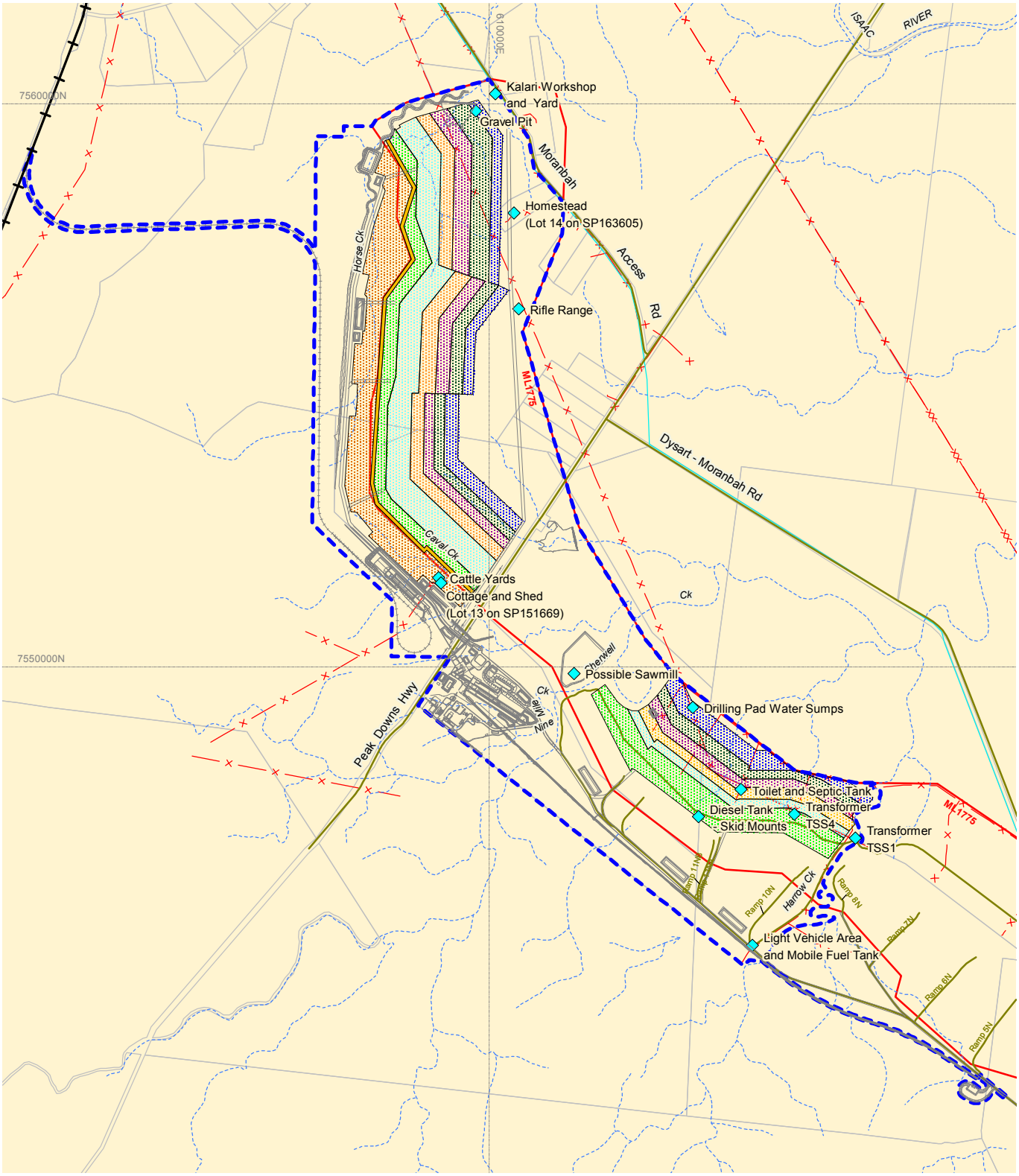
The various areas investigated (with the exception of the homestead, rifle range, and sawmill sites), are within the project footprint. A protocol will be developed to further assess (and manage as required) these areas. These assessments will include site inspections as deemed necessary and possible soil testing where required.

Mineral Wastes

Coal is deposited within environments that typically have a high potential to produce sulphides within the sediments. The mining of coal and removal of the overburden and interburden can result in the oxidation of the sulphides upon exposure to air and water, generating sulphuric acid. The resulting mine drainage is characterised by highly acidic waters with elevated metal and sulphate concentrations. Geochemical assessment is used to determine whether the spoil contains sulphides and whether they will potentially form acidic conditions, if oxidised. Mineral wastes generated by the project have the potential to impact on the identified land environmental values, depending on the characteristics of the material and methods of disposal employed.

Acid Generating Potential

Geochemical static-test data collected from seven drill holes at the project site (Figure 3.7.6) indicate that all overburden/interburden and almost all potential rejects tested are clearly non acid forming (NAF). In addition, the total sulphur contents of these materials was very low, with 29 of the 31 overburden and interburden samples having total sulphur concentrations ≤0.1% and therefore classed as barren. Similarly for the reject samples, where the average and median total sulphur concentrations for the 43 samples tests were 0.1% and 0.06%, respectively. One coal-seam roof sample from the P08 seam was classified as potentially acid forming (PAF), indicating the some fine-grained sulphide mineral is likely to be present in some materials, most likely the roof and floor (potential reject) materials, but the proportions of such PAF materials are expected to be very low.



Source: DCDB Feb2009; Client Supplied Data

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Client: BHP Billiton Mitsubishi Alliance

Project: CAVAL RIDGE MINE
DRAFT ENVIRONMENTAL MANAGEMENT PLAN

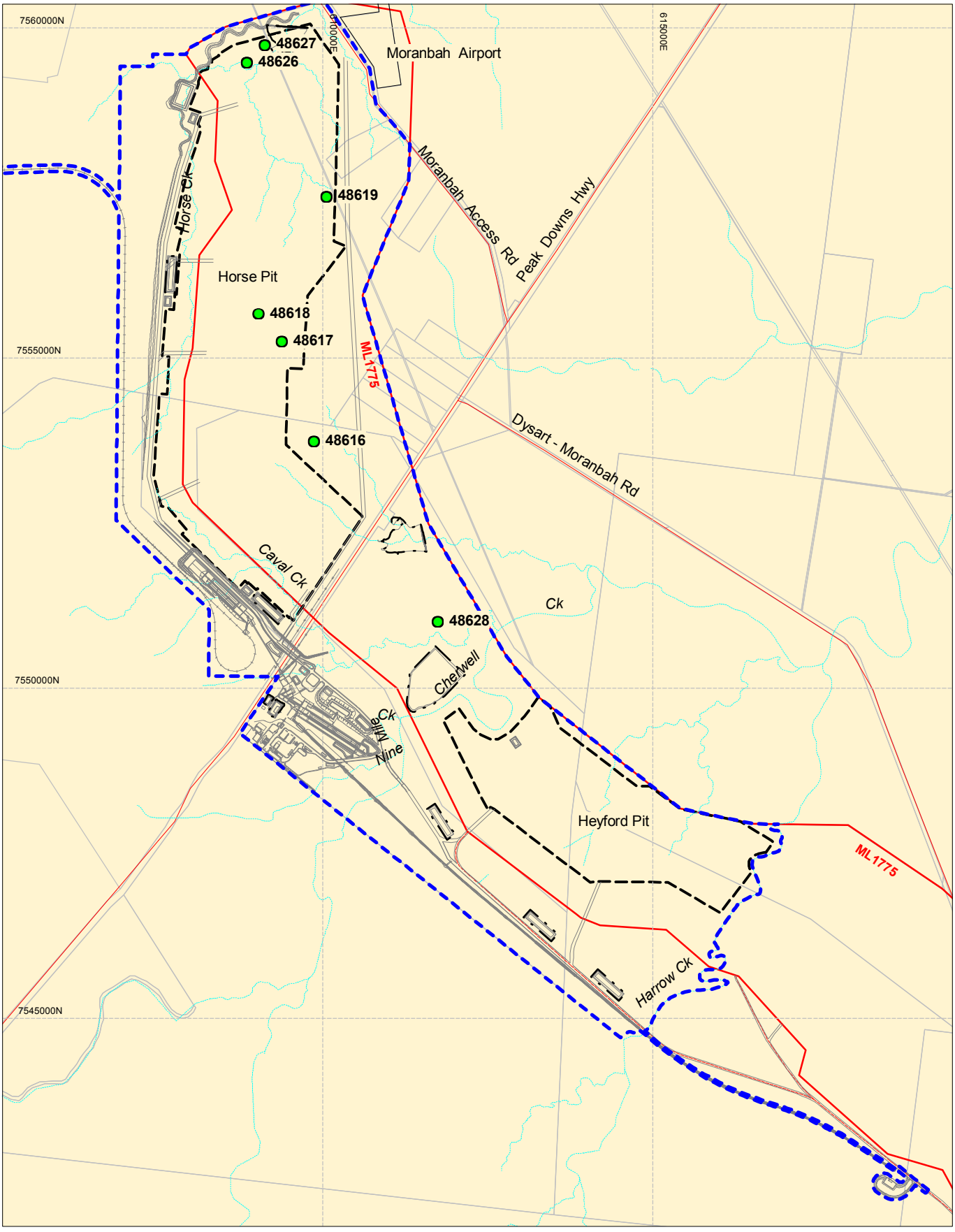
Title: **POTENTIAL CONTAMINATION LOCATIONS AFFECTED BY MINING PLAN**

Drawn: VH	Approved: RS	Date: 30-10-2009
Job No: **4262 6420** /6158	File No: 42626158-g-2317.wor	

Figure: **3.7.5**

Rev:B

A4



Source: Client Supplied Data (November 2007)

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Client: BHP Billiton Mitsubishi Alliance (BMA)	Project: CAVAL RIDGE MINE DRAFT ENVIRONMENTAL MANAGEMENT PLAN	Title: **DRILL HOLE LOCATIONS FOR GEOCHEMICAL SAMPLES**
URS	Drawn: VH | Approved: RS | Date: 30-10-2009 Job No: **4262 6420** /6158 | File No: 42626158-g-2318.wor	Figure: **3.7.6** | Rev:B | **A4**

From an acid-base perspective almost all materials are NAF, but the high acid neutralising capacity (ANC) of many of the samples combined with the very low sulphur concentrations, indicates there will be excess alkalinity to buffer the small quantity of acid that may potentially be produced by a very small proportion of the likely mineral waste materials. As a general rule, an ANC to maximum potential acidity (MPA) ratio of two or more generally signifies that there is a high probability that the material will remain circum-neutral in pH and thereby should not be problematic with respect to acid rock drainage. The median ANC/MPA ratio for the project samples tested was 31. Geochemical analysis indicates that rejects from PDM coal to be processed and disposed at the project are not expected to generate acid.

Multi-Element Composition and Water Quality

Composite overburden and potential reject samples were tested for total and water-soluble metals concentrations. Only total manganese (Mn) was present in solids in concentrations that exceeded the applied Draft Queensland Guidelines for the Assessment and Management of Contaminated Land (1998), but still well within the National Environment Protection Council (NEPC) (1999a) health-based investigation level (HIL) guidelines. Despite this, the water extracts from all composite samples (evaluated for the immediate solubility of multi-elements in solids) had soluble metal concentrations below applied ANZECC (2000) values for livestock drinking water and below NEPC (1999b) groundwater investigation levels.

Although soluble metals concentrations were low, the electrical conductivity (EC) of the materials was moderate to high, ranging from 388 to 1,970 µS/cm (median 679 µS/cm), and was similar for both overburden and potential rejects. These results indicated that metals concentrations in overburden and potential reject materials was low and that the initial water solubility of these materials with respect to metals in mineral waste materials from the project was also low, but the materials may contribute some salt load to the surrounding environment.

The multi-element analyses undertaken by URS (2002) on coarse rejects and tailings from PDM indicates that rejects from PDM coal to be processed and disposed at the project site are not expected to cause environmental issues with respect to metal and salt concentrations in leachate.

Potential for Use of Overburden Materials in Rehabilitation

It is proposed that rejects and almost all overburden materials will be disposed of together back into the void behind the mining (stripping) face in Horse and Heyford Pits. Some quantity of overburden materials will be set aside for rehabilitation of the spoil, as rejects will not be permitted to report to final surfaces. Also, a small proportion of overburden (<2% of the overall total) will be disposed into an out of pit dump along the western edge of the Horse Pit box-cut.

All of the tested overburden composite materials (and also the potential reject materials) had variously elevated Exchangeable Sodium Percentage (ESP) values, ranging from 8.5% to 25% (median 11%). An ESP value of between 6% and 14% indicates that these materials are regarded as marginally sodic to sodic and may be prone to dispersion (Isbell, 2002). Sodic material will be disposed of away from the final landform surfaces where possible. Any marginally sodic or sodic material to be disposed on at the surface of landforms (e.g. as a growth medium) will be treated appropriately.

Sodic soils often have unbalanced nutrient ratios that can lead to macro-nutrient deficiencies (Hazelton and Murphy, 2007). Table 3.7.3 shows the proportions of each exchangeable cation relative to the effective

cation exchange capacity (eCEC). The desirable proportions of each major cation are also shown (Abbott, 1989, *in* Hazelton and Murphy, 2007). Exchangeable cation proportions in the overburden and potential rejects were outside the average ranges, but were not extreme. The exchangeable proportions of the alkali metals Na and K are high, which supports the naturally alkaline nature of most mineral waste materials. Exchangeable Ca and exchangeable Mg proportions are marginally imbalanced, but were generally acceptable. Exchangeable Ca:Mg ratios less than two typically require some form of amelioration before these materials can be used as a growth layer. The overburden materials have a median exchangeable Ca:Mg ratio of 2.7, whereas the potential reject materials have a median exchangeable Ca:Mg ratio of 1.6, indicating that amelioration of overburden materials for use as a growth layer may not be required.

Table 3.7.3 Proportions of eCEC of major exchangeable cations

Exchangeable Cation	Desirable ranges	Overburden	Potential Rejects
	% eCEC		
Calcium (Ca)	65 - 80	26 – 65 (average 53)	29 – 65 (average 50)
Magnesium (Mg)	10 - 15	15 – 35 (average 24)	14 – 34 (average 25)
Potassium (K)	1 - 5	3 – 20 (average 11)	10 – 25 (average 14)
Sodium (Na)	0 - 1	9 – 25 (average 13)	9 – 15 (average 12)

In soil chemistry a pH 1:5 (solid:water w/v) of between 7.9 and 8.4 is regarded as moderately alkaline and a soil pH 1:5 of between 8.5 and 9.0 is regarded as strongly alkaline. Of the overburden samples, 58% were regarded as moderately alkaline and 29% were regarded as strongly alkaline. Comparatively, 77% of the potential reject samples were regarded as moderately alkaline and 16% were regarded as strongly alkaline. Therefore some degree of nutrient imbalance is likely to already exist in these materials, despite exchangeable Ca:Mg ratios in these materials being generally acceptable.

3.7.4 Environmental Protection Objective

The objectives to protect the environmental values of the mined land are:

- To provide a stable, non-polluting landform;
  - Land disturbed by mining activities will be made stable (geotechnically and erosionally) to ensure that the post mine landform are not compromised by instability.
- To provide a beneficial post mining land use;
  - The post-mine land uses for areas disturbed by mining will be a mosaic of self sustaining vegetation communities and grazing land, using appropriate native tree, shrub and grass species, and improved pasture species as appropriate.
- To minimise the extent and degree of disturbance on land and remnant vegetation as mining continues and will continue to rehabilitate land disturbed by mining;
- To maximise the recovery and reuse of topsoil;
- To minimise land contamination and to continue to remediate areas of contamination, as appropriate within the constraints of the continuing operations; and

- To minimise pre-mining disturbance and to continue to rehabilitate exploration areas

3.7.5 Performance Criteria

The performance criteria for land management are:

- Compliance with the requirements of the project's environmental authority.
- No off site impacts from acid rock drainage.
- Stable landforms once rehabilitated with no visible rill or gully erosion.

3.7.6 Control Strategies

Soils

The strategies discussed below will be implemented to minimise and manage potential impacts on soils at the project site, along with other control strategies to be implemented as part of rehabilitation and decommissioning of the site (refer Section 3.7.5.2). A topsoil management plan will be maintained and regularly updated. This will include:

- All relevant aspects for topsoil retrieval such as striping, stockpiling and re-spreading procedures, stockpile locations and inventory;
- Topsoil stripping quantities formulated from pre-mining soil survey information; and
- Stripping and stockpile methodology.

Topsoil Stripping, Handling and Respreading

Where topsoil stripping and transportation is required, the following topsoil handling techniques will be implemented to prevent excessive soil deterioration:

- Strip material to the depths stated in Table 3.7.4 and shown in Figure 3.7.7, subject to further investigation as required;
- Topsoil will be maintained in a slightly moist condition during stripping. Material will not be stripped in either an excessively dry or wet condition;
- Marker pegs will be used to indicate required stripping depth in the uniform clays (brown clays and dark clays), especially where over-stripping may expose potentially dispersive subsoils;
- Place stripped material directly onto reshaped overburden and spread immediately (if mining sequences, equipment scheduling and weather conditions permit) to avoid the requirement for stockpiling;
- Grade or push soil into windrows with graders or dozers for later collection by elevating scrapers, or for loading into rear dump trucks by front-end loaders, to minimises compression effects of the heavy equipment that is often necessary for economical transport of soil material;
- Soil transported by dump trucks may be placed directly into storage. Soil transported by bottom dumping scrapers is best pushed to form stockpiles by other equipment (e.g. dozer) to avoid tracking over previously laid soil;
- The surface of soil stockpiles will be left in as coarsely textured a condition as possible in order to promote infiltration and minimise erosion until vegetation is established and to prevent anaerobic zones forming;

- Maintain a maximum stockpile height of 3 m. Clayey soils, such as the brown clay topsoil, will be stored in lower stockpiles for shorter periods of time (i.e. less than 12 months) compared to sandier soils, selected from the alluvial soils;
- If long-term stockpiling is planned (i.e. greater than 12 months), seed and fertilise stockpiles as soon as possible. An annual cover crop species that produce sterile florets or seeds will be sown. A rapid growing and healthy annual pasture sward provides sufficient competition to minimise the emergence of undesirable weed species. The annual pasture species will not persist in the rehabilitation areas but will provide sufficient competition for emerging weed species and enhance the desirable micro-organism activity in the soil; and
- An inventory of available suitable surface cover material will be maintained to ensure adequate topsoil materials are available for planned rehabilitation activities.

Table 3.7.4 Soil Stripping Depths for Soil Types

Soil Unit	Recommended Stripping Depth (cm)
Uniform Clays	15
Yellow Duplex Soils	40
Brigalow Clays	15
Skeletal Soils	Not recommended for stripping
Shallow Heavy Clays *	10
Dark Heavy Clays *	10
Shallow Sandy Soils	25
Red Brown Duplex Soils	50
Deep Sandy Loams	45

N.B.* High clay content material may benefit from mixing with a sandy textured material for use in rehabilitation

Sampling and analysis of topsoil resources for pH, conductivity, exchangeable Na% and nutrient requirements, whether stockpiled or *in situ*, will be undertaken prior to respreading to assess suitability (Table 3.7.5). This will assist in identifying potential soil deficiencies and estimating required rates of fertiliser or ameliorant (i.e. gypsum or lime) application.

Table 3.7.5 Soil Suitability Criteria

Structure	30% peds present coherent when wet or dry no mottle present
Texture	finer than sandy loam sand and gravel content < 60%
Dispersion	EAT > 2 (2) exchangeable Na% < 12%
pH	> 4.5 & < 8.4
Conductivity	< 1.5 dS/m

Not all reshaped overburden areas will require topdressing using conserved topsoil reserves when direct tree

seeding techniques are implemented in the revegetation program. Where possible, suitable topsoil will be re-spread directly onto reshaped areas. Where topsoil resources allow, topsoil will be spread to a minimum depth of 10 cm on all regraded spoil. Topsoil will be spread, treated with fertilizer or ameliorants (if required) and seeded in one consecutive operation, to reduce the potential for topsoil loss to wind and water erosion. Prior to re-spreading stockpiled topsoil onto reshaped overburden (particularly onto designated tree seeding areas), an assessment of weed infestation on stockpiles will be undertaken to determine if individual stockpiles require herbicide application and/or scalping of weed species prior to topsoil spreading.

Post Disturbance Regrading

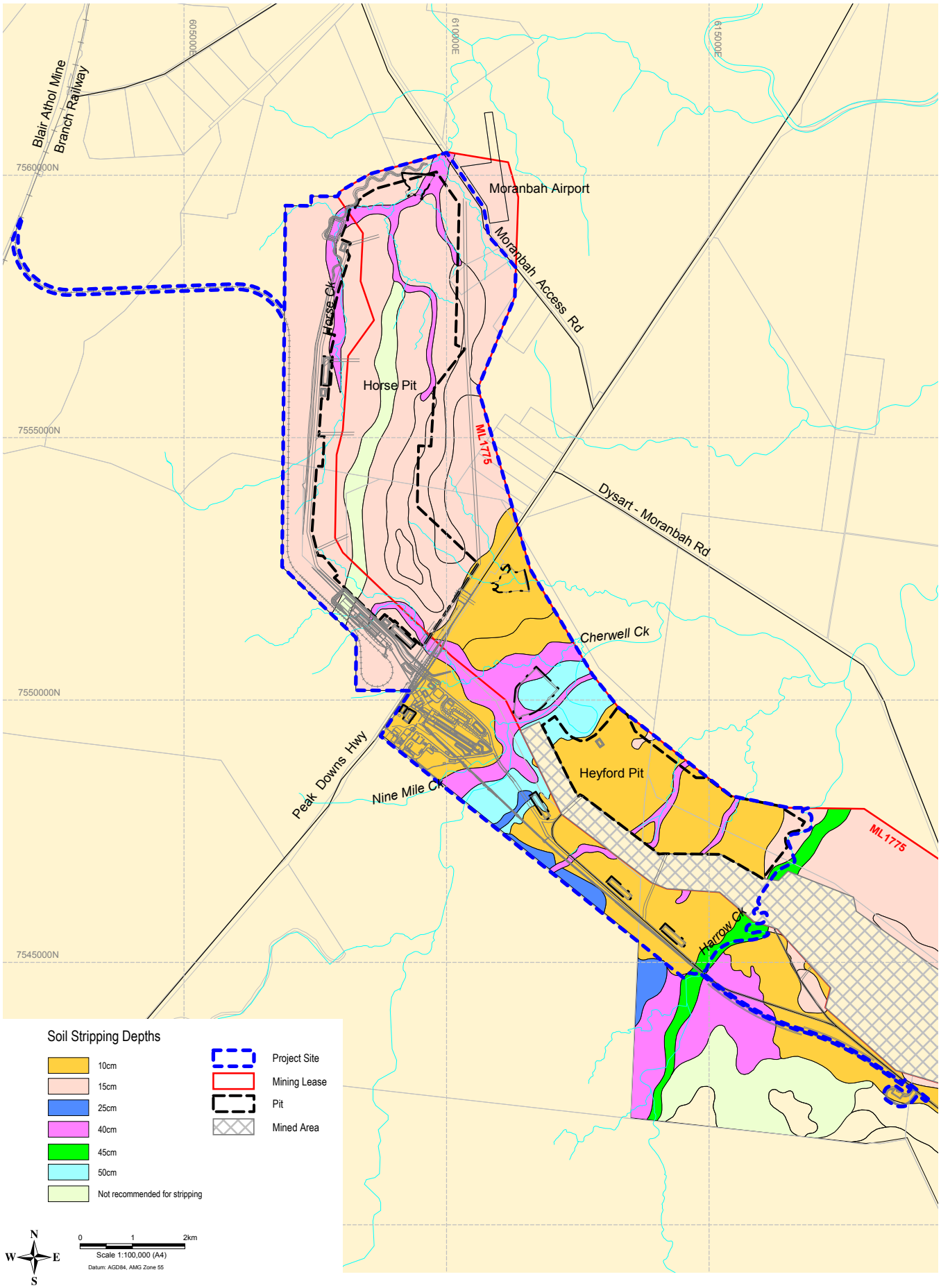
Regrading will be undertaken to produce slope angles, lengths and shapes that are compatible with the proposed post-mine land use and not prone to an unacceptable rate of erosion. A drainage system will be installed that is capable of conveying runoff from the newly created catchments whilst minimising the risk of erosion and sedimentation. Contour furrows or contour banks will be constructed at intervals down the slope to divide long slopes into a series of short slopes with the catchment area commencing at each bank or furrow. This will prevent runoff from reaching a depth of flow or velocity that would cause erosion. As the slope angle increases, the banks or furrows will be spaced closer together until a point is reached where they are no longer effective.

Contour ripping across the grade (to minimise erosion and cultivate the surface in readiness for sowing) will be constructed away from the true contour, at a designed gradient (0.5% to 1%) to drain water towards the sediment control structures. The use of engineered waterways using erosion blankets, ground-cover vegetation and/or rip rap will be used to safely dispose of runoff downslope. Sediment control basins will be constructed to capture sediment laden runoff prior to off-site release. The following points will be considered when selecting sites for sediment control basins:

- Each dam will be located so that runoff may easily be directed to it, without the need for extensive channel excavation or for excessive channel gradient. Channels must be able to discharge into the dam without risk of erosion. Spillways must be designed and located so as to safely convey the maximum anticipated discharge;
- The material from which the dam is constructed must be stable. Dispersive clays, such as the subsoils of the dark clays, will require treatment with lime, gypsum and/or bentonite to prevent failure of the wall by tunnel erosion. Basins will be well sealed, as leakage may lead to instability, as well as allowing less control over the storage and release of water; and
- The number and capacity of basins will be related to the total area of catchment and the anticipated volume of runoff.

Seedbed Preparation

Thorough seedbed preparation will be undertaken to ensure optimum establishment and growth of vegetation. All topsoiled areas should be contour ripped (after topsoil spreading) to create a “key” between the soil and the spoil. Ripping should be undertaken on the contour and the tynes lifted for approximately 2 m every 200 m to reduce the potential for channelised erosion. Ripping will be undertaken when soil is moist and immediately prior to sowing where possible. The respread topsoil surface will be scarified prior to, or during seeding, to reduce run-off and increase infiltration. This can be undertaken by contour tilling with a fine-tyned plough or disc harrow.



Source: DCDB Feb2009; 250th Geodata; Graham Tuck (May 2000) & GSS Environmental 2008

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Client: BMA / BHP Billiton Mitsubishi Alliance	Project: CAVAL RIDGE MINE DRAFT ENVIRONMENTAL MANAGEMENT PLAN	Title: **RECOMMENDED SOIL STRIPPING DEPTHS**
URS	Drawn: VH · Approved: RS · Date: 30-10-2009 Job No: **4262 6420** /6158 · File No: 42626158-g-2319.wor	Figure: **3.7.7** · Rev:B · **A4**

Rehabilitation and Decommissioning

Objectives

The objectives of rehabilitating disturbed land that will result from the project comprise:

- Achievement of acceptable post-disturbance land use suitability – Mining and rehabilitation will aim to create a stable landform with land use capability and/or suitability similar to that prior to disturbance, unless other beneficial land uses are pre-determined and agreed. This will be achieved by setting clear rehabilitation success criteria and outlining the monitoring requirements that assess whether or not these criteria are being accomplished;
- Creation of stable post-disturbance landform - Mine wastes and disturbed land will be rehabilitated to a condition that is self-sustaining, or to a condition where maintenance requirements are consistent with an agreed post-mining land use; and
- Preservation of downstream water quality – Surface and ground waters that leave the mining leases should not be degraded to a significant extent. Current and future water quality should be maintained at levels that are acceptable for users downstream of the site.

Rehabilitation Strategy

All areas significantly disturbed by mining activities will be rehabilitated to a stable landform with a self-sustaining vegetation cover. Rehabilitation of disturbed land will generally proceed within two years of the areas becoming available for rehabilitation. In some situations, progressive rehabilitation may not be possible because the area may be effectively integrated with areas nearby that are unavailable for rehabilitation. To achieve the objectives above, rehabilitation will be conducted so that:

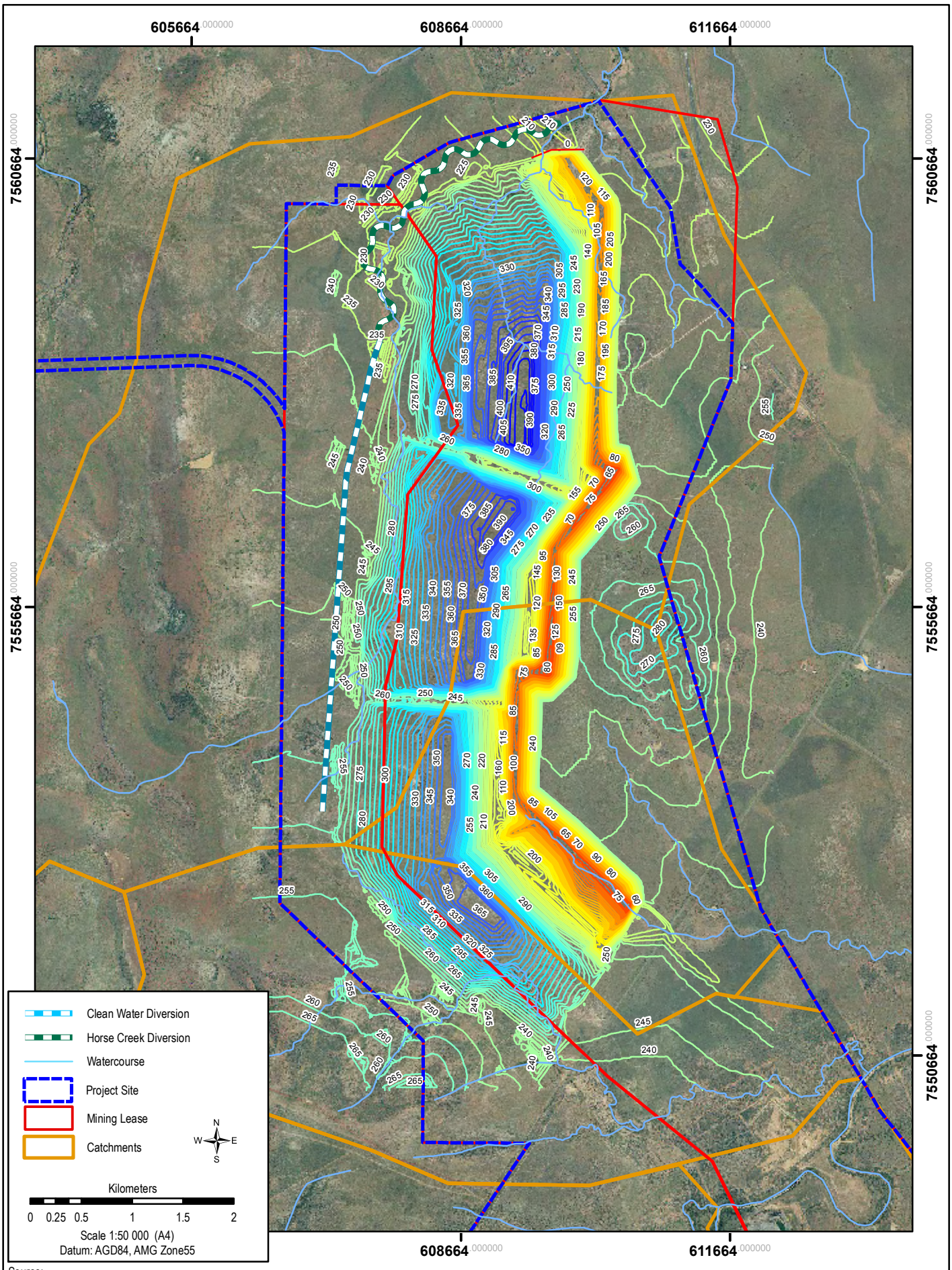
- Suitable species of vegetation are planted and established to achieve the relevant grassland and bushland post-mine land uses;
- Wherever practicable landscaping and rehabilitation works will include endemic native species of local provenance, and if suitable will also make use of conservation significant flora species or species that can provide habitat opportunities for conservation significant fauna
- Potential for erosion is minimised, including likelihood of environmental impacts being caused by the release of dust;
- The quality of surface water and seepage released from the site is such that releases of contaminants are not likely to cause environmental harm;
- The water quality of any residual water bodies meets criteria for subsequent uses and does not have the potential to cause environmental harm; and
- The final landform is stable and not subject to slumping or erosion which will result in the agreed post-mining landform being maintained.

A Rehabilitation Management Plan will be developed to incorporate the control strategies and monitoring programs identified in Section 3.7.5 to 3.7.7 of this EM Plan.

Landform Design and Planning

Rehabilitation planning at the project will ensure the total area of disturbance at any one time is minimised to reduce the potential for wind-blown dust, visual impacts and increased sediment-laden run-off. Rehabilitation will be designed to achieve a stable final landform compatible with the surrounding environment. This will involve the reshaping, using large dozers, of the majority of overburden emplacement

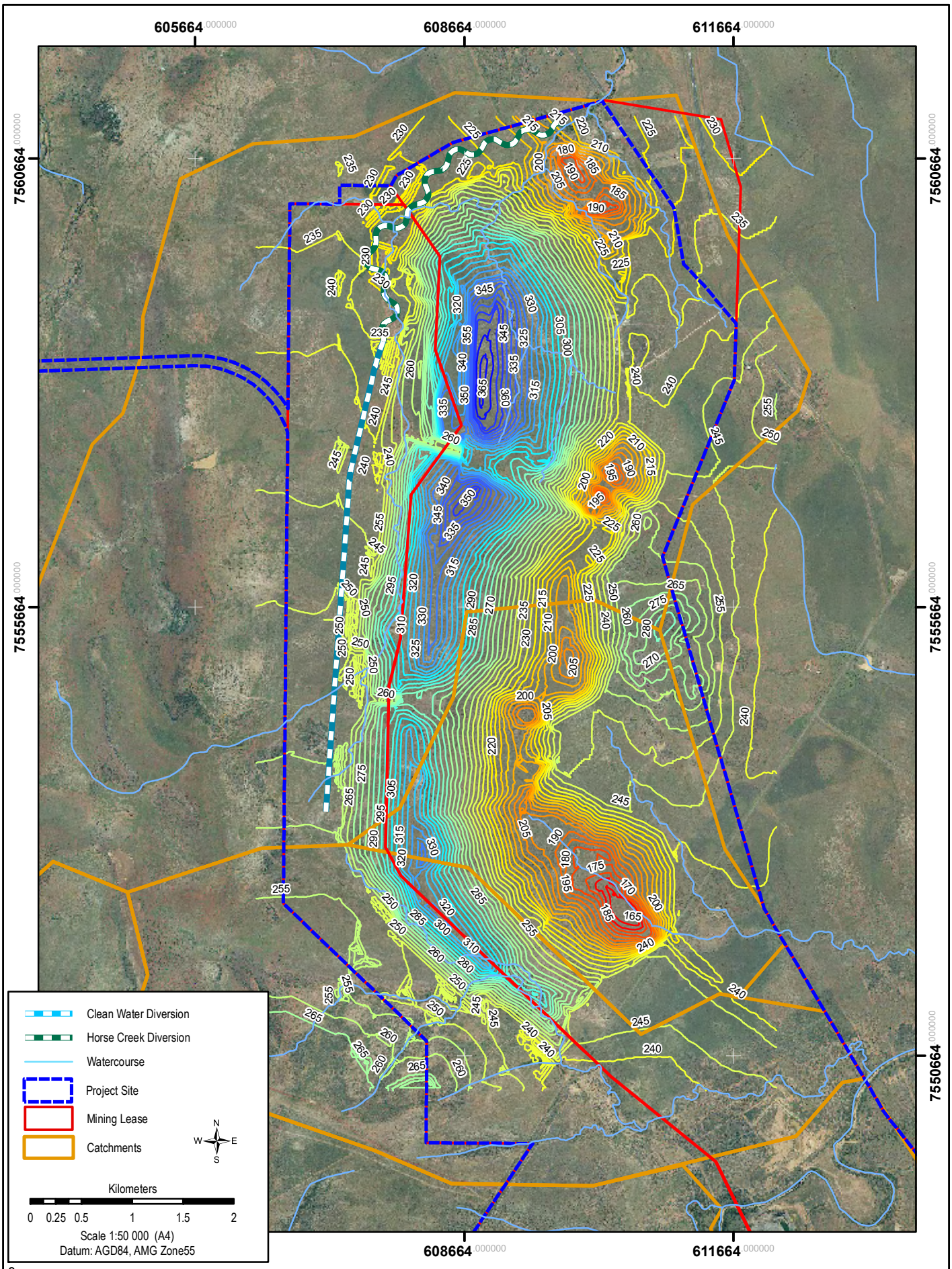
slopes to 10 degrees or less. Should slopes exceed 10 degrees, additional drainage and revegetation works will be carried out to ensure erosion / sediment control and groundcover establishment is achieved. Natural re-contouring will be incorporated in rehabilitation design and construction wherever possible and treed vegetation along the toe of rehabilitation areas will not be cleared unless an unacceptable safety or erosion risk remains. Waterways and diversions on the project site will be rehabilitated to a post-mining standard to include a diverse riparian vegetative community of native trees, shrubs and grasses. The conceptual final landform contour is illustrated on Figure 3.7.8a to Figure 3.7.8c..



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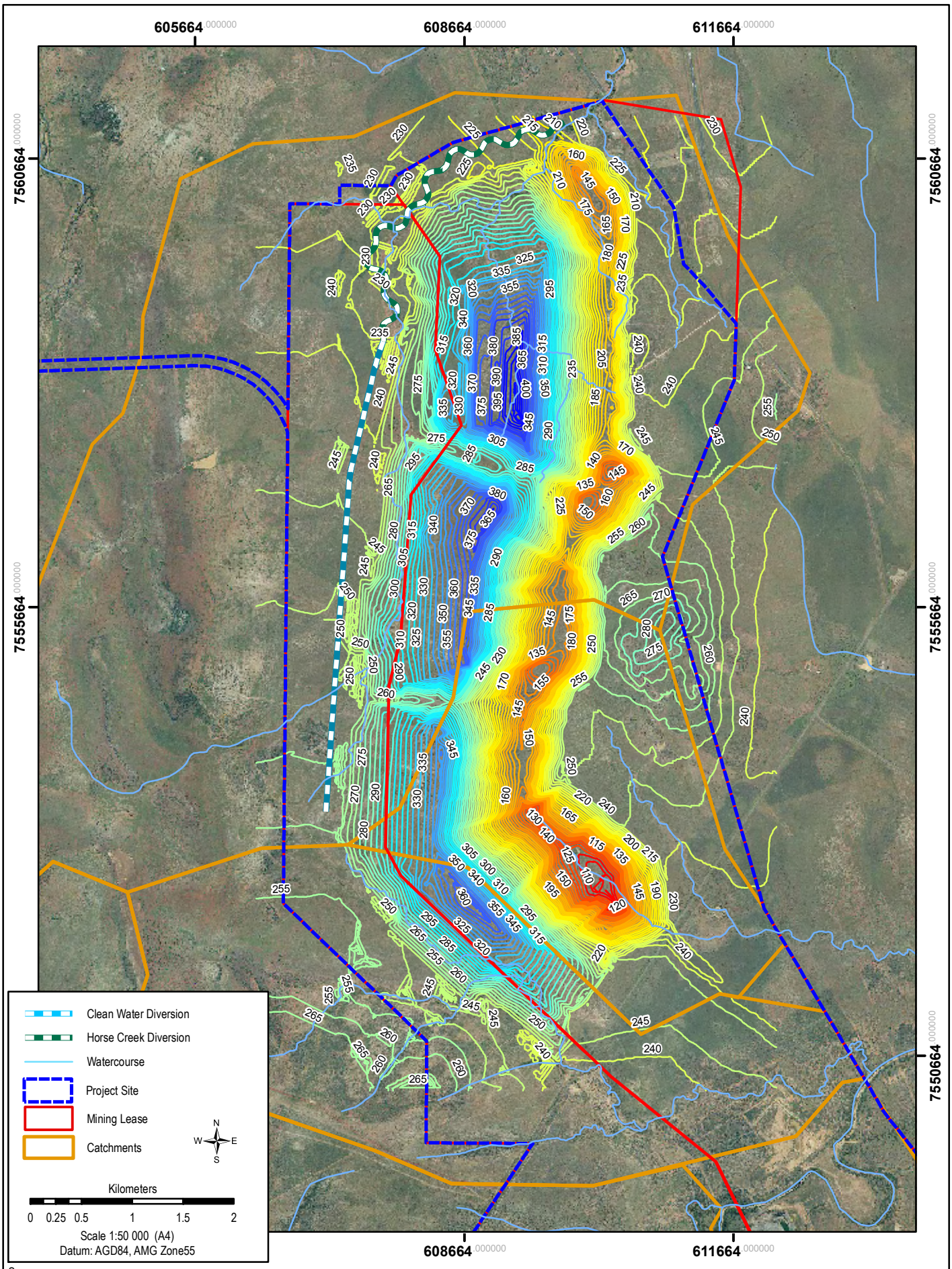
Client: BMA — BHP Billiton Mitsubishi Alliance	Project: CAVAL RIDGE PROJECT DRAFT ENVIRONMENTAL MANAGEMENT PLAN		Title: **DECOMMISSIONING AND REHABILITATION - FINAL VOID CONFIGURATION BASE CASE**
URS	Drawn: MG	Approved: RS	Date: 11-11-2009
	Job No: **4262 6420**/6158	File No.: 42626158-g-2332.mxd	Figure: **3.7.8a**
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URS	Drawn: MG	Approved: RS	Date: 11-11-2009
	Job No: **4262 6420**/6158	File No.: 42626158-g-2333.mxd	Figure: **3.7.8b**
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URS	Drawn: MG	Approved: RS	Date: 11-11-2009
	Job No: **4262 6420**/6158	File No.: 42626158-g-2334.mxd	Figure: **3.7.8c**
			Rev. A A4

Rehabilitation Methods

Progressive Rehabilitation

Rehabilitation will be progressively undertaken on areas that cease to be used for mining or mine-related activities within two years of becoming available. This will reduce the amount of disturbed land at any one time. Results of progressive rehabilitation and vegetation trials (if appropriate) will be used to refine rehabilitation methods for future application such as the selection of appropriate drainage measures and plant species for re-establishment. Areas available for progressive rehabilitation and the types of disturbance at those sites will be detailed in the Plan of Operations. Rehabilitation of exploration disturbance will be undertaken in accordance with the BMA Geological Services Environmental Management Plan. Disturbance will be minimised. Drill holes will be capped and drill lines and tracks not required again in the near future will be rejuvenated or ripped and seeded.

Revegetation

Revegetation activities will be scheduled to occur after the completion of reshaping, re-topsoiling and drainage works. Where possible, the timing of these works will enable a preferred seasonal sowing of pasture and tree seed in autumn or spring. On prepared surfaces, selected tree, shrub and pasture species will be sown using seed stock and/or planted depending on the species, slope gradients and area to be revegetated. Tree and shrub species will be established at a density and richness consistent with the nominated post-mine ecosystem.

Plant selection for areas to be returned to bushland will focus on those species that will successfully establish on the available growth medium, species that that will bind the soil and species that will result in a variety of structure and food/habitat resources, with an aim to establishing woodland to open forest. Native species will be established through direct seeding or planting of tube stock/nursery-raised stock from local propagules. Seed will be collected from site where possible and treated if necessary to ensure it is adapted to environmental conditions in the area. Tree and shrub establishment on site will be dominated by the direct seeding method, currently being used at the majority of coal mines in the Bowen Basin. An initial tree and shrub mix, based on the species list from the terrestrial ecology assessment is provided in Table 3.7.6 below, and will be reviewed periodically depending on changes in best practice, technology and rehabilitation monitoring results.

Table 3.7.6 Initial Native Tree and Shrub Species Mix

Acacia leiocalyx	*Corymbia intermedia*
Acacia cambagai	*Corymbia polycarpa*
Acacia farnesiana	*Corymbia tessellaris*
Acacia holosericea	*Eucalyptus camaldulensis*
Acacia rhodoxylon	*Eucalyptus cambageana*
Acacia salicina	*Eucalyptus microtheca*
Acacia shirleyi	*Eucalyptus crebra*
Allocasuarina luehmannii	*Eucalyptus drepanophylla*
Atriplex muelleri	*Eucalyptus populneum*
Brachychiton australis	*Eucalyptus tereticornis*
Brachychiton rupestric	*Eucalyptus thozetiana*
Callistemon viminalis	*Melaleuca bracteata*
Corymbia erthrophobia	

A combination of native and introduced pasture species will be used on the bushland sites to ensure the quick establishment of a continuous groundcover, thereby reducing the risk of erosion. Legumes may also be selected to assist in the supply of bio-available nitrogen to the soil. If the use of introduced grasses and/or legumes is deemed necessary for erosion control in the bushland areas, pasture seed and fertiliser will be applied at a lower rate than for pasture outcomes to reduce competition with tree seed and/or seedlings. Native and exotic pasture species will be sown where the risk of erosion is less and on the more protected aspects of landforms. Introduced, stoloniferous grass species (e.g. Rhodes Grass, Indian Couch) will be sown on the steeper slopes (>10°) as their growth habit provides more extensive coverage in a shorter time. Aerial sowing and ground broadcasting will be conducted for pasture seed as the preferred sowing methods and grazing will be restricted whilst the vegetation is establishing. Potentially suitable pasture species include.

- Indian Couch
- Rhodes Grass
- Bambasti Panic
- Purple Pidgeon Grass
- Siratro
- Stylo
- Red Natal Grass
- Sabi Grass
- Silk Sorghum

Weeds will be managed in accordance with Section 3.9.5.1 below.

Decommissioning of Infrastructure, Plant and Buildings

Site Services

All services including power, water, data and telephone for the project site will be isolated, disconnected and terminated to make them safe. The inspection pits and junction boxes for underground services will be sealed. Generally all underground services will be made safe and left buried in the ground. Overhead power lines will be removed and the materials (i.e. poles and wire) recovered for potential re-sale or recycling as applicable. Switch room buildings will be disconnected and demolished. The substations will be removed from the site and either used on another project or sold as a going concern.

Infrastructure and Buildings

All sumps will be de-watered and the excess coal removed prior to the commencement of demolition. In addition, all items of equipment will be de-oiled, degassed, depressurised and isolated and all hazardous materials (HAZMATs) removed from the site.

All buildings, including the main administration building, workshop, CHPP and fixed plant (including stacker / reclaimers, conveyors and gantries, transfer points, thickener tank, coarse reject hopper, vehicle wash, etc) will be required to be demolished and removed from the site. Where possible assets may be re-used or sold to other mining operations. The remaining items will be demolished, removed and transported from the site as required. All recoverable scrap steel will be sold and recycled, with the remaining non-recyclable wastes either being taken to a licensed landfill or buried in the backfill of the final voids. Only inert wastes will be placed in the backfill.

All concrete footings and pads will be broken up to at least 1.5 m below the surface and removed with the non contaminated waste material and buried in the voids. The carbonaceous material on the base of the ROM and product stockpile areas will be stripped to a depth of at least 0.5 m and buried in the low wall of the open cut void. Where possible the material will be considered for reprocessing before the CHPP goes off line.

The entire CHPP and infrastructure areas will be dozer trimmed to facilitate the appropriate drainage of surface runoff from the site. Appropriate surface water management structures (contour banks, drains and settlement ponds) will also be constructed. The site will be rock raked to remove all surface rocks to a size of less than 500 mm and ripped to a depth of at least 1 m. Fertiliser and pasture/tree seed will be applied to assist establish grassland post-mine land use.

Roads, Car Parks and Hardstands

The bitumen roadways, car parks and hardstand areas around the CHPP, workshop and administration areas will be ripped up with the inert waste material being placed in the open cut voids and buried. Contaminated, carbonaceous or unsuitable (gravel, etc) material will be removed from the haul roads and hardstand surfaces and disposed of and covered in the low wall area. Minor dozer reshaping work will be undertaken to ensure surface level consistency with the surrounding areas. Any creek crossings (i.e. culverts, etc) will be removed and the pre-existing drainage line re-instated where applicable. The site will be rock raked to remove all surface rocks to a size of less than 500 mm and ripped to a depth of at least 1 m. Fertiliser and pasture/tree seed will be applied to assist establish pasture post-mine land use.

A light vehicle access road is to be maintained to enable inspections of the site following closure of the mine. All roadside markers (tyres and guideposts) and signs are also to be removed from within the area once mine closure activities within the pit area have been completed.

Sediment Control Basins and Surface Water Features

All sediment control basins which assist in the water flow from the final rehabilitated surface will be retained following mine closure. The water storage basins will be removed and the original drainage paths re-established wherever possible. These areas will be rock raked to remove all surface rocks to a size of less than 500 mm and ripped to a depth of at least 1 m. Fertiliser and pasture/tree seed will be applied to the site.

Void Management

A void management strategy will be developed and provide:

- Measures to minimise potential impacts associated with the final void;
- Measures for monitoring and management of potential impacts of the void over time; and
- Options for the final post-mine use of the void.

Void Water Quality

Groundwater and surface water assessments indicate that the water quality in the final void will be saline. The following aspects will be considered with respect to managing final void water quality:

- Stratification of the water column;
- Concentration of dissolved salts resulting from the mining of the coal seams;
- Surface flow into the void;
- Recharge rates to the spoil aquifer and void;
- Movement of flow through the spoil aquifer;
- Groundwater inflows and outflows; and
- Rainfall and evaporation.

Post-closure, a ground and surface water monitoring program will remain in place to closely monitor any changes to water chemistry within the void.

Low Wall Slope Stability

Stability of the low wall will be achieved through implementing the following:

- The low wall will be battered back from the angle of repose to ensure that long term geotechnical stability of the face. Determination of geotechnical stability will be based on an assessment of the spoil material, the likely degree of settlement, and the degree of weathering expected in the long term. Where required the sides of the final void will be battered back to 17 degrees;
- Drainage on and over the low wall will be minimised through the construction of drainage control structures;
- Erosion of the low wall will be controlled by limiting the length of slope, minimising the degree of slope, and by the establishment of suitable vegetation;
- Battering of the low wall against the bottom of the high wall will enhance stability; and

- Benching of the spoil material may need to be considered in some areas in order to achieve geotechnical stability and minimise erosion.

High Wall Slope Stability

To ensure the safety of the final void, the surrounding final slopes will be left in a condition where the risk of slope failure is minimised. The following will be considered when assessing the geotechnical stability of the highwalls:

- Long term groundwater levels;
- Long term final void water levels;
- Height and inclination of slope and number and spacing of intermediate benches;
- Shear strength of the highwall soils and rocks;
- Density and orientation of fractures, faults, bedding planes, and any other discontinuities, and the strength along them; and
- The effects of the external factors, such as surface runoff.

Prior to closure, further investigations will be undertaken to confirm the criteria above and appropriate action will be taken to ensure effective long term safety, stability and management of the void.

Spontaneous Combustion

Spontaneous combustion is not known to occur at Peak Downs Mine and is therefore not expected to occur on the project site. However, it has been included for reference as it is often an issue associated with final voids. Spontaneous combustion above ground commonly occurs in waste dumps containing reject coal material, in unconsolidated heaps where oxygen can come into contact with the coal and heat can't dissipate. The problem is compounded when rainfall events cause erosion, progressively exposing the coal. Spontaneous combustion may also occur in the coal seam exposed in the remaining highwall of the final void. The following will be undertaken to reduce the potential for spontaneous combustion to occur:

- Accumulations of coal material, particularly pyritic, will be buried under inert spoil;
- Any remaining coal spalling will be removed from the highwall where possible;
- If any coal on the highwall face is prone to spontaneous combustion, it will be sealed with water, clay or inert soil where possible; and
- Should any outbreaks of spontaneous combustion occur in the final void, details on the materials involved, presence of pyrites, location, date, time and climatic conditions will be recorded. This will be undertaken as part of the ongoing inspection and monitoring to occur post closure of the mine.

Control of Surface Inflow

The control of surface inflow into the final void is essential for the long term management of water quality within the pit and will also aid in the control of erosion to low walls and high walls. Drainage will be directed away from the highwall face through the construction of interceptor channel drains around the perimeter of the highwall and spoon drains will be utilised on the upslope side of all benches. Drainage will be such that external catchments are diverted away from the final void (ie only internally draining voids, where possible, not receiving draining from external catchments). Drainage over the low wall will be minimised through constructing surface water diversions, and drainage on the wall will be limited and controlled to reduce the erosion potential.

Safety

At mine closure, voids will be rendered safe in terms of access by humans, livestock and wildlife. The following will be considered at the time of closure to ensure that the void is left in a safe manner:

- To ensure stability, the high walls and low walls will be battered back to a stable slope angle as required;
- Exposed coal seams will be covered with inert material to prevent ignition either from spontaneous combustion, bush fires or human interference;
- A barrier at a safe distance from the perimeter of the void to prevent human access will be constructed. The highwall areas will be secured by the construction of a trench and a 2 m safety berm, as well as a 2.1 m security fence along the entire length of the remaining high wall. This is to provide an engineered barrier between the pit and the surrounding area. The trench and berm is to be constructed in such a way that it will physically stop most vehicles;
- Suitable signs, clearly stating the risk to public safety and prohibiting public access will be erected at 50 m intervals along the safety fence;
- Surface runoff from land surrounding the void will be diverted from entering the void so as to prevent flooding of the pit and potential development of instability of the void walls;
- Shrub and/or tree planting along the outside edge of the bund wall will be implemented where practicable to lessen the visual impact of the wall, and will be in accordance with the agreed post-mining rehabilitation criteria and land use.

Catchment Management Strategies

The catchments, formerly reporting to the final void, will be diverted away from the low wall areas to minimise the amount of clean water runoff accumulating in the voids. These catchment areas will be either rehabilitated or in an advanced stage of rehabilitation. Runoff from these areas will be diverted to appropriate sediment control measures prior to leaving the site through stable water disposal areas.

The remainder of the regraded low wall area entering the void, will be stabilised with structural soil conservation earthworks (banks, drains, drop structures, etc), and suitable vegetation to minimise low wall erosion.

Contaminated Land

The principal risks for land contamination from the construction and operation of the project result from waste storage (refer Section 3.6), reject handling and the potential for acid rock drainage (refer Section 3.7.3.6), and hydrocarbon storage and use. General control strategies minimise the potential impact of the project on soil and groundwater are identified in Section 3.4.4. Additional control strategies to avoid the contamination of land include the following:

- Any contaminated material will be removed and placed in an appropriate area for remediation. This material will be kept separate from any material used for rehabilitation activities.
- During excavation works, any existing potentially contaminated fill material will be segregated from clean material. The fill material will be analysed prior to removal from site. If contaminated soil is to be removed from site, the DERM regulations for waste transport and disposal will be followed. Any fill material to be imported for use during construction works will be clean. The status of fill will be confirmed prior to delivery on site.

- Coal stockpiles, workshop areas, chemical stores, fuel tanks and waste disposal/storage areas will be located on hardstand or compacted soil. As runoff from these areas may be contaminated, runoff will be collected using appropriate drainage and water management structures and managed within the mine water management system.
- Record all hazardous materials used in a Hazardous Materials Register that includes details on storage location, storage requirements, proper usage, handling information and disposal procedures.
- Where possible, hazardous chemicals and materials will be replaced with less harmful alternatives. Material Safety Data Sheets (MSDSs) for chemicals used or brought to site will be kept in a central register on site and at the area of use and be readily available to workers at all times. Prohibit using chemicals on site that are not contained in the Hazardous Materials Register and do not have an MSDS.
- Clearly label all fuels, oils and chemicals.
- Store and handle corrosive materials in accordance with AS 3780.8 (Class 8 substances – corrosives).
- Stores flammable and combustible liquids in accordance with the bunding requirements of AS 1940:2004.
- Store all fuels, oils and chemicals in containers less than 200 L, either in a bunded area with capacity of at least 110% of the largest container, or in a fenced and roofed compound.
- Regular inspections of containers, bund integrity, valves and storage and handling areas will be carried out.
- Spills will be cleaned up immediately. Provide spill clean-up kits including absorbent materials in close proximity to each store containing fuels, oils and chemicals. Site vehicles will be equipped with appropriate spill kits. For significant chemical or fuel spills, the site emergency response plan will be followed and the appropriate authorities notified as soon as possible.
- Install tank level indicators on fuel oil tanks for monitoring of fuel oil levels.
- Maintain fuel oil tanks to ensure safe and effective operation of all components.
- Design fuel tanks in accordance with AS 1692:2006 ‘Steel tanks for flammable and combustible liquids’ to minimise the potential for failure of the diesel storage vessel.
- Maintain contractor management procedures that require contractors to provide MSDS and apply for approval prior to bringing new chemicals on site.
- All staff will be trained as part of their site induction in appropriate handling, storage and containment practices for chemicals, fuel and other potential contaminants as relevant.
- Detailed records will be kept of any activities or incidents that have the potential to result in land contamination. Records will be kept on an inventory that contains information on storage locations, personnel training and disposal procedures for all chemicals, fuel and other potential contaminants used on site. Records will be maintained and reviewed regularly.

Lots identified at the project site as being potentially contaminated will be treated as follows:

- The cattle yard on Lot 13/SP151669 - A protocol will be developed to further assess (and manage as required) this area. These assessments will include site inspections as deemed necessary and possible soil testing where required. This area is the proposed location of the box-cut spoil pile. Any contaminated soil present in the site, identified through soil analysis, will be handled through an

appropriate management strategy. The soil removed as part of the original DPI remediation order be located, assessed and if required, disposed of in an appropriate facility.

- Prior to any development of the project area taking place, the plan of mining operations shall be compared to the locations of the identified areas of potential contamination to identify what actions need to be undertaken. If a site is to be disturbed by proposed mining activities, a protocol will be developed to further assess (and manage as required) identified areas. These assessments will include site inspections as deemed necessary and possible soil testing where required.
- The development of Heyford Pit will require the removal of potentially contaminated soils from five sites over the life of the mine. These include areas that previously had diesel tank skid mounts, transformers, toilets and septic tanks, and drilling pad sumps.
- The development of Horse Pit will require the removal of potentially contaminated soils from a former gravel pit site, located on the northern section of the development.
- The development of Horse Creek Diversion will require the removal of potentially contaminated soils from the site currently occupied by the Kalari Workshop and Yard.

Mineral Wastes

The ongoing management of mineral waste (overburden, interburden and potential reject materials) will consider the geochemistry of materials with respect to their potential risk to cause harm to the environment and their suitability for use in revegetation. A mineral waste management strategy for the project will be designed to focus on the placement of mineral waste materials to minimise run-off and erosion and the evaluation of the geochemical characteristics of materials from untested areas or lithologies that have not been evaluated. Monitoring of mineral wastes is discussed in Section 3.7.6 below.

3.7.7 Monitoring

Mineral Wastes

Geochemical Analysis

The geochemical information for the project site has largely been derived from the Horse Pit area. The geology of the project site, from Harrow Creek to the northern boundary of Horse Pit, is relatively uniform (*i.e.* the same units and lithology) despite seam splits. Therefore, the geochemical characteristics of mineral waste materials from the Heyford Pit (the southern section of the project) are expected to be the same as those tested at Horse Pit and similar to the geochemical characteristics of the existing PDM to the south. BMA will undertake ongoing operational geochemical characterisation of mineral waste materials in the southern section of the project site to confirm the expected geochemical characteristics of these materials.

Continued characterisation of reject materials from the CHPP will also be undertaken to verify the expected geochemical data of rejects. This data will be used to re-evaluate the management strategies of mineral waste materials. Future geochemical characterisation will comprise standard acid-base and metals testing (static tests), and assessment of general soil properties (sodicity, exchangeable cations) of mined waste materials to evaluate their suitability for use in revegetation activities.

Water Quality

Leachate and site water derived from, or in contact with, spoil piles, reject materials or other mineral waste is not expected to be problematic with respect to pH (acid) and metals, however the moderate EC of the

overburden materials means that monitoring of salt concentrations in leachate will be undertaken to ensure nearby drainages are not receiving salt loads that could impact upon existing ecosystems. This will be managed by retaining surface seepage and runoff water on-site. This water will be reused in the mine water management system. This will be particularly important in the vicinity of the CHPP where coal washing is likely to produce brackish run-off water.

Rehabilitation and Decommissioning

Rehabilitation will be monitored regularly in accordance with the preliminary monitoring program identified below. Monitoring results will be compared against the nominated success criteria to track the progress of rehabilitation towards the objective of a self-sustaining ecosystem. Rehabilitation techniques will be continually developed and refined over the life of mine through an ongoing process of monitoring at the site and recognition of other industry experiences. A corrective action program will be implemented to address areas of failed rehabilitation and periodic and final rehabilitation reports will be submitted to the DERM as detailed in the Rehabilitation Management Plan.

Success Criteria

Preliminary success criteria (or closure criteria) for the rehabilitation of the main mine areas have been proposed in Table 3.7.7 below. The success criteria are performance objectives or standards against which rehabilitation success in achieving a sustainable system for the proposed post-mine land use is demonstrated. Satisfaction and maintenance of the success criteria (as indicated by monitoring results) will demonstrate that the rehabilitated landscape is ready to be relinquished from the mine's financial assurance and handed back to stakeholders in a productive and sustainable condition.

The success criteria have been developed to comprise indicators for vegetation, fauna, soil, stability, land use and safety on a landform-type basis that reflects the nominated post-mine land use of bushland and grassland. For each element, standards that define rehabilitation success at mine closure are provided. Based on the generic indicators in Table 3.7.7, each criterion will be further developed to be specific, measurable, achievable, realistic and outcome based, and to reflect the principle of sustainable development. The further development of each criterion will be based on results of research, monitoring of progressive rehabilitation areas and risk assessments. The success criteria will be reviewed every three to five years with stakeholder participation to ensure the criteria remain realistic and achievable.

3.7.8 Commitments

- At closure the mine will achieve the agreed rehabilitation success criteria.
- Progressive rehabilitation of the disturbed areas will be undertaken on an availability basis.
- An ongoing rehabilitation monitoring program will be undertaken against the agreed criteria.

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Table 3.7.7 Rehabilitation Success Criteria

Rehabilitation Element	Indicator	Criteria
1. In–Pit and Out-of-Pit Spoil Dumps and Dragline Spoil Areas		
Landform stability	Slope gradient	No less than 75% of the area has slopes <10° and up to 25% of the area has slopes >10°. Where reject layers are present and exposed, the landform is capped.
	Erosion control	Erosion control structures are installed commensurate with the slope of the landform. Average soil loss per annum per domain unit is <40 tonnes/ha/yr (sheet erosion).
	Surface Water Drainage	Use of contour banks and diversion drains to direct water into stable areas or sediment control basins.
Water quality		Ensure receiving waters affected by surface water runoff have contaminant limits of electrical conductivity maximum of 1,500 µS/cm and pH range of 5.5 to 9.5
Water Storages, Creek Diversions		Clean water storages and diversions to be stabilised and left as required. Dirty water storages to be cleaned out and rehabilitated to a stable non-polluting condition.
Topsoil	Salinity (electrical conductivity)	Soil salinity content is <0.6 dS/m.
	pH	Soil pH is between 5.5 and 8.5.
	Sodium content	Soil Exchange Sodium Percentage (ESP) is <15%.
	Nutrient cycling	Nutrient accumulation and recycling processes are occurring as evidenced by the presence of a litter layer, mycorrhizae and/or other microsymbionts. Adequate macro and micro-nutrients are present.
Vegetation	Land use	Area accomplishes and remains as a healthy working bushland ecosystem.
	Surface cover	Minimum of 70% vegetative cover is present (or 50% if rocks, logs or other features of cover are present). No bare surfaces >20 m^2 in area or >10 m in length down slope.
	Species composition	Comprise a mixture of native trees, shrubs and grasses representative of regionally occurring woodland to open forest where possible.
	Community structure	Groundcover, understorey and overstorey structure similar to that of appropriate reference site(s)*.

Rehabilitation Element	Indicator	Criteria
	Resilience to disturbance	Established species survive and/or regenerate after disturbance. Weeds do not dominate native species after disturbance or after rain. Pests do not occur in substantial numbers or visibly affect the development of native plant species.
	Sustainability	Species are capable of setting viable seed, flowering or otherwise reproducing. Evidence of second generation of tree/shrub species. Vegetation develops and maintains a litter layer evidenced by a consistent mass and depth of litter over subsequent seasons. More than 75% of shrubs and/or trees are healthy when ranked healthy, sick or dead.
Fauna	Vertebrate species	Representation of a range of species characteristics (e.g. activity pattern, habitat usage, diet, dispersal character etc (WMB, 2003; Kimber et. al., 1999)) from each faunal assemblage group (e.g. reptiles, birds, mammals), present in the ecosystem type, based on pre-mine fauna lists and sighted within the three-year period preceding mine closure. Sighting of species of conservation significance or indicators of the presence of species of conservation significance (e.g. tracks) likely to be present in the established ecosystem type within the three-year period preceding mine closure (assuming non-mine related disturbance has not eliminated local populations thereby removing the colonising source). The number of vertebrate species does not decrease by more than 25% in the successive seasons prior to mine closure or by more than 40% over the two successive seasons prior to mine closure.
	Invertebrate species	Presence of representatives of a broad range of functional indicator groups involved in different ecological processes (including termites for soil structure, Collembola for decomposition, Hemiptera for herbivory and predatory groups such as arachnids, centipedes, earwigs, cockroaches and ants as indicators of a range of other processes (Bisevac and Majer, 1998).
	Habitat structure	Typical food, shelter and water sources required by the majority of vertebrate and invertebrate inhabitants of that ecosystem type are present, including: a variety of food plants; evidence of active use of habitat provided during rehabilitation such as nest boxes, stags and logs and signs of natural generation of shelter sources including leaf litter.
Safety		Risk assessment has been undertaken in accordance with relevant guidelines and Australian Standards and risks reduced to levels agreed with the stakeholders.
2. Final Voids (including Ramps)		
Landform stability	Slope gradient	Highwall faces exhibit long-term geotechnical stability and a geotechnical report has been completed. Competent rock Highwall to have slope of <65°. Incompetent rock highwall to have slope of <17°. Low wall to have slope of <17°. Ramp walls not backfilled exhibit long-term geotechnical stability and a geotechnical report has been completed.

Rehabilitation Element	Indicator	Criteria
		In-pit rejects and spoil slope gradients can exceed 15%.
	Erosion control	Average soil loss per annum per domain unit is <40 tonnes/ha/yr (sheet erosion). Erosion mitigation measures have been applied to ensure slope stability
	Surface Water Drainage	Use of contour banks and diversion drains to direct water into stable areas or sediment control basins.
Water quality		Electrical conductivity of any void water may exceed 1,500 µS/cm if an ecological assessment shows the long-term ecological stability and groundwater quality is not adversely affected.
Water Storages, Creek Diversions		As for 1.
Topsoil		As for 1.
Vegetation	Land use	Where ramps and in-pit spoil design allow, area accomplishes and remains as a healthy working bushland ecosystem (although naturalised grasses may be used).
	Surface cover	As for 1.
	Species composition	Comprise a mixture grasses, shrubs and trees (where possible) suitable for establishment on steeper slopes
	Community structure	Groundcover and understorey structure to that of appropriate reference site(s)*.
	Resilience to disturbance	As for 1.
	Sustainability	More than 75% of individual grasses and shrubs are healthy when ranked healthy, sick or dead.
Safety		Risk assessment has been completed and risk mitigation measures have been implemented. Where risk mitigation measures include bunds, safety fences and warning signs, these have been erected generally in accordance with relevant guidelines and Australian Standards.
3. Rejects Dumps		
Landform stability	Slope gradient	Final slope of 1V:6H (9.5°)
	Erosion control	Reject emplacements have been capped to a depth of 1.5 m of inert material. Erosion mitigation measures have been applied. Average soil loss per annum per domain unit is <40 tonnes/ha/yr (sheet erosion).

Rehabilitation Element	Indicator	Criteria
	Surface Water Drainage	Drainage control measures are installed.
Water quality		As for 1.
Water Storages, Creek Diversions		As for 1
Topsoil		As for 1.
Vegetation		As for 1 where capping allows for tree establishment.
Fauna		As for 1.
Safety		As for 1.
4. Mine Plant/Industrial Areas		
Landform stability	Slope gradient	Area has gradient of <2°.
	Erosion control	Erosion mitigation measures have been applied. Average soil loss per annum per domain unit is <40 tonnes/ha/yr (sheet erosion).
	Surface Water Drainage	Use of contour banks and diversion drains to direct water into stable areas or sediment control basins.
Water quality		As for 1.
Water Storages, Creek Diversions		As for 1.
Topsoil		As for 1.
Vegetation	Land use	Buildings, water storage, roads (except those used by the public) and other infrastructure have been removed unless stakeholders have entered into formal written agreements for their retention. Areas are readily accessible and conducive to safe cattle management activities. Predicted economics and /or benefits have been defined and agreed by the stakeholders.
	Surface cover	As for 1.
	Species composition	Palatable, nutritious pasture grass species are present.
	Community structure	Desirable grass species comprise at least 60% of total grass cover. Tree density and height of >25 stems per 5 ha each being >2 m in height.

Rehabilitation Element	Indicator	Criteria
	Resilience to disturbance	As for 1.
	Sustainability	Nitrogen fixing grass species present. More than 75% of shrubs and/or trees are healthy when ranked healthy, sick or dead.
Fauna	Vertebrate species	Representation of a range of species characteristics (e.g. activity pattern, habitat usage, diet, dispersal character etc (WBM, 2003; Kimber et. al., 1999)) from each faunal assemblage group (e.g. reptiles, birds, mammals), present in the grassland ecosystem type, based on pre-mine fauna lists and sighted within the three-year period preceding mine closure. The number of vertebrate species does not decrease by more than 25% in the successive seasons prior to mine closure or by more than 40% over the two successive seasons prior to mine closure.
	Invertebrate species	Presence of representatives of a broad range of functional indicator groups involved in different pastoral ecological processes (including termites for soil structure, Collembola for decomposition, Hemiptera for herbivory and predatory groups such as arachnids, centipedes, earwigs, cockroaches and ants as indicators of a range of other processes (Bisevac and Majer, 1998).
	Habitat structure	Typical food, shelter and water sources required by the majority of vertebrate and invertebrate inhabitants of pastoral ecosystem type are present, including: a variety of food plants and signs of natural generation of shelter sources including leaf litter.
Safety		Risk assessment has been undertaken in accordance with relevant guidelines and Australian Standards and risks reduced to levels agreed with the stakeholders. Closure documentation includes the contaminated sites register which identifies contaminated sites and the treatment applied.

Note: * Reference sites discussed below.

Monitoring Program

Regular monitoring of the rehabilitation will be required during the vegetation establishment period, to demonstrate whether the objectives of the rehabilitation strategy are being achieved and whether a sustainable landform has been provided. In addition to rehabilitated areas, reference sites will be identified and monitored to allow a comparison of the development and success of the rehabilitation against a control. Reference sites indicate the condition of surrounding un-mined areas or areas successfully rehabilitated that the mine sites must replicate. The rehabilitation at neighbouring Peak Downs Mine will be reviewed to determine if any areas would provide suitable reference sites for the project.

Monitoring will be conducted periodically by independent, suitably skilled and qualified persons at locations which will be representative of the range of conditions on the rehabilitating areas. Annual reviews will be conducted of monitoring data to assess trends and monitoring program effectiveness. Monitoring of the rehabilitated areas will broadly involve the following:

- Ongoing chemical analysis of topsoil;
- Comparison of soil erosion rates and rill and gully dimensions with measurements taken from reference sites;
- Comparison of vegetation measurements with measurements taken from reference sites;
- Ongoing analysis of water quality parameters in accordance with the development consent and environmental protection licence conditions from data collected monthly at water storages, ramps and pits, sediment basins and sewage effluent outfalls on-site, and from creeks (upstream and downstream of mine); and
- Visual surveillance including the use of digital photogrammetry/low level obligue or vertical aerial photography to monitor changes over time in the rehabilitation (e.g. changes in vegetation structure, erosion rates and landform drainage).

More specifically, monitoring of the elements in Table 3.7.8 will be undertaken to determine the level of achievement of success criteria.

Table 3.7.8 Rehabilitation Monitoring Program

Aspect of Rehabilitation	Elements to be Monitored
Ecosystem Establishment	
Ground cover	Percentage of ground covered by vegetation, rocks, logs and other obstructions. Obstruction lengths and widths (indicates the amount of ground cover that is present to collect, hold and disseminate available resources necessary for ecosystem function) for use in Landscape Function Analysis (LFA). Fetch lengths (measure of distances of soil surface that is bare of matter that could slow water velocity) for use in LFA.
Community structure and composition	Species composition. Number and form of ground cover and understorey species per plot. Density, height, canopy cover and DBH of tree and large shrub species. Numbers, heights and species identity (where able to be determined) of any seedlings. Evidence of reproduction/regeneration (e.g. flower heads, fruits/seeds, germination of seedlings etc). Assessment of individual plant health (healthy, sick or dead).
Habitat	Availability and variety of food sources (e.g. flowering/fruiting trees, presence of invertebrates etc). Availability and variety of shelter (e.g. depth of leaf litter, presence of logs, hollows etc). Presence/absence of free water.
Fauna	Presence and approximate abundance and distribution of functional indicator invertebrate species. General observations of vertebrate species (including species of conservation significance). Detailed fauna surveys including presence and approximate abundance and distribution of vertebrate species (focussing on species of conservation significance).
Weeds and pests	Species identity. Approximate numbers/level of infestation. Observations of impact on rehabilitation (if any).
Erosion Monitoring and Soil Characteristics	
Soil	Stability, infiltration and nutrient cycling undertaken according to LFA procedure. Electrical Conductivity, as a measure of salinity.

Aspect of Rehabilitation	Elements to be Monitored
	pH. Soil exchangeable Na potential.
Erosion	Location and extent of sheet wash. Location and extent of rill and gully erosion including measurements of depth, width and length. Extent of bare areas with potential to erode. Sediment movement and runoff.
Geotechnical Stability	
	Stability of batter and surface settlements, in particular where these features could impact on the performance of any surface water management system. Surface integrity of landform cover/capping (measurement of extent of integrity failure). Landform slumping (distance of material movement and extent).
Surface and Ground Water	
	Groundwater quality and depth. Efficiency of landform surface water drainage systems. Presence and quality of any surface water and seepage at selected locations at the lower part of potentially acid producing landforms such as reject dumps. Water quality including pH, EC and total suspended solids of water in water storages, ramps and pits, sediment basins and sewage effluent outfalls onsite. Water quality including pH, salinity and turbidity of water entering creek/river systems on site.
Creeks and Diversions	
	Vegetation density, diversity and vigour Structural stability of channel Water quality including pH, salinity and turbidity of water entering creek/river systems on site.

Maintenance

Maintenance of rehabilitated areas will be undertaken where necessary and in response to results of the monitoring program, to ensure success criteria are met, or in the case of progressive rehabilitation, are projected to be met at the time of mine closure. Depending on the criteria to be achieved, examples of maintenance works include re-seeding or planting of tube stock of tree and/or shrub species to meet required revegetation parameters and implementation of erosion protection measures to reduce erosion rates.

Responsibility for the maintenance of rehabilitation will lie with BMA, as owner/operator of the project. As extensive areas of disturbed land will not be available for progressive rehabilitation, much of the rehabilitation work will be required to be carried out at the end of mine life. Post-mining surveys of the rehabilitation will be undertaken across the site to determine whether the site meets success criteria and whether this result is being maintained over time. Once this occurs and the site is relinquished, the land will be returned to the relevant stakeholders and maintenance of the rehabilitation will no longer be required.

3.7.9 Proposed Environmental Authority Conditions: Schedule F – Land

Preventing contaminant release to land

(F1-1) Contaminants must not be released to land in manner which constitutes nuisance, material or serious environmental harm.

Topsoil

(F2-1) Topsoil must be strategically stripped ahead of mining in accordance with a topsoil management plan.

(F2-2) A topsoil inventory which identifies the topsoil requirements for the mining project and availability of suitable topsoil on site must be detailed in the Plan of Operations.

Rehabilitation landform criteria

(F3-1) Progressive rehabilitation must commence within two (2) years of when areas become available within the operational land.

Residual void outcome

(F4-1) Complete an investigation into residual voids and submit a report to the administering authority proposing acceptance criteria to meet the outcomes in F3-1 and landform design criteria for Departmental review and comment. On acceptance of the criteria proposed in the residual void management plan, the criteria must be specified in the Environmental Authority.

The investigation must at a minimum include the following:

a) a study of options available for minimising final void area and volume;

b) develop design criteria for rehabilitation of final voids;

c) a void hydrology study, addressing the long-term water balance in the voids, connections to groundwater resources and water quality parameters in the long term;

d) a pit wall stability study, considering the effects of long-term erosion and weathering of the pit wall and the effects of significant hydrological events;

e) a study of void capability to support native flora and fauna; and

f) a proposal/s for end of mine void rehabilitation success criteria and final void areas and volumes.

These studies will be undertaken during the life of the mine, and will include detailed research and modelling.

Rehabilitation monitoring program

(F5-1) Once rehabilitation has commenced, the holder of the environmental authority must conduct a Rehabilitation Monitoring Program on a 2 yearly basis, which must include sufficient spatial and temporal replication to enable statistically valid conclusions as established under the rehabilitation program.

(F5-2) The Rehabilitation Monitoring Program must be developed and implemented by a person possessing appropriate qualifications and experience in the field of rehabilitation management, nominated by the environmental authority holder.

(F5-3) The Rehabilitation Monitoring Program must be included in the Plan of Operations and updated with each subsequent Plan of Operations, describing:

a) how the rehabilitation objectives will be achieved; and

b) verification of rehabilitation success.

Post closure management plan

(F6-1) A Post Closure Management Plan for the site must be prepared at least 18 months prior to the final coal processing on site and implemented for a nominal period of:

c) at least thirty (30) years following final coal processing on site; or

d) a shorter period if the site is proven to be stable and it can be demonstrated to the satisfaction of the administering authority that the probability that environmental harm will occur within the foreseeable future is less than 1 percent.

(F6-2) The Post Closure Management Plan must include the following elements:

a) operation and maintenance of:

- wastewater collection and reticulation systems;
- wastewater treatment systems;
- the groundwater monitoring network;
- final cover systems; and
- vegetative cover.

b) monitoring of:

- surface water quality;
- groundwater quality;
- seepage rates;
- erosion rates;
- the integrity and effectiveness of final cover systems; and
- the health and resilience of native vegetation cover.

Mining waste management

(F7-1) A Mining Waste Management Plan together with the certification by an appropriately qualified person must be developed and implemented during the continuation of the environmental authority. The Mining Waste Management Plan must at a minimum include:

a) characterisation programs to ensure that all mining waste is progressively characterised during disposal for net acid producing potential, salinity and the following contaminants: pH, Electrical Conductivity (EC), Acid Neutralising Capacity (ANC), Net Acid Generation (NAG) (reporting NAG capacity and NAG pH after oxidation), Net Acid Producing Potential (NAPP), Total Sulfur (S), Chromium Reducible Sulfur (Scr), Boron (B) Cadmium (Cd), Iron (Fe), Aluminium (Al), Copper (Cu), Magnesium (Mg), Manganese (Mn), Calcium (Ca), Sodium (Na), Zinc (Zn) and Sulfate (SO_4).

b) characterisation programs to ensure that the physical properties of the mining waste is progressively characterised during disposal;

c) the availability or leachability of metals from the mining waste;

d) quantity of PAF mining waste;

e) review potential impacts of PAF mining waste on the success of proposed rehabilitation methods;

f) management actions for mining waste that has been identified as having a high availability or leachability of metals in accordance with condition F8-1;

g) management actions for mining waste that has been defined as PAF;

h) identification of environmental impacts and potential environmental impacts;

i) control measures for routine operations to minimise likelihood of environmental harm;

j) contingency plans and emergency procedures for non-routine situations; and

k) periodic review of environmental performance and continual improvement.

Acid mine drainage and leachate management

(F8-1) Subject to the release limits defined in C1 to C52, all reasonable and practicable measures must be implemented to prevent hazardous leachate being directly or indirectly released or likely to be released as a result of the activity to the environment.

Storage and handling of flammable and combustible liquids

(F9-1) All flammable and combustible liquids must be contained within an on-site containment system and controlled in a manner that prevents environmental harm and maintained in accordance with the current version of AS 1940 – Storage and Handling of Flammable and Combustible Liquids.

(F9-2) Spillage of all flammable and combustible liquids must be controlled in a manner that prevents environmental harm.

Storage and handling of chemicals

(F10-1) All chemicals must be contained within an on-site containment system and controlled in a manner that prevents environmental harm and maintained in accordance with the current version of the relevant Australian Standard.

(F10-2) Spillage of all chemicals must be controlled in a manner that prevents environmental harm.

Coal Handling and Preparation Plant Waste

(F11-1) Waste from the Coal Handling and Preparation Plant must be disposed of in:

a) regulated dams in accordance with conditions in Schedule G of this environmental authority if the residual shear strength of the waste is less than 1000 Pascals prior to disposal; or

b) the Authorised Spoil Disposal Areas in accordance with conditions in Schedule E if the residual shear strength of the waste is equal or more than 1000 Pascals prior to disposal.

Spoil disposal facility - certification and operation

(F12-1) Authorised spoil disposal facilities, used for the disposal of waste are located within the control points defined in Table 17 (Location of spoil disposal facility).

Table 3.7.9 Location of spoil disposal facility

Name of Spoil Disposal Facility	Control Points	
	Easting (GDA 94)	**Northing (GDA 94)**
Caval Ridge Spoil Dumps	(A list of control points to be provided by the proponent)	(A list of control points to be provided by the proponent)

(F12-2) Spoil disposal facility(s) shall be designed to prevent environmental harm arising from contaminants being generated in the facility, leachate and runoff from the facility or other sources.

(F12-3) Authorised spoil disposal facility(s) must be constructed and maintained in accordance with certified design plans, submitted to the administering authority.

(F12-4) Design plans for the authorised spoil disposal facility(s) must include performance indicators, such that:

a) during operations the spoil disposal facility(s) will be operated with minimal or no potential for adverse environmental harm resulting from collapse of any component of facility; and

b) the potential for leachate generation will be minimal or non existent; and

c) adequate drainage structures, erosion protection and storage are provided to manage seasonal and rare rainfall events with minimal or no environmental harm.

(F12-5) Construction of any spoil disposal facility detailed in Table 17 (Location of spoil disposal facilities) must not commence unless:

a) the environmental authority holder has submitted to the administering authority two copies of a design plan; and

b) certification from a suitably qualified and experienced person that the design of the spoil disposal facility(s) will deliver the performance stated in that design plan and that it will be compliant in all other respects with this environmental authority, and

c) at least 20 business days has passed since the receipt of those documents by the administering authority; or

d) the administering authority notifies the environmental authority holder that a design plan and certification, has been submitted for that disposal facility.

Operational plan – Spoil disposal facility

(F13-1) An operational plan must be developed and maintained for the spoil disposal facility. The operational plan must include but not be limited to:

a) description of landform development stages of the spoil disposal facility;

b) placement technique for spoil and waste material from the coal handling and processing plant on the Caval Ridge mine site;

c) management of any containment structures within the spoil disposal facility designed to contain materials from the coal handling an processing plant on the Caval Ridge mine site;

d) demonstration of how operations of the spoil disposal facility are consistent with the accepted design plan for the facility; and

e) decommissioning and rehabilitation strategies for the spoil disposal facility that demonstrate consistency with conditions of this Environmental Authority.

Exploration

(F14-1) Disturbance due to exploration activities in areas not scheduled to be mined must be rehabilitated in accordance with provisions detailed in the Code of Environmental Compliance for Exploration and Mineral Development Projects.

END OF CONDITIONS FOR SCHEDULE F

3.8 Landscape Character and Visual Amenity

3.8.1 Background

Landform

Topography across the Isaac River Valley in the vicinity of the project site varies from approximately 200 m elevation along the Isaac River east of the project site to approximately 450 m elevation along portions of the Denham Range that define the western edge of the Isaac River Valley. This variation in elevation is over a distance of approximately 25 km and represents an average gradient of approximately 1v:100h. The relatively steep slopes associated with the Denham Range, contrast with the extensive flat areas along the base of the valley, which have gradients significantly less than 1v:100h. Drainage along the western slopes of the Isaac River Valley generally takes the form of deeply incised gullies flowing east and north-east towards the Isaac River. The northern portion catchments of the project site generally drain north-east to the Isaac River while the southern portion catchments of the project site generally drain south-east to the Isaac River. Drainage lines are generally not deeply incised or visually prominent in most of the project site. However, steep embankments and the woodland vegetation associated with Cherwell Creek create a more visually distinctive landscape character in the central portion of the project site.

Mining Operations

While current open cut coal mining operations are visually prominent in many locations within the Bowen Basin they are generally not visible from the sections of Peak Downs Highway or Moranbah Access Road that adjoin the project site. An exception is the northern part of Peak Downs Mine in which the upper portions of the overburden stockpiles are visible in views to the south-west from some elevated sections of the Peak Downs Highway. However, these visible portions are not dominant due to the view distance, which is in the order of 5 km, and the lower portions of the overburden landform generally being screened by remnant woodland vegetation and local landforms. The Peak Downs mining operations do form a visually prominent element in the landscape along sections of the Dysart-Moranbah Access Road that runs close to the mine at a point approximately 10 km south of the Peak Downs Highway turnoff.

Commercial and Industrial Development

Commercial and industrial developments in the vicinity of the project site are generally limited in extent and do not form visually prominent elements across the landscape. They include:

- The Shell Roadhouse located at the Moranbah turnoff from the Peak Downs Highway;
- The truck and machinery service facilities (Kalari Workshop and Trucking Yard) located alongside the Moranbah Access Road at the northern end of the project site;
- The Moranbah Airport. Signage associated with the airport also forms a visual feature for motorists travelling along the Moranbah Access Road. The elevated location of the airport in relation to the road contributes to the visual prominence of aircraft and the terminal buildings.

Moranbah Township

Moranbah is visually integrated into the landscape setting largely due to the extensive tree cover within and around the township. Some elements such as the white water tower and other large structures are visible

from the section of Moranbah Access Road adjoining the project site, when approaching the township from the south.

Roads

Peak Downs Highway forms the main transport route between Mackay and Central Queensland. In addition to carrying regional and local traffic associated with mining and agricultural activities, it also functions as a major tourist route. The highway is mostly a two-lane undivided bitumen sealed road with passing lanes at various locations. While the highway generally follows the natural landform, there are a number of bridges and culverts at creek and river crossings with associated roadside cuttings. Consequently views from the section of Peak Downs Highway in the vicinity of the project site alternate between open long distance views across cleared grazing land and sections that are visually enclosed by woodland vegetation and roadside cuttings. The section of Peak Downs Highway passing through the central portion of the project site is generally adjoined by woodland vegetation that blocks views from the highway.

Moranbah Access Road provides the main entrance to Moranbah township from the Peak Downs Highway. It is a two-lane undivided bitumen sealed road that generally follows the undulations of the natural landform. The only significant cutting occurs where the road crosses over a prominent hill approximately 2 km north of the Peak Downs Highway turnoff. The section of Dysart-Moranbah Road running south from Peak Downs Highway is generally parallel to the eastern boundary of the project site at a distance of approximately 3 km. Views towards the project site from the Dysart-Moranbah Road are generally screened by woodland vegetation associated with drainage lines located between the road and project site. Views of existing Peak Downs Mine overburden landforms in the southern portion of the project site are visible from the Dysart-Moranbah Road where it comes closer to the boundary at about 10 km south of the Peak Downs Highway turnoff.

Landscape Quality

The landscape quality of the project site has been significantly altered by agricultural land uses over many years and more recently by open cut mining. An assessment of the current landscape quality was carried out for the project EIS using a methodology that has been adapted from the United States Bureau of Land Management (BLM) methodology (1984). The assessment criteria used are defined in Table 3.8.1 and the maximum potential rating for each of the criteria is shown by a number in the bottom right corner of each cell.

Table 3.8.1 Scenic Quality Ratings Table (Source: BLM, 1984)

Key Factors	Rating Criteria and Scores		
Landform	High vertical relief as expressed in prominent cliffs, spires or massive rock outcrops or severe surface variation or highly eroded formations or detailed features, dominant and exceptionally striking and intriguing.	Steep valleys, volcanic cones, hills or ridges; or interesting erosion patterns or variety in size and shape of landforms; or detailed features which are interesting though not dominant or exceptional.	Low rolling hills, foothills or flat valley bottoms or few or no interesting landscape features
	5	3	1
Vegetation	A variety of vegetative types has expressed in interesting	Some variety of vegetation, but only one	Little or no variety or contrast to vegetation

Key Factors	Rating Criteria and Scores		
	forms, textures and patterns	or two major types	
	5	3	1
Water	Clear and clean appearing, still or cascading white water and any of which are a dominant factor in the landscape	Flowing or still, but not dominant in the landscape	Absent or present, but not noticeable
	5	3	0
Colour	Rich colour combinations, variety or vivid colour or pleasing contrast in the soil, rock, vegetation, water or snowfields	Some intensity of variety in colours and contrast of soil, rock and vegetation, but not a dominant scenic element	Subtle colour variations, contrast or interest; generally muted tones
	5	3	1
Influence of adjacent scenery	Adjacent scenery, greatly enhances visual quality	Adjacent scenery moderately enhances overall visual quality	Adjacent scenery has little or no influence on overall visual quality
	5	3	0
Scarcity	One-of-a-kind or unusually memorable or very rare within the region. 5+	Distinctive, though somewhat similar to others within the region 3	Interesting within its setting, but fairly common within the region 1
	5+	3	1
Cultural modifications	Modifications add favourably to visual variety while promoting visual harmony	Modifications add little or no visual variety to the area and introduce no discordant elements	Modifications add variety, but are very discordant and promote strong disharmony
	2	0	-4

The maximum potential rating that could be achieved is 32. This rating would apply to a landscape that was assessed as meeting all of the criteria in the left hand column. The Scenic Quality Rating Categories defined in the BLM system are:

19 - 32 = High

12 - 18 = Medium

11 or less = Low

The Scenic Quality of the project site was assessed by applying the criteria in Table 3.8.1 and allocating a rating for each factor. Results of the assessment are presented in Table 3.8.2.

Table 3.8.2 Scenic Quality Rating of the project site

Key Factors	Rating	Comments
Landform	3	Undulating landform with distinct ridge line
Vegetation	3	Remnant clumps or individual trees and regrowth with pasture grass dominant ground cover
Water	0	No significant bodies of permanent water in drainage lines or visible in the landscape
Colour	3	Colour contrast between pasture grasses and patches of shrub/woodland; patches of red soil visible along edges of central ridge
Influence of adjacent scenery	3	Views to forest-covered range to west of project site as well as trees along some sections of drainage line create visual contrast with pasture on most of the project site
Scarcity	3	The landscape character of the project site is distinctive in the regional setting
Cultural modifications	0	Cultural modifications include fencing, structures, signs and powerlines that add little visual variety to the area
Total	15	

The rating of 15 out of a possible 32 indicates that the Scenic Quality of the project site is considered to be Medium in accordance with the BLM system.

Visual Amenity

The estimated Viewshed of the project site is indicated on Figure 3.8.1. Key aspects of the Viewshed are:

- The hill located in the centre of the project site is visible from some locations in the eastern portion of Moranbah township, which is located approximately 10 km to the north, but the areas of lower elevation in the northern portion of the project site are screened from view by the low ridge on which Railway Siding Road is located;
- Potential views from Moranbah township to the portion of the project site south of Peak Downs Highway are blocked by the central hill;
- The project site is potentially visible from locations along the lower slopes of the Denham Ridge but the extensive vegetation cover would generally block most of these potential views;
- Views from the section of Peak Downs Highway that runs through the centre of the project site are generally blocked by roadside woodland vegetation;
- The project site is highly visible to motorists travelling west along the section of Peak Downs Highway commencing approximately 3 km east of the Moranbah Access Road turn and extending to the Dysart – Moranbah Access Road turnoff;
- The project site is highly visible from most of Moranbah Access Road north of the Peak Downs Highway to the turn off to Long Pocket Road; exceptions are where the road passes through a cutting on the hill top about 2 km north of the Peak Downs Highway turnoff and near the Railway Siding Road turnoff, where views are blocked by roadside cut slopes and vegetation;

- The upper portions of the central hill in the of the project site are likely to be visible from rural areas between Moranbah Access Road and the Isaac River but the extent of visibility varies locally as a result of vegetation and local landforms; and
- The portion of project site south of the Peak Downs Highway is generally not visible from the highway due to screening by woodland vegetation; similarly potential view of the site from or the Dysart-Moranbah Road are generally blocked by woodland vegetation associated with the broad floodplain located between the road and the site. Views of the tops of the overburden stockpiles associated with the Peak Downs Mine are available from a limited number of locations.

Key Landscape Features

The key landscape features that comprise the visual character of the project site and surrounding areas include the Isaac River, Moranbah township, public roads (Peak Downs Highway, Moranbah Access Road, and Dysart-Moranbah Road), Moranbah Airport and Moranbah railway station.

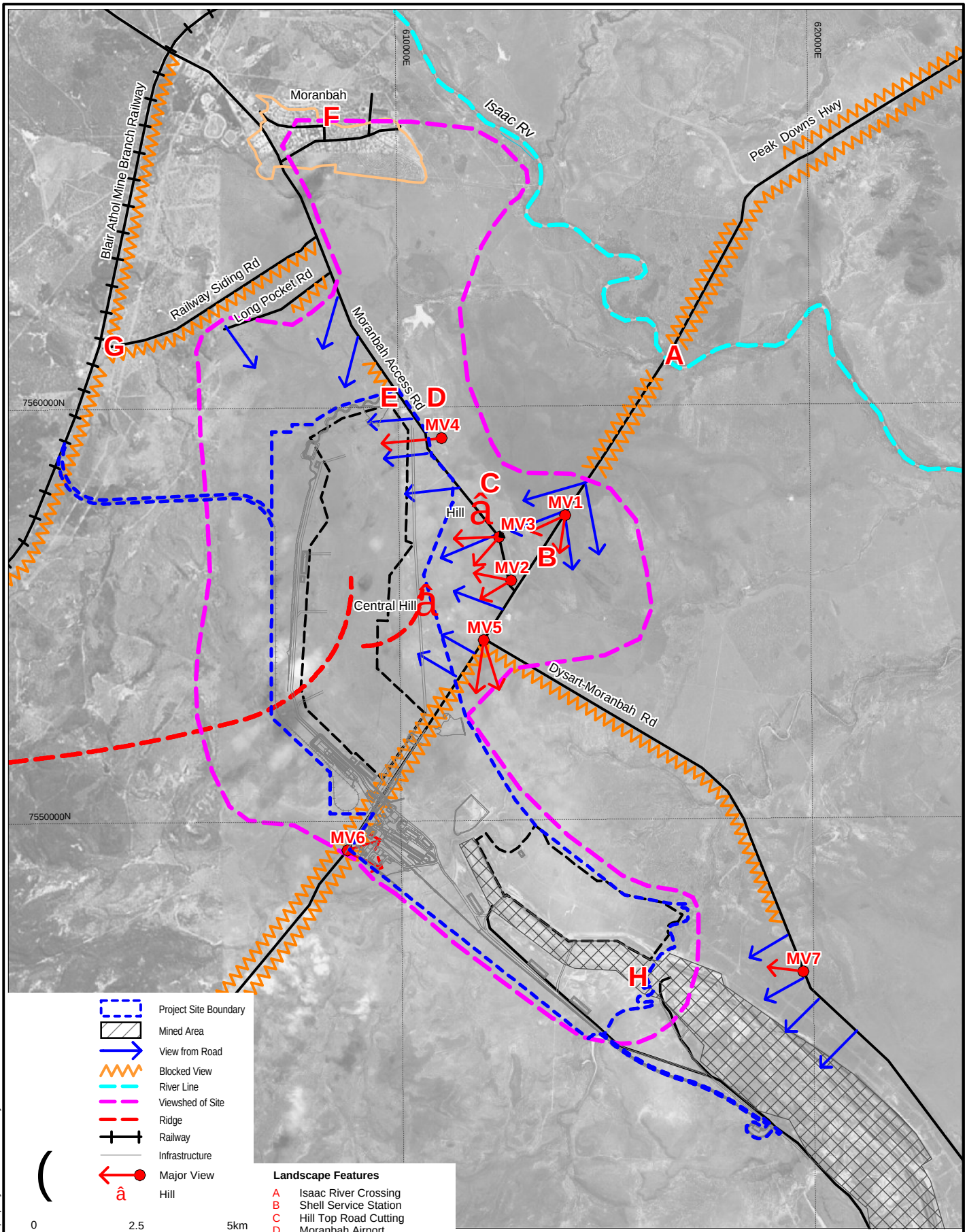
Landscape Significance of the Project Site

At a local level the project site is highly significant as it forms part of the entrance zone into Moranbah township. All traffic travelling into and out of Moranbah from the Peak Downs Highway must drive past the northern portion of the project site. In the vicinity of the Moranbah Airport the boundary of the project site immediately adjoins the Moranbah Access Road. The project site also forms a major part of the visual experience of passengers arriving at the Moranbah Airport as it is not only visible from aircraft landing and taking off but also from vehicles driving out of the airport onto Moranbah Access Road.

The project site is also significant in a regional landscape context as it is visible from sections of the Peak Downs Highway, which carries significant volumes of regional traffic between Mackay, Clermont, Emerald and other Central Queensland towns. However, the landscape character of the project site is similar to extensive sections of landscape along the Peak Downs Highway.

Project Site Capacity to Visually Absorb Change

The generally open visual character of the portion of project site north to Peak Downs Highway means that any significant change to land use would be visible from the adjoining public roads, airport and residents. The hill located near the centre of the project site is visible from surrounding areas and forms a landmark for motorists travelling along the Peak Downs Highway, particularly those travelling to and from Moranbah township. However it does block views of the portion of the project site to the west and thus provides some visual absorption capacity. The portion of the project site south of the Peak Downs Highway has a moderate capacity to visually absorb change due to the extensive remnant woodland vegetation associated with the broad drainage channels located between the road and the project site. Consequently it has a low capacity to visually absorb development that involves construction of substantial structures. However, the woodland vegetation south of Peak Downs Highway provides some capacity to visually absorb development provided an adequate buffer strip of trees is maintained along the roadside.



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Client: BHP Billiton Mitsubishi Alliance

Project: CAVAL RIDGE MINE
DRAFT ENVIRONMENTAL MANAGEMENT PLAN

Title: **PROJECT SITE VISIBILITY**

Drawn: TE/VH	Approved: RS	Date: 30-10-2009
Job No: **4262 6420** /6158	File No: 42626158-g-2321.wor	

Figure: **3.8.1**

Rev:B

A4

Screening by Existing Vegetation

Remnant woodland vegetation in the portion of the project site south of Peak Downs Highway provides effective screening of potential views to the south. Current open cut mining is generally not visible from this section of the highway due to screening by the existing woodland vegetation. Similarly views of the overburden landforms from the Dysart-Moranbah Road are generally screened by trees along the broad drainage channels south-west of the road.

Potential views to the north across the project site from the Peak Downs Highway are also screened to some extent by existing vegetation along the northern edge of the highway. However, the upper portions of the central hill of the project site are often visible in these views. The existing grassland vegetation over most of the northern portion of the project site does not screen views from the adjoining sections of Moranbah Access Road or Peak Downs Highway. However woodland vegetation adjoining Moranbah Access Road south of Railway Siding Road screens views of part of the project site.

3.8.2 Environmental Values

The environmental values at the project site that are to be protected or enhanced are:

- The integrity of the landscape character of the project site within its local and regional context; and
- The visual amenity experienced by local residents and visitors to the area.

3.8.3 Potential Impacts on Environmental Values

Potential visual impacts associated with the project will result primarily from the construction and operation of:

- Out-of-pit overburden dumps
- New overpass along the Peak Downs Highway
- CHPP structures
- Coal loading facilities
- Administration buildings.

Visual impacts of the project on the various view situations identified in this section will vary throughout the 30-year period of mining and site rehabilitation works. For example the visual impact of the mining operations on a particular view situation will increase as the mining moves closer to it. Similarly, the visual impact of out-of-pit overburden dumps will be greatest immediately after they are created and will decline as they are regraded and vegetation established on the visible slopes. Due to this variation in potential visual impact over the life of the mine, the results presented in this section are an overall assessment that takes account of visual impacts throughout the full 30-year period of the project.

The two principal sections of public road that adjoin areas where mining operations will be carried out are Moranbah Access Road near the airport, and the section of Peak Downs Highway that passes though the centre of the project site.

The operating face of the mining operations that will adjoin Moranbah Access Road will run parallel to the road and be oriented away from it. Consequently lighting on the draglines and other equipment will generally not visible from the road as it will face away from the road and the mining operations will be blow the natural

ground surface. However, the upper portion of the active slope created by dumping overburden material will above the natural ground surface elevation and will face towards Moranbah Access Road. Consequently lighting on trucks and the spreader used in placing the overburden may be visible from the road. However proposed mitigation measures include earth mounding and tree planting alongside Moranbah Access Road to block views of the mining operations both daytime and at night. It should be noted that mining operations only come within 1 km of the Moranbah Access Road during the last 5 years of the planned 30 year life of the mine.

The operating face of the mining operations adjoining the northern edge of Peak Downs Highway will be oriented at right angles to the road alignment. Consequently there will be a significant difference between the views of motorists depending on the direction of travel. Motorists travelling to the west will potentially see the lights of vehicles and equipment operating on top of the overburden slope. Lighting associated with the coal extraction face will be below the natural ground surface and therefore generally not directly visible. For motorists travelling east along Peak Downs Highway the lighting on vehicles and equipment operating on the overburden landform will not be directly visible because the slope will be oriented away from the viewer. In addition the existing woodland vegetation adjoining this section of the Highway would provide substantial visual screening of potential views to the mining operations. As the mining operations that will adjoin the northern edge of Peak Downs Highway are planned to take place over the 30 year life of the mine it will be necessary to minimise the potential visual impact form lighting associated with mining operations as well as the coal processing facilities.

The potential visual impact of the project depends on extent to which the development will be visible (Visibility) and the significance of the visible change to the landscape that may result from the development. The level of significance of the potential visual impact of the project is dependent on the Magnitude of Visibility of change to existing views together with the Sensitivity of the viewers to that change. The Magnitude of Visibility of change to existing views will depend on a combination of scale, extent and duration of the views. It would be influenced by the:

- Extent of area from which the project development would be visible
- Number and type of viewers who see the development
- Distance of the view to the development
- Duration of change to the view (i.e. temporary or permanent, continuous or intermittent) that would result from the development
- Scale of change to the view that would result from the development (i.e. proportion of the view occupied by the development)
- Degree of contrast between the development and the existing landscape in terms of form, scale, line, height, colour and texture.

Viewer Sensitivity is the extent to which a viewer is willing to accept a change to the landscape resulting from the development without perceiving it as an adverse impact on the existing landscape character or value attributed to the current view. Viewer Sensitivity may range from high to low and is dependent on the:

- Location of the viewer (e.g. dwelling, workplace, recreation/open space, road/highway)
- Context of the view (e.g. visibility of existing mines, power lines)

- Expectations and activity of the viewer (e.g. resident, visitor, worker, motorists, cyclists, pedestrian, recreation/sporting participant)
- Importance of the view (e.g. identified in regional scenic resources assessment, referenced in tourist maps/guides, numbers of people deliberately seeking the view, reference to the view in literature and art).

Viewers with the highest sensitivity levels are likely to include:

- Residents with views affected by the development
- Users of public open space where their attention is focused on visual landscape values, such as scenic lookouts, natural landscape areas with attractive views
- Communities where the development would result in changes to the landscape setting of views that are valued by the community.

The various levels of Visual Impact Significance that result from the combinations of Magnitude of Visibility and Viewer Sensitivity are presented in Table 3.8.3, and are defined as:

- Negligible Visual Impact - only a very small part of the development would be discernible and/or it would be located at such a distance that it would be scarcely visible
- Low Visual Impact - the development would constitute only a minor component of the wider view and might be missed by the casual observer or awareness of the development would not have a marked effect on the overall quality of the view
- Moderate Visual Impact - the development may form a visible and recognisable new element within the overall scene and may be readily noticed by an observer
- High Visual Impact - the development would form a significant and immediately apparent part of the view that would affect and change its overall character (the change may be positive or negative).

Table 3.8.3 Visual Impact Significance Matrix

	Viewer Sensitivity		
Visibility Magnitude	**Low**	**Medium**	**High**
High	Moderate	Moderate/High	High
Medium	Low/Moderate	Moderate	Moderate /High
Low	Low	Low/Moderate	Moderate
Negligible	Negligible	Negligible/Low	Low

Note: the levels of Visual Impact Significance in shaded cells are not considered to be significant enough to constitute potential barriers of the development or land use change. However mitigation measures may still be required.

The visual assessment involved:

- Analysis of the existing landscape character
- A field inspection to determine the extent to which the site is generally visible
- Identification of the various viewing situations from which the project may potentially be visible from surrounding areas.

Particular attention was given to potential views of the site from residents, Moranbah township, Peak Downs Highway, other public roads, and areas adjoining the project site. Views from the site were analysed to identify the extent to which the residents and public roads were visible from the site, which provided an indication of the likely level of visibility from those residents and sections of road. This analysis was based on the principle of intervisibility, which means that if a dwelling or section of road is visible from the site then the site would be visible from those viewing situations. The various criteria used to determine Magnitude of Visibility are defined in Table 3.8.4.

Table 3-8.4 Magnitude of Visibility Assessment Criteria

Criteria	Definition
Number of Viewers	
High	>5,000 people per day
Moderate	1,000-5,000 people per day
Low	100-1,000 people per day
Very Low	<100 people per day
View Distance	
Long	>5 km
Medium	1-5 km
Short	200-1,000 m
Very short	<200 m
Period of View	
Long term	>2 hrs
Moderate term	1 minute to 2 hours
Shirt term	< 1 minute

The levels of Magnitude of Visibility resulting from combination of the various criteria in Table 3.8.4 are presented in Table 3.8.5. These categories of Magnitude of Visibility are defined further below.

Table 3.8.5 Magnitude of Visibility Matrix

	Long Distance			**Medium Distance**			**Short Distance**			**Very Short Distance**		
Period of View	**Long**	**Medium**	**Short**	**Long**	**Medium**	**Short**	**Long**	**Medium**	**Short**	**Long**	**Medium**	**Short**
No. of viewers - High	M	L	L	H	M	M	H	H	M	H	H	H
No. of viewers - Medium	L	L	N	M	M	L	H	M	M	H	H	M
No. of viewers - Low	L	N	N	M	L	L	M	M	L	H	M	M
No. of viewers - Very Low	N	N	N	L	N	N	L	L	L	M	L	L

Note: N = negligible Magnitude of Visibility
L = low Magnitude of Visibility
M= medium Magnitude of Visibility
H = high Magnitude of Visibility

Negligible Magnitude of Visibility is defined as very minor loss or alteration to one or more key element/features/characteristics of the baseline visual character (i.e. pre-development landscape or view) and/or introduction of elements that are not uncharacteristic to the existing landscape (i.e. approximating the 'no change' situation).

Low Magnitude of Visibility is defined as minor loss of/or alterations to one or more key elements/features/characteristics of the baseline visual character (i.e. pre-development landscape or view) and/or introduction of elements that are not uncharacteristic of the existing landscape.

Medium Magnitude of Visibility is defined as partial loss of or alteration to one or more key elements/features/characteristics of the baseline visual character (i.e. pre-development landscape or view) and/or introduction of elements that may be prominent but not considered to be substantially uncharacteristic of the existing landscape.

High Magnitude of Visibility is defined as total loss of key elements/features/characteristics of the baseline visual character (i.e. pre-development landscape or view) and/or introduction of elements considered to be totally uncharacteristic of the existing landscape.

View Situations and Simulations

The locations of the various view situations (VS) assessed are shown on Figure 3.8.8. A series of visual simulations show how the final landform to be created by the proposed mining operations would appear in the landscape (locations shown on Figure 3.8.8). The simulations are of views from:

- View Situation 11, at the entrance to Moranbah Airport (Visual Simulation 1)
- View Situation 13, along Moranbah Access Road north of the intersection with Peak Downs highway (Visual Simulation 2)
- View Situation 19, along Dysart-Moranbah Road south of the intersection with Peak Downs highway (Visual Simulation 3)

Visual Simulation 1

The visual simulation presented in Figure 3.8.2 illustrates how the final landform would appear from View Situation 11 at the entrance to the Moranbah Airport from the Moranbah Access Road. A high visual impact would result at this location as a result of the new landform to be created by the proposed mining operations. The vegetation located close to the viewer, such as the small flowering tree in the centre of the photograph, could effectively screen views of the new landform. Such planting would need to include tall-growing trees planted dense enough to create a continuous visual screen. The existing long distance view is illustrated in Figure 3.8.3 extends well beyond the project site to mountain the range on the skyline.

Visual Simulation 2

The visual simulation presented in Figure 3.8.4 shows the final landform viewed from View Situation 13 along the Moranbah Access Road north of the intersection with the Peak Downs Highway. The existing ridgeline would partly screen views of the lower slopes of the new landform but the upper slopes will be visible, resulting in a moderate visual impact. The existing view from Moranbah Access Road is illustrated in Figure 3.8.5. The view extends across grazing paddocks in the mid distance to the hill and ridge on the skyline.



Figure 3.8.2 Visual Simulation of View from View Situation 11

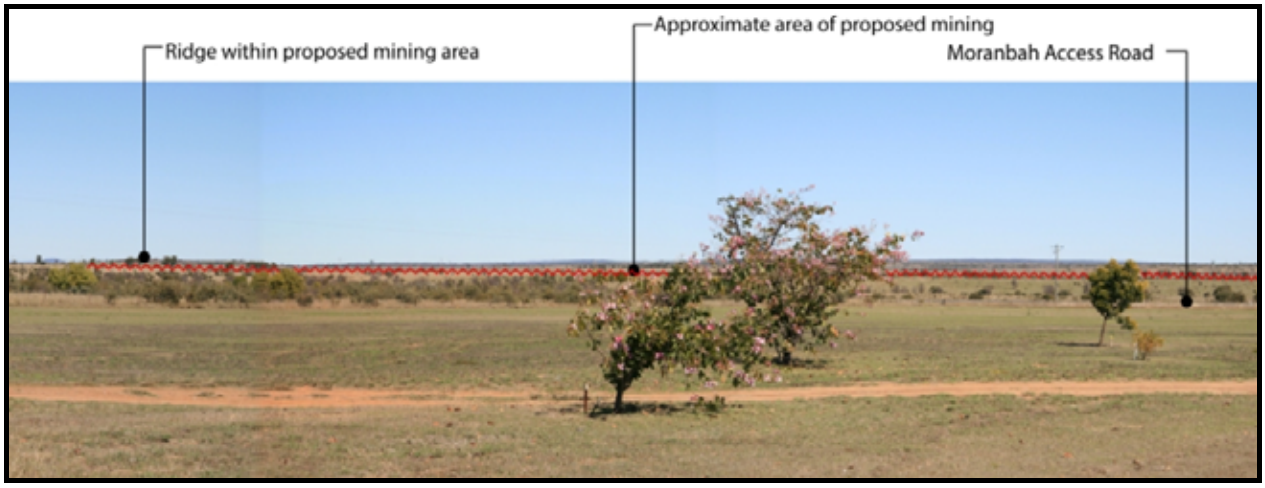


Figure 3.8.3 Existing View from Moranbah Airport (11)

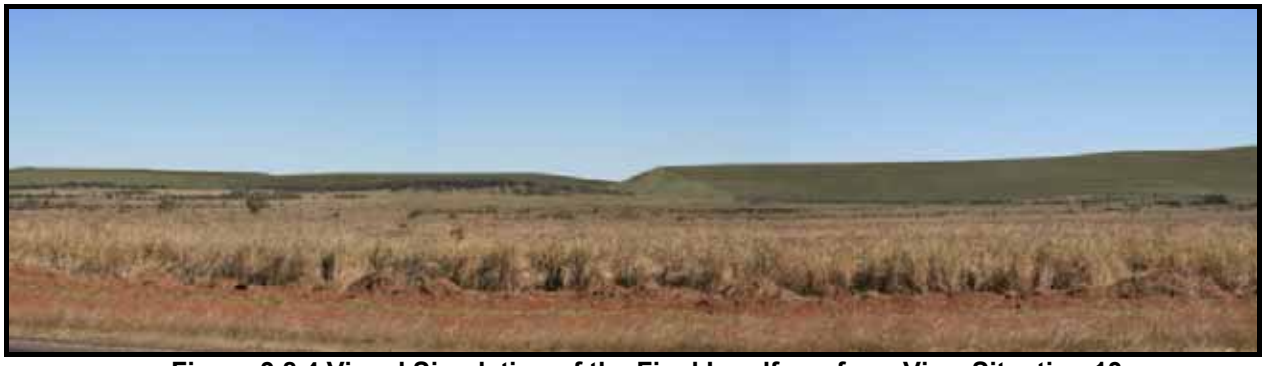


Figure 3.8.4 Visual Simulation of the Final Landform from View Situation 13

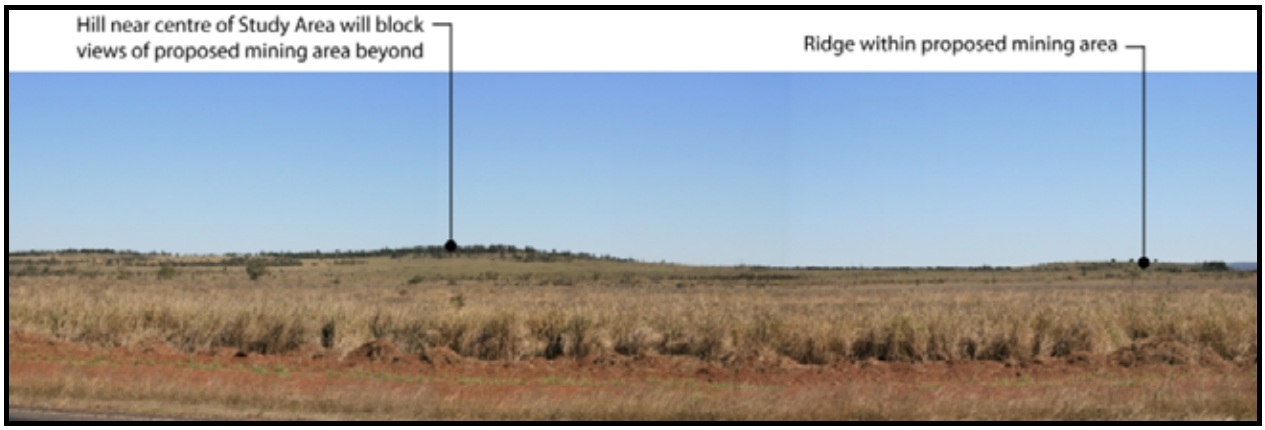


Figure 3.8.5 Existing View from Moranbah Access Road

Visual Simulation 3

The visual simulation presented in Figure 3.8.6 shows the final landform viewed from View Situation 19 along the section of Dysart-Moranbah Road south of the intersection with the Peak Downs Highway. The steep slopes in the centre of the landform are associated with a cutting through the new landform. The existing landform between the road and the mine site would partly screen views of the lower slopes of the new landform, but the upper slopes will be visible. The simulation also demonstrates if earth mounding was carried out near the road edge and planted with trees then views of the new landform could be screened as the trees matured.

The existing view from Dysart-Moranbah Road looking toward Peak Downs Mine is illustrated in Figure 3.8.7. The view extends across grass-covered grazing paddocks in the mid distance to the Peak Downs Mine overburden landforms with the Denham Range visible on the skyline.



Figure 3.8.6 Visual Simulation of View of the Final Landform from View Situation 19



Figure 3.8.7 Existing View from Dysart-Moranbah Road

Visual Impact Assessment

The assessment of significance of potential visual impact is based primarily on an analysis of the View Situations mentioned above (Table 3.8.6 and Figure 3.8.8).

Table 3.8.6 Visual Impact Assessment

View Situation	Category Of Viewer	Approx. Distance To Mine	Approx. Period Of View	Relative No. Of Viewers	Magnitude Of Visibility	Viewer Sensitivity	Visual Impact Significance	Comments
VS 1. Recreation Reserve Moranbah Township	Sports participants and spectators	L	M	L	N	L	N	Views to proposed mining area blocked by vegetation and landform
VS 2. Mills Av. Moranbah	Residents, motorists and pedestrians	L	S	M	N	L	N	Views to proposed mining area blocked by houses. No photograph is presented for this reason
VS 3. Federation Walking Track and Moranbah Access Rd.	Pedestrians and motorists	L	S	M	N	M/L	N	Views to proposed mining area blocked by vegetation and landform
VS 4. Moranbah Access Rd. and roadside rest area	Motorists	L	S	M	N	M/L	N	Views to proposed mining area blocked by vegetation and landform
VS 5. Railway Siding Rd.	Motorists	M	M	L	N	M	N	Views to proposed mining area blocked by vegetation and landform
VS 6. Moranbah Access Rd. toward airport	Motorists	M	M	M	L	M	L/M	Views to proposed mining area partly blocked by vegetation and landform
VS 7. Long Pocket Rd. (east)	Motorists	M	S	VL	N	L	N	Views to proposed mining area blocked by vegetation and landform
VS 8. Long Pocket Rd. (south)	Motorists	M	M	VL	N	L	N	Views to proposed mining area partly blocked by vegetation and landform
VS 9. South along Moranbah Access Rd.	Motorists	M	M	M	M	M	M	Views to proposed mining area partly blocked by vegetation and landform
VS 10. View from Moranbah Airport	Passengers and airport staff	S	M	M	M	M	M	Views from terminal and entrance road are directly towards the proposed mining area
VS 10a. Aircraft in flight	Passengers and aircrew	L	M	L	L	M	L/M	Views only available from window seats on one side of the aircraft
VS 11. West from Moranbah Access Rd.	Motorists	VS	M	M	H	M	H	Proposed mining operations will immediately adjoin the road

View Situation	Category Of Viewer	Approx. Distance To Mine	Approx. Period Of View	Relative No. Of Viewers	Magnitude Of Visibility	Viewer Sensitivity	Visual Impact Significance	Comments
VS 12. West and north from Moranbah Access Rd.	Motorists	S	S	M	M	M	M	Views of mining area will be partly screened by landform and vegetation
VS 13. North and north-west from Moranbah Access Rd.	Motorists	M	M	M	M	M	M	Central hill in project site will partly screen views of mining area
VS 14. North-west from Peak Downs Hwy.	Motorists	L	M	M	L	M	L/M	Central hill in project site will partly screen views of mining area
VS 15. North-west from Peak Downs Hwy.	Motorists	L	M	M	L	M	N	Views to proposed mining area blocked by vegetation and landform
VS 16. North from Peak Downs Hwy.	Motorists	M	M	M	M	M	M	Views to proposed mining area partly blocked by ridge and vegetation
VS 17. East and west along Peak Downs Hwy.	Motorists	VS	M	M	H	M	H	Views to proposed mining area and coal handling facilities may be partly blocked by woodland vegetation if it is retained along road corridor
VS 18. Peak Downs Hwy.	Motorists	M	M	M	N	M	N	Views to proposed mining area blocked by vegetation and landform
VS 19. North along, and south-west from, Dysart-Moranbah Rd.	Motorists	M	M	M	M	M	M	View from Road travelling north is focused towards Central Hill in project site that blocks views to proposed mining area
VS 20. West from Dysart-Moranbah Rd.	Motorists	M	M	M	M	M	M	Long distance view includes Peak Downs Mine overburden
VS 21. North-west from Dysart-Moranbah Rd.	Motorists	M	M	M	N	M	N	Views to proposed mining area blocked by vegetation and landform
VS 22. North from Dysart-Moranbah Rd.	Motorists	M	M	M	M	M	M	Peak Downs Mine overburden visually prominent

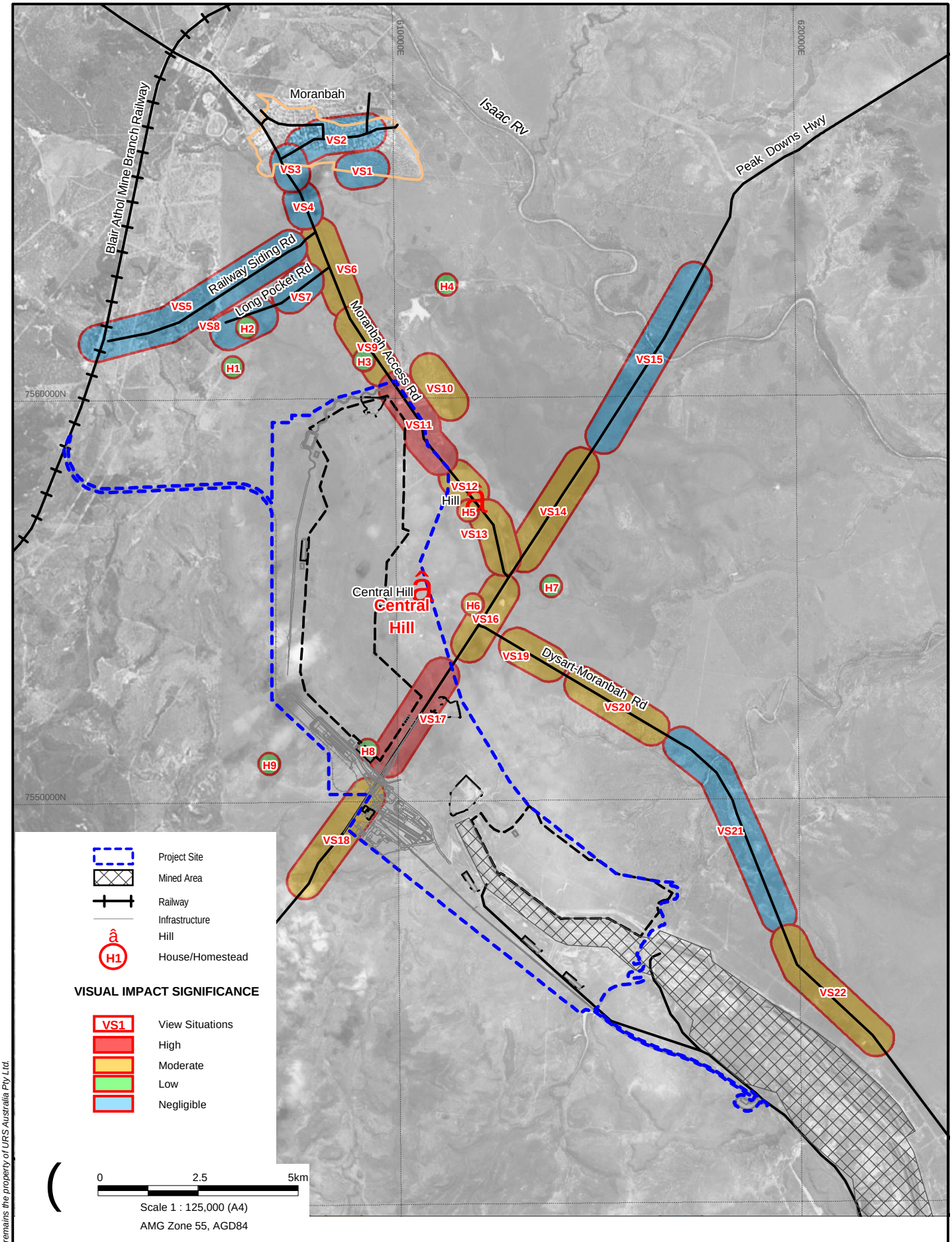
View Situation	Category Of Viewer	Approx. Distance To Mine	Approx. Period Of View	Relative No. Of Viewers	Magnitude Of Visibility	Viewer Sensitivity	Visual Impact Significance	Comments
Houses								
H1. Long Pocket Rd. – House 1	Residents	M	M	VL	N	H	L	Views to proposed mining area partly blocked by trees and landform
H2. Long Pocket Rd. – House 2	Residents	M	M	VL	N	H	L	Views to proposed mining area partly blocked by trees and landform
H3. Mitchell Residence	Residents	M	M	VL	N	H	L	Views to proposed mining area generally blocked by woodland vegetation
H4. Grosvenor Downs Residences	Residents	M	M	VL	N	H	L	
H5. Cattery and Residence	Residents	VS	M	VL	L	H	M	
H6. Homery Residence	Residents	S	M	VL	L	H	M	Central hill on project site partly blocks views of proposed mining area
H7. Muirehead Residence	Residents	M	M	VL	N	H	L	Central hill on project site partly blocks views of proposed mining area
H8. Batchelor Residence	Residents	M	M	VL	N	H	L	
H9. Buffel Park Residence	Residents	M	M	VL	N	H	L	

Note: N = negligible Magnitude of Visibility

L = low Magnitude of Visibility

M = medium Magnitude of Visibility

H = high Magnitude of Visibility



Source: Image from Google Earth 2007

Client: BHP Billiton Mitsubishi Alliance	Project: CAVAL RIDGE MINE DRAFT ENVIRONMENTAL MANAGEMENT PLAN	Title: **VISUAL IMPACT SIGNIFICANCE**	
URS	Drawn: TE/VH	Approved: RS	Date: 30-10-2009
	Job No: **4262 6158** /6158	File No: 42626158-g-2322b.wor	Figure: **3.8.8** Rev:B A4

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3.8.4 Environmental Protection Objective

The environmental protection objective is to ensure that the integrity of the local and regional landscape character and the visual amenity of the area are not significantly adversely affected as a result of the project.

3.8.5 Performance Criteria

The performance criteria for visual amenity are:

- Compliance with the requirements of the project's environmental authority.

3.8.6 Control Strategies

The visual impact of the project would be significantly reduced through implementation of a range of mitigation measures. The objectives of these mitigation measures are to:

- Minimise the extent to which the mining operations would be visible from the various View Situations by screening or blocking potential views of the operations
- Minimise the visual contrast between major components of the mining operations, such as out of pit overburden dumps and new structures, and the surrounding landscape in which they would be seen.

The most effective screening of views is achieved by locating screening objects such as, vegetation or structures as close as possible to the viewer. In the case of the project this means locating visual screening measures as close as possible to the public roads, dwellings and airport that may have views of the mining operations. The selection of the most appropriate visual mitigation measures must take account of the timing of those components of the project that will potentially be visible. Coal processing infrastructure and loading facilities, the railway line, Peak Downs Highway overpass and administration buildings will be constructed as the first stage to allow mining operations to proceed. Where visual mitigation measures are required in relation to these components of the project development, then they will be implemented within a short time frame.

For view situations where the mining operations will not be visible for more than 10 years it would be appropriate to use tree planting to provide visual screening as there will be adequate time for the trees to reach sufficient height to provide the visual screening required. Similarly, where the mining operations will not be significantly visible for more than 10 years, it may be feasible to facilitate natural regeneration of the indigenous woodland vegetation to provide visual screening of the mine. The 24 hour operation of the project will require lighting. Mitigation measures will therefore be required to minimise potential visual impacts on motorists travelling along the Moranbah Access Road, Peak Downs Highway and Dysart-Moranbah Road as well as dwellings in the vicinity of the mine.

Mitigation options include:

- Earth mounding with tree and shrub planting - soil and waste rock material from the mining operation will be used to construct sections of mounding (5 to 10 m) as close as possible to the sections of public road where visual mitigation is considered necessary. Tree or grass planting on the outer slope of the mound according to the surrounding vegetation will be carried out to provide additional visual screening over time and to integrate the mounding into the landscape.
- Tree and shrub planting in natural ground - planting of trees into natural ground would provide effective visual screening within the time frame of the mining operation. Indigenous plant species would be

used in order to maximise survival rate and to minimise maintenance requirements while contributing to enhancement of biodiversity.

- Retention of existing vegetation buffer zones - extensive stands of remnant woodland vegetation alongside the section of Peak Downs Highway running through the project site creates an opportunity to retain buffer zones. They will be a minimum of 50 m wide on both sides of the highway and supplemented with tree planting in some locations to ensure effective visual screening.
- Management of natural regeneration in buffer zones - management of the regeneration requires the removal of grazing, control of weeds and fire management to allow the natural regeneration to occur.
- Colour selection for various structures including the CHPP, loading facilities, administration and other buildings - colour contrast and reflectivity are major factors in the level of visibility. Colours to be used for the various structures would be selected with the aim of minimising the level of contrast.
- Lighting design for the MIA including the ROM, CHPP infrastructure and conveyors - Design of the lighting for the project will aim to minimise light spill and avoid direct line of sight to lights associated with the CHPP and loading facilities. This will involve the use of hoods and shields where necessary and ensuring lights are not directed at adjoining public roads or dwelling.
- Lighting design for mining operations – directional lighting will be employed where operational activities come within 1 km of Moranbah Access Road or Peak Downs Highway. The planning of truck movements will aim to avoid their headlights shining directly at motorists travelling along either of the roads. Mining operations only come within 1 km of the Moranbah Access Road during the last 5 years of the planned 30 year life of the mine, by which time proposed tree planting will be reaching mature heights.

In View Situations where the level of Visual Impact Significance has been assessed as High or Moderate, a series of appropriate mitigation measures have been identified aimed at minimising the potential visual impact (Table 3.8.7).

Table 3.8.7 Proposed Mitigation Measures

View Situation	Proposed Mitigation Measures
VS 9. South along Moranbah Access Rd.	- Roadside vegetation to be retained to maintain visual screening of views from road to the mine.
VS 10. View from Moranbah Airport	- Earth mounding combined with tree planting along the western edge of Moranbah Access Road to provide visual screening of views from the airport access road. - Additional planting alongside the access road and adjoining the terminal building to screen views of the mine. - Rehabilitation of the out of pit overburden dumps to create a natural landscape character post-mining.
VS 11. West from Moranbah Access Rd.	- Earth mounding combined with tree planting along the western edge of Moranbah Access Road to provide visual screening of views from the road. - Rehabilitation of the out of pit overburden dumps to create a natural landscape character post-mining.
VS 12. West and north from Moranbah Access Rd.	- Roadside tree planting and management of natural regeneration to screen views of the mine. - Rehabilitation of the out of pit overburden dumps to create a natural landscape character post-mining.
VS 13. North and north-	- Roadside tree planting and management of natural regeneration to

View Situation	Proposed Mitigation Measures
west from Moranbah Access Rd.	screen views of the mine. - Rehabilitation of the out of pit overburden dumps to create a natural landscape character post-mining.
VS 14. North-west from Peak Downs Hwy.	- Rehabilitation of the out of pit overburden dumps to create a natural landscape character post-mining.
VS 16. North from Peak Downs Hwy.	- Roadside tree planting and management of natural regeneration to screen views of the mine.
VS 17. East and west along Peak Downs Hwy.	- Retention of existing woodland vegetation alongside both sides of the Peak Downs highway to provide a visual buffer zone (minimum 50 m wide). - Additional tree planting where necessary to fill gaps in the existing roadside woodland vegetation in the proposed buffer zone. - Rehabilitation of the out of pit overburden dumps to create a natural landscape character post-mining. - Selection of appropriate colours for the CHPP and buildings that may be visible from the Peak Downs highway. - Design of lighting to avoid light spill on to adjoining section of the highway.
VS 19. North along, and south-west from Dysart-Moranbah Rd.	- Retention of existing vegetation and management of natural regeneration is to screen potential views of the mine in the longer term. - Rehabilitation of the out of pit overburden dumps to create a natural landscape character post-mining.
VS 20. West from Dysart-Moranbah Rd.	- Retention of existing vegetation and management of natural regeneration to screen potential views of the mine. - Rehabilitation of the out of pit overburden dumps to create a natural landscape character post-mining.
VS 22. North from Dysart-Moranbah Rd.	- Retention of existing vegetation and management of natural regeneration to screen potential views of the mine. - Rehabilitation of the out of pit overburden dumps to create a natural landscape character post-mining.

3.8.7 Monitoring

Monitoring of the effectiveness of the proposed visual impact mitigation measures is to be carried out over the period of the mining operations. Site inspections are to be carried out at least every two years by an independent professional with appropriate qualifications and experience in visual assessment and management. The inspection is to include both day and night conditions. The reviewer is to prepare a report that documents the results to the assessment, including photographs from the key viewing points identified in the EIS. Recommendations are to be made in the report for any additional actions that may be considered necessary to achieve the mitigation outcome identified in the EIS. Copies of the report are to be submitted to the relevant authority as required.

3.8.8 Commitments

- At closure the mine will achieve the agreed rehabilitation success criteria.
- Progressive rehabilitation of the disturbed areas will be undertaken on an availability basis to reduce the potential visual impact.

- Visual impact mitigation strategies, where appropriate, as outlined in the EIS will be undertaken.

3.8.9 Proposed Environmental Authority Conditions

There are no proposed environmental authority conditions for landscape character and visual amenity.

3.9 Terrestrial Ecology

3.9.1 Background and Environmental Values

Flora

Ground-truthing has confirmed that 19 distinct vegetation communities occur within the project site as listed in Table 3.9.1.

Table 3.9.1 Vegetation communities recorded across the project site

Vegetation Community	Description	Conservation Significance	
		VM Act	EPBC Act
1	Open/Closed Grassland with Isolated Trees (Height 0.5- 1.5 m)	Non-remnant	-
2	Open Grassland/ Forbland with Isolated Trees (Height: 0.2 – 1.0 m)	RE 11.8.11 - Of Concern	Analogous to Nationally Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin
3	Open/Closed Grassland/ Forbland with Isolated Trees (Height: 0.5 -12 m)	RE 11.8.5 - Not of Concern. Note: portions currently mapped by the EPA as RE 11.8.11 (Of Concern - VM Act)	-
4	Open Woodland (Height 8-14 m)	RE 11.4.9 - Endangered	Analogous to Nationally Endangered Brigalow (*Acacia harpophylla* Dominant and Co-dominant) Community
5	Open forest/ Woodland (Height: 15-18 m)	RE 11.3.2 - Of Concern	-
6	Woodland (Height: 15-18 m)	RE 11.3.2 - Of Concern	-
7	Open Forest/ Woodland (Height: 18-25 m)	RE 11.5.3 - Not of Concern	-
8		RE 11.5.3 - Not of Concern	-
9	Open Forest/ Woodland (Height: 15-18 m)	RE 11.8.5 - Not of Concern	-
10	Tall Open Forest/ Woodland (Height: 25-30 m)	RE 11.3.25 - Not of Concern	-

Vegetation Community	Description	Conservation Significance	
		VM Act	EPBC Act
11	Tall Open Shrubland (Height: 6-8 m)	Non-remnant	-
12 (site 14)	Open Forest/ Woodland (Height: 15-18 m)	RE 11.5.9 - Not of Concern	-
13	Open Shrubland (Height: 1-8 m)	Non-remnant	-
14	Open Forest/ Woodland (Height: 4-6 m)	RE 11.9.5 - Endangered Note: currently mapped by the DERM as Non-remnant	Analogous to the Nationally Endangered Brigalow (*Acacia harpophylla* Dominant and Co-dominant) Community.
15	Woodland/ Open Woodland (Height: 15-18 m)	RE 11.5.9b - Not of Concern	-
16	Open Forest (Height 8-14 m)	RE 11.4.8 - Endangered	Analogous to Nationally Endangered Brigalow (*Acacia harpophylla* Dominant and Co-dominant) Community
17	Woodland/ Open Woodland (Height 14-23 m)	RE 11.5.3 - Not of Concern	-
18	Mixed Eucalypt spp. Open Woodland	11.4.2 / 11.4.8 - Of Concern / Endangered	Analogous to the Nationally Endangered Brigalow (*Acacia harpophylla* Dominant and Co-dominant) Community
19	Low Open Forest (Height 3-6 m)	Non-remnant	-

Fourteen of the communities are currently mapped as remnant (i.e. as regional ecosystems (REs)) under the provisions of the Vegetation Management Act (VM Act), while an additional community (vegetation community 14) is comparable to RE 11.9.5. Of the fifteen ground-truthed remnant communities, eight have a Not of Concern management status, four have an Of Concern management status and three have an Endangered management status under the provisions of the VM Act, while five are comparable to ecological communities listed as Endangered under the Environmental Protection and Biodiversity Conservation Act (EPBC Act). The latter includes:

- Brigalow (Acacia harpophylla dominant and co-dominant) communities - (comparable to REs 11.4.8, 11.4.9 and 11.9.5).
- Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin – (comparable to RE 11.8.11).

These communities are comparable to ground-truthed vegetation communities 2 (Natural Grassland), 4 (Brigalow), 14 (Brigalow), 16 (Brigalow) and 18 (Brigalow).

Terrestrial Flora Species

A search of the Queensland Herbarium's records via the DERM's Wildlife Online database (EPA 2008b) indicates that one terrestrial plant species of special conservation significance, *Bertya pedicellata* (a shrub with no common name listed as Rare under the NC Act), occurs within the locality of the project site.

The EPBC Act Online Protected Matters Search Tool results indicate that two species of special conservation significance may occur within the vicinity of the project site, as follows:

- King Blue-grass (*Dichanthium queenslandicum*) - Vulnerable NC Act, Vulnerable EPBC Act.
- Finger Panic Grass (*Digitaria porrecta*) - Rare NC Act, Endangered EPBC Act.

A previous ecological assessment undertaken for the adjacent Peak Downs mining lease (including southern sections of the current project site) by Ecoserve and LAMR (2005) also indicated that, although not recorded during surveys, King Blue-grass and Queensland Blue-grass (*Dichanthium setosum* - Vulnerable EPBC Act, Rare NC Act) both have a "reasonable probability of occurrence on the site in either Regional Ecosystems 11.8.5 or 11.8.11."

A ground survey of the project site recorded 176 flora species, of which 157 (89.2%) were native and 19 (10.8%) were exotic. This includes species recorded during formal survey transects, as well as incidental records from across the project site. No flora species listed as significant under the provisions of the NC Act or the EPBC Act were recorded within the project site during ground survey.

Declared Weed Species

Five flora species listed as declared pests under the provisions of the Lands Protection (Pest and Stockroute Management) Act (LP Act) were recorded from the project site, as follows:

- Mother of Millions (*Bryophyllum delagoense*).
- Harrisia Cactus (*Eriocereus martini*).
- Lantana (*Lantana camara*).
- Velvet Tree-pear (*Opuntia tomentosa*).
- Parthenium Weed (*Parthenium hysterophorus*).

Lantana is currently listed as a Class 3 weed and the remaining species are listed as Class 2 weeds under the provisions of the LP Act.

Of these species, Harrisia Cactus, Mother of Millions and Velvet Tree-pear were distributed throughout the entire site, particularly within vegetation communities 1 and 7, while Parthenium was generally restricted to areas overlying basalt (i.e. vegetation communities 2 and 3). Infestation of Parthenium within these areas was very high, resulting in suppression of native species, particularly grasses.

Fauna

Ground survey recorded a total of 153 terrestrial vertebrate species from the project site or nearby, including 20 species of mammal, 113 birds, 10 reptiles and 10 amphibians (Table 3.9.2). The complete list of terrestrial vertebrate species recorded during the survey is provided in Appendix K. This list includes the results of previous surveys undertaken on the adjacent Peak Downs mining lease (including southern sections of the current project site), which indicate that an additional 136 terrestrial vertebrate species also occur, resulting in an overall total of 289 terrestrial vertebrate species for the project site and surrounds.

Table 3.9.2 Terrestrial vertebrate species diversity from survey

Site	Mammals	Birds	Reptiles	Amphibians	Total[1]
1	4	21	4	4	33
2	2	18	6	4	32
3	4	21	0	4	29
4	3	14	0	1	18
H1	5	13	0	0	19
H2	3	0	0	0	3
Incidental	5	69	3	3	80
TOTAL Diversity (current survey)	20	113	10	10	153
Previous Surveys[2]	44	176	42	16	278
TOTAL Diversity (all surveys)	46	182	45	16	289

Note:

1. Totals for specific sites and surveys may include a number of the same species as those for other sites and surveys. As such, totals for the 'current survey' and 'all surveys' are derived from the summation of adjacent cells within the same row, not the summation of totals in preceding rows. Incidental records refer only to species not recorded from a formal survey site.
2. Includes data that may or may not have been recorded on the current project site.

Significant Species

The majority of the terrestrial vertebrate species recorded from the current and previous surveys are currently listed in Queensland's NC Act as Least Concern wildlife (i.e. native animals that are not currently listed as Presumed Extinct, Endangered, Vulnerable or Rare, although are still prescribed as protected wildlife). However, twenty are recognised as species of special conservation significance under Commonwealth (EPBC Act) and/or Queensland Government (NC Act) legislations, while a further nine were not recorded but may occur based on database records from the local area and the presence of suitable habitat within the project site, as listed in Table 3.9.3. Full profiles are provided in Appendix K. Those species recorded on databases for the area but not considered likely to occur are addressed in Appendix K.

Declared Pest Species

The feral fauna species noted during the current and previous surveys and database searches were the Cane Toad (Bufo marinus), House Sparrow (Passer domesticus), House Mouse (Mus musculus), Black Rat (Rattus rattus), Cat (Felis catus), Brown Hare (Lepus capensis), Rabbit (Oryctolagus cuniculus), Donkey (Equus asinus), Pig (Sus scrofa) and Goat (Capra hircus). Of these, Cat, Rabbit and Pig are listed as Class 2 pests under the LP Act.

None of these species are unexpected and all are commonly found in central Queensland.

Table 3.9.3 Terrestrial vertebrate species of special conservation significance known or potentially occurring within the project site

Zoological Name	Common Name	NC Act Status	EPBC Act Status	Comments
Reptiles				
Paradelma orientalis	Brigalow Scaly-foot	V	V	Potential occurrence within a patch of Brigalow on a variety of substrates around site V16 (Figure 8.1) that retains areas of leaf litter and coarse woody debris.
Egernia rugosa	Yakka Skink	V	V	Potential occurrence within small areas very close to Site V16 (Figure 8.1).
Denisonia maculata	Ornamental Snake	V	V	Previously recorded on the adjacent Peak Downs Mine (Figure 8.5). Potential occurrence within an area of Brigalow around site V16 (Figure 8.1).
Birds				
Nettapus coromandelianus albipennis	Cotton Pygmy-Goose	R	M	There are previous survey records for this species (Figure 8.5). Potential occurrence on Boomerang Dam, the wetlands adjacent to 7 South fill point, Windsor's Dam and 4 North Dam, subject to the presence of aquatic vegetation.
Ephippiorhynchus asiaticus	Black-necked Stork	R		Potential occurrence on the project site, including shallow margins of wetlands adjacent to 7 South fill point, and may utilise small dams scattered throughout the grazing land north of Cherwell Creek.
Bubulcus ibis	Cattle Egret	S	M	Potential occurrence on the cleared and actively grazed areas of the project site at times.
Ardea alba	Great Egret	S	M	Recorded from artificial waterbodies, including Four North Dam.
Haliaeetus leucogaster	White-bellied Sea-Eagle	S	M	Breeding pair previously recorded from nearby One Mile Dam at Saraji Mine.
Rostratula australis	Australian Painted Snipe	V	V	Potential occurrence on the project site at times, possibly years apart, including One North Dam (to the south of the project site).
Gallinago hardwickii	Latham's Snipe	S	M	Potential occurrence sporadically, including the shallow margins of wetlands adjacent to 7 South fill point and Windsor's Dam to the south of the project site.
Numenius minutus	Little Curlew	S	M	Use of the project site by this species would be sporadic and probably short-term and is likely only in areas either of non-remnant vegetation and/or in areas heavily disturbed by livestock.

Zoological Name	Common Name	NC Act Status	EPBC Act Status	Comments
Tringa stagnatilis	Marsh Sandpiper	S	M	Previously recorded for the project site from limited suitable habitat such as Boomerang Dam 21.
Actitis hypoleucos	Common Sandpiper	S	M	Previously recorded for the project site from limited suitable habitat such as Boomerang Dam 21.
Calidris ruficollis	Red-necked Stint	S	M	Previously recorded for the project site from limited suitable habitat such as Boomerang Dam 21.
Calidris acuminata	Sharp-tailed Sandpiper	S	M	Previously recorded for the project site from limited suitable habitat such as Boomerang Dam 21.
Sterna caspia	Caspian Tern	S	M	Two previous survey records, including Raw Water Dam.
Geophaps scripta scripta	Squatter Pigeon (southern subspecies)	V	V	During the recent ground survey, Squatter Pigeons were observed on a number of occasions, most near a creek (Figure 8.5). Also recorded during previous surveys on the project site and adjacent Peak Downs Mine.
Hirundapus caudacutus	White-throated Needletail	S	M	Previously recorded aerial species that may at times fly over the project site.
Apus pacificus	Fork-tailed Swift	S	M	
Merops ornatus	Rainbow Bee-Eater	S	M	Recorded from wooded and rehabilitated habitats within the project site, but is likely to utilise almost any habitat present. Potential breeding habitat is present on the exposed banks of Cherwell Creek.
Rhipidura rufifrons	Rufous Fantail	S	M	Only one previous survey record and unlikely to be a regular visitor to the area.
Monarcha melanopsis	Black-faced Monarch	S	M	Potential occurrence on the project site on passage during migration, most likely in riparian vegetation.
Myiagra cyanoleuca	Satin Flycatcher	S	M	Only one previous survey record and unlikely to be a regular visitor to the area.
Acrocephalus australis	Australian Reed-Warbler	S	M	Present at Dam 1 North during recent ground survey and previous records both a rehabilitation area and Dam 1 North. It regularly occurs on artificial waterbodies should they have suitable fringing vegetation and may breed in the project site.

Zoological Name	Common Name	NC Act Status	EPBC Act Status	Comments
Mammals				
Tachyglossus aculeatus	Short-beaked Echidna	S		Short-beaked Echidna has been recorded six times for all surveys combined, suggesting that it is reasonably common in the project site and surrounds.
Phascolarctos cinereus	Koala	S		Over 100 records of the species from previous surveys, indicating that there is a substantial population present, presumably in the areas of better quality habitat south of Cherwell Creek.
Taphozous troughtoni	Troughton's Sheathtail-bat	E		Previous Anabat records for Cherwell Creek (Figure 8.5).
Nyctophilus timoriensis	Greater Long-eared Bat (South-eastern)	V	V	Sporadic use of the site by any individuals possibly present in the local area cannot be discounted.
Chalinolobus picatus	Little Pied Bat	R		Numerous Anabat survey records from recent ground survey and pervious surveys (Figure 8.5), including in or near woodland with Acacia harpophylla, Windsor's Dam, wetlands adjacent to 10 North Fill Point, and within the Brigalow remnant adjacent to the boundary with Saraji mine.

Note:

Special Status abbreviations are as follows:

- Queensland's *Nature Conservation Act 1992* (NC Act Status): E = Endangered, V = Vulnerable, R = Rare, S = Special Least Concern (Migratory), S = Special Least Concern, C = Least Concern wildlife.

Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act Status): E = Endangered, V = Vulnerable, M = Migratory Species. Terrestrial Habitat Values

General Values

The habitats within and immediately surrounding the project site can be assigned to five broad categories:

i. Woodland and Open Forest.
ii. Grasslands – both introduced pasture and native grasslands.
iii. Jump-ups with shrubby vegetation.
iv. Ephemeral creeks and drainage lines.
v. Dams and other artificial waterbodies.

More detailed discussions (including photos) are provided in Appendix K.

Habitat Protection for Significant Fauna

The likelihood of a species occurring in an RE can be determined based on the description of the RE and the known distribution of the species in question. The exclusion of an RE in relation to a particular species does not mean that it may not at times occur there, especially for migratory species. Rather, the REs have been chosen to represent the habitats of greatest likelihood of regular occurrence. Waterbirds and wetland species, such as those associated with rank vegetation fringing waterbodies, may use many REs beyond those listed should appropriate waterbodies exist within the area in question. The habitat requirements of White-throated Needletail, Rainbow Bee-eater and Short-beaked Echidna are so broad that they could occur in all REs.

It should also be noted that non-remnant vegetation may provide significant resources for many of the species listed. Section 8 of the EIS calculates the total area of REs listed for each species listed in Table 8.9 of the EIS and gives the land tenure, indicating the amount of habitat for conservation significant species that is currently conserved. This is, however, a broad scale approach as particular species do not occur in all available and apparently suitable habitat due to a variety of patch characteristics including connectivity and habitat condition. An actual habitat assessment is required to accurately identify the likelihood of a species occurring in a habitat patch.

Significant Species (EPBC Act and NC Act)

Brigalow Scaly-foot, Yakka Skink and Ornamental Snake have 16,778; 20,032 and 3,675 ha of reserved habitat (i.e. within National Parks and Forest Reserves) respectively. These species are susceptible to disturbance and the loss of suitable ground cover such as coarse woody debris and leaf litter. Non-reserved remnant vegetation may be grazed or otherwise disturbed and is less likely to provide suitable resources for these species, though Yakka Skink can occupy degraded areas with log piles or rabbit warrens to provide shelter. Due to the possible consequences of grazing the extent of reserved land is of much greater importance for these species than for many other conservation significant species.

The Australian Painted Snipe is not particularly restricted to any RE types in the BBN bioregion. It requires terrestrial shallow wetlands and will use inundated grasslands, saltmarsh, dams, rice crops, sewage farms and bore drains. Therefore the area of conserved REs for this species gives little indication of the amount of suitable habitat as this species is often recorded from non-remnant vegetation.

The Squatter Pigeon occurs in open woodlands with a grassy understorey with permanent water nearby. The 23,330 ha of reserved habitat would include some areas where the understorey is too dense for this species. Given a tolerance of low to medium intensity cattle grazing and a willingness to eat some pasture grasses much of the freehold and leasehold land and state forest may actually provide better resources. The species probably also benefits from artificial waterbodies in non-remnant vegetation.

The 6,869 ha of reserved habitat for Greater Long-eared Bat may be considerable under-estimation given that the species occurs in a variety of habitats. The lack of knowledge of its biology makes it difficult to make accurate assessments of its habitat use. It is likely, however, to require large, intact remnants (Turbill et al. 2008) and hence may be dependent on reserved lands.

Significant Species (NC Act)

Cotton Pygmy-goose and Black-necked Stork are similar to Australian Painted Snipe in that their habitat requirements are not well reflected by REs.

Little Pied Bat occurs in a wide variety of habitats and, based on Anabat records, is often found in non-remnant, highly modified landscapes. It does require caves, tunnels, other similar subterranean structures or hollow-bearing trees as roosts, which may be just as common in non-reserved remnant vegetation as in forest reserves and National Parks. The sparseness of this species is not indicated by the amount of apparently suitable remnant vegetation in the BBN bioregion.

Non-Significant Migratory Species (EPBC Act)

White-bellied Sea-eagle, Latham's Snipe, Marsh Sandpiper, Common Sandpiper, Red-necked Stint, Sharp-tailed Sandpiper Caspian Tern and, to a lesser degree, Great Egret and Little Curlew, are dependent on waterbodies, including artificial ones. Cattle Egret is an open country species that most often occurs in highly modified non-remnant habitats such as pasture. RE extent does not indicate the amount of suitable habitat for these species in the BBN bioregion.

Rufous Fantail and Black-faced Monarch prefer areas with intact mid-strata. This is more likely to be the case in reserved remnants not subject to grazing. The extent of reserved suitable habitats, <3% of the relevant REs in the BBN bioregion, is hence more significant than for many other conservation significant species. These species will appear in a much greater variety of habitats, including non-remnant vegetation, during passage.

3.9.2 Potential Impacts on Environmental Values

Flora

During the construction phase, clearing will be required for a range of infrastructure within the project site, along with a number of sediment basins, creek diversions, the initial open-cut mining pit(s), ramps and out of pit waste dump areas. Clearing will also occur progressively during mine operation for the extension of pits and spoil areas. Overall, it is understood that a total area of approximately 3,900 ha will be disturbed over the life of the project. This will incorporate the clearing of remnant vegetation as defined under the provisions of the VM Act as well as non-remnant vegetation. The approximate areas of each RE to be cleared (calculated via aerial photograph interpretation and subsequent geographic information system (GIS) analysis), together with their description under the provisions of the VM Act, their bioregional extent, local extent and area contained in the project site is provided within Table 3.9.4.

Table 3.9.4 Approximate current extent of ground-truthed REs within the Bioregion, Local Government Area and Project Site and extent to be disturbed during the Project

Comparable RE and Description (REDD)	Management Status	Approximate Total Extent (ha)			Approximate Extent to be Disturbed				
		Within BBN Bioregion[1]	Within Local Government Area1	Within Project Site[2]	Area (ha)[2]	% of Bioregional Extent	% of Local Extent	Area with Existing Approval (ha) [3]	Area to be offset (ha)
11.3.2 – *Eucalyptus populnea* woodland on alluvial plains	Of Concern (VM Act)	545,265	30,830	351.8	248.6	0.05	0.8	140.3	108.3
11.3.25 – *Eucalyptus tereticornis* or *E. camaldulensis* woodland in Cainozoic clay plains	Not of Concern (VM Act)	498,414	28,566	75.9	31.5	0.01	0.1	0	N/A[3]
11.4.2 – *Eucalyptus spp.* and/or *Corymbia.spp* grassy or shrubby woodland on Cainozoic clay plains	Of Concern (VM Act)	37,135	514	4.5	4.5	0.01	0.9	0	4.5
11.4.8 – *Eucalyptus cambageana* woodland to open forest with *Acacia harpophylla* or *A. argyrodendron* on Cainozoic clay plains	Endangered (VM Act and EPBC Act)	80,904	30,910	10.1	8.2	0.01	0.03	0	8.2
11.4.9 – *Acacia harpophylla* shrubby open forest to woodland with *Terminalia oblongata* on Cainozoic clay plains	Endangered (VM Act and EPBC Act)	105,656	39,723	92.1	15.5	0.02	0.04	3.1	12.4
11.5.3 – *Eucalyptus populnea* and/or *E. melanophloia* and/or *Corymbia clarksoniana* on Cainozoic sand plains/remnant	Not of Concern (VM Act)	413,237	183,023	245.5	100	0.02	0.05	0.5	N/A

Comparable RE and Description (REDD)	Management Status	Approximate Total Extent (ha)			Approximate Extent to be Disturbed				
		Within BBN Bioregion[1]	Within Local Government Area1	Within Project Site[2]	Area (ha)[2]	% of Bioregional Extent	% of Local Extent	Area with Existing Approval (ha) [3]	Area to be offset (ha)
surfaces									
11.5.9 – *Eucalyptus crebra* and other *Eucalyptus spp.* and *Corymbia spp*. woodland on Cainozoic sand plains/remnant surfaces	Not of Concern (VM Act)	251,427	31,532	259.4	217.3	0.09	0.69	37.9	N/A[3]
11.8.5 – *Eucalyptus orgadophila* open woodland on Cainozoic igneous rocks	Not of Concern (VM Act)	348,697	39,976	255.0	25.1	0.01	0.06	6.8	N/A[3]
11.8.11 – *Dichanthium sericeeum* grassland on Cainozoic igneous rocks	Of Concern (VM Act), Endangered (EPBC Act)	188,169	37,194	153.1	124.6	0.07	0.33	0	124.6
11.9.5 – *Acacia harpophylla* and/or *Casuarina cristata* open forest to woodland on fine grained sedimentary rock.	Endangered (VM Act and EPBC Act)	149,368	499	31.7	3.9	0.003	0.79	3.9	0

Note:

1. Based on most recent data available from the EPA (2004).

2. Approximate areas calculated via aerial photograph interpretation and subsequent GIS analysis.

3. These areas are excluded from the subsequent considerations of proposed offsets under relevant legislation.

4. Based on an indicative breakdown of vegetation community 18 (Section 4.2.2) into 60% comparable RE 11.4.2 and 40% comparable RE 11.4.8.

Fauna

Tables 3.9.5 and 3.9.6 set out each significant fauna element present in the project site, summarise the impact mechanisms and their potential effects on each element, provide appropriate mitigation measures, and show the assessed residual impact for the construction and operation phases of the Project, respectively. For the purposes of this assessment, significant fauna elements refer to those species, communities or processes that have the potential to constrain the proposed activities (e.g. species and habitat listed as significant under the provisions of the EPBC Act, NC Act, Mineral Resource Act 1989 and the VM Act).

Assessment of the nature and scale of predicted impacts are based on known or likely occurrence, fecundity, dispersal abilities, home range, habitat specialisation, resilience to disturbance, and mobility.

The tables in Appendix K further clarify the impact assessment process applied to Table 3.9.5 and 3.9.6.

Table 3.9.5 Fauna Construction and Clearing[1] Impact Assessment

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type [2]	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures	Residual Impact Assessment
Nationally Significant Fauna (Endangered or Vulnerable) Objective: Minimise long term loss of habitat in project site.	Brigalow Scaly-foot (*Paradelma orientalis*) (species not recorded - reasonable possibility of occurrence in project site)	Vulnerable EPBC Act and NC Act	Pits	Direct – Loss of habitat	Possible	Minor	Fauna spotter/catcher during clearing of remnant woodland. Consideration of vegetation offset areas will take into account habitat for significant fauna species.	Minor
			Infrastructure [4]	Direct – Loss of habitat	Possible	Minor		Minor
	Yakka Skink (*Egernia rugosa)* (species not recorded - low possibility of occurrence in project site)		Pits	Direct – Loss of habitat	Very Unlikely	Negligible – marginal habitat	Fauna spotter/catcher during clearing of remnant woodland. Retention of log piles where practical.	Negligible
			Infrastructure [4]	Direct – Loss of habitat	Unlikely	Minor – marginal habitat		Negligible
	Ornamental Snake (*Denisonia maculata)* (species present)		Pits	Direct – Loss of habitat	Unlikely	Minor – marginal habitat	Fauna spotter/catcher during clearing of remnant woodland.	Negligible
			Infrastructure [4]	Direct – Loss of habitat	Possible	Negligible – marginal habitat		
	Australian Painted Snipe (*Rostratula australis*) (species not recorded, but predicted to occur occasionally)		Pits	None – No habitat within area of disturbance	Not applicable	Not applicable	None provided – no loss of important foraging habitat and no loss of potential breeding habitat.	None
			Infrastructure [4]	None – No habitat within area of disturbance	Not applicable	Not applicable		
	Squatter Pigeon (southern subspecies)		Pits	Direct – Loss of breeding habitat	Certain	Minor	Consideration of vegetation offset areas will take into account	Minor

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type [2]	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures	Residual Impact Assessment
	(*Geophaps scripta scripta)* (species present)						habitat for significant fauna species.	
			Infrastructure [4]	Direct – Loss of breeding habitat	Certain	Minor	Consideration of vegetation offset areas will take into account habitat for significant fauna species.	Minor
	Greater Long-eared Bat (*Nyctophilus timoriensis*) (species not recorded – low possibility of occurrence in project site)		Pits	Direct – Loss of foraging and roosting habitat	Unlikely	Minor	Retention of hollow-bearing trees where practical.	Negligible
			Infrastructure [4]	Direct – Loss of foraging and roosting habitat	Unlikely	Negligible		Negligible
State Significant Fauna Objective: Minimise long term loss of habitat in project site.	Black-necked Stork *Ephippiorhynchus asiaticus* (species not recorded, but predicted to occur occasionally)	Rare NC Act	Pits	Direct – Loss of foraging habitat: farm dams and pasture (when inundated)	Certain	Negligible – marginal habitat	None provided – no loss of important foraging habitat and no loss of potential breeding habitat.	Negligible
			Infrastructure [4]	None – No suitable habitat within area of disturbance	Not applicable	Not applicable		
	Short-beaked Echidna (*Tachyglossus aculeatus)* (species present)	Special Least Concern (Culturally Significant) NC Act	Pits	Direct – 1. Loss of habitat, 2. Predation by feral predators when fleeing disturbance, 3. Mortality from vehicle strike	1. Certain 2. Possible 3. Possible	Moderate	Fauna spotter/catcher during clearing of remnant woodland. Strategies for managing pest species will be maintained in the EM Plan. Appropriate speed limits for construction vehicles.	Minor

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type [2]	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures	Residual Impact Assessment
							Awarenss of wildlife matters will be incorporated in the site induction.	
			Infrastructure [4]	Direct – 1. Loss of habitat. 2. Predation by feral predators when fleeing disturbance	1. Certain 2. Possible	Minor		Negligible
	Koala (*Phascolarctos cinereus*) (species present)		Pits	Direct – 1. Loss of habitat, 2. Predation by feral predators when fleeing disturbance, 3. Mortality from vehicle strike	1. Certain 2. Possible 3. Possible	Minor	Fauna spotter/catcher during clearing of remnant woodland. Strategies for managing pest species will be maintained in the EM Plan. Appropriate speed limits for construction vehicles. Awarenss of wildlife matters will be incorporated in the site induction.	Minor
			Infrastructure [4]	Direct – 1. Loss of habitat, 2. Predation by feral predators when fleeing disturbance, 3. Mortality from vehicle strike	1. Certain 2. Possible 3. Possible	Minor		Negligible
	Troughton's Sheathtail-bat (*Taphozous troughtoni)*	Endangered NC Act	Pits	Direct – Loss of foraging habitat	Possible	Not appropriate – there is uncertainty concerning the validity of this	None provided.	Not applicable

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type [2]	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures	Residual Impact Assessment
	(species present)					species and of the reliability of Anabat as a means of identification (see Section 4.3.4).		
			Infrastructure [4]	Direct – Loss of foraging habitat	Possible	2 Not appropriate		
	Little Pied Bat *Chalinolobus picatus* (species present)	Rare NC Act	Pits	Direct - Loss of foraging habitat and potential roosting habitat	Certain	Moderate	Consideration of vegetation offset areas will take into account habitat for significant fauna species.. Retention of hollow-bearing trees where practical.	Minor
			Infrastructure [4]	Direct – Loss of foraging habitat and potential roosting habitat	Certain	3 Minor		
Nationally Significant Fauna (Migratory) Objective: Minimise long term loss of habitat in project site.	Australian Cotton Pygmy-goose *(Nettapus coromandelianus albipennis)* Also listed as Rare under the NC Act (species present)	Migratory EPBC Act	Pits	None – No suitable habitat within area of disturbance	Not applicable	Not applicable	None provided – no loss of important foraging habitat and no loss of potential breeding habitat.	None
			Infrastructure [4]	None – No suitable habitat within area of disturbance	Not applicable	Not applicable		
	Great Egret (*Ardea alba)* (species present)		Pits	Direct – Loss of foraging habitat: farm dams and pasture (when inundated)	Certain	Minor	None provided – no loss of important habitat and no constraints to movement across the landscape.	Minor
			Infrastructure [4]	None – No suitable habitat within area of disturbance	Not applicable	Not applicable		
	Cattle Egret (*Bubulcus ibis)*		Pits	Direct – Loss of foraging habitat:	Certain	Negligible	None provided – no loss of important habitat and	Negligible

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type [2]	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures	Residual Impact Assessment
	(species not recorded, but predicted to occur sporadically)			pasture and native grasslands			no constraints to movement across the landscape.	
			Infrastructure [4]	None – No suitable habitat within area of disturbance	Not applicable	Not applicable		
	White-bellied Sea-eagle (*Haliaeetus leucogaster*) (species present)		Pits	None – No habitat within area of disturbance	Not applicable	Not applicable	None provided – no loss of habitat and no constraints to movement across the landscape.	Negligible
			Infrastructure [4]	None – No habitat within area of disturbance	Not applicable	Not applicable		
	Painted Snipe (*Rostratula benghalensis s. lat).* and Latham's Snipe (*Gallinago hardwickii*) (species not recorded, but predicted to occur occasionally)		Pits	None – No habitat within area of disturbance	Not applicable	Not applicable	None provided – no loss of habitat and no constraints to movement across the landscape.	None
			Infrastructure [4]	None – No habitat within area of disturbance	Not applicable	Not applicable		
	Little Curlew (*Numenius minutus)* (non-breeding wader, not recorded but may occur sporadically)		Pits	Direct – Loss of foraging habitat: pasture and native grasslands	Unlikely	Negligible	None provided – no loss of important habitat and no constraints to movement across the landscape.	Negligible
			Infrastructure [4]	None – No suitable habitat within area of disturbance	Not applicable	Not applicable		
	Marsh Sandpiper (*Tringa stagnatilis)*,		Pits	Direct – Loss of foraging habitat: farm dams	Possible	Minor – marginal habitat	None provided – no loss of important habitat and no constraints to	Minor

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type [2]	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures	Residual Impact Assessment
	Common Sandpiper *(Actitis hypoleucos)*, Red-necked Stint (*Calidris ruficollis)* and Sharp-tailed Sandpiper *(Calidris acuminata)* (non-breeding waders, species present)		Infrastructure [4]	None – No habitat within area of disturbance	Not applicable	Not applicable	movement across the landscape.	
	Caspian Tern (*Sterna caspia)* (species present)		Pits	None – No habitat within area of disturbance	Not applicable	Not applicable	None provided – no loss of habitat and no constraints to movement across the landscape.	None
			Infrastructure [4]	None – No habitat within area of disturbance	Not applicable	Not applicable		
	White-throated Needletail (*Hirundapus caudacutus)* and Fork-tailed Swift (*Apus pacificus*) (non-breeding aerial species – species present)		Pits	Indirect – Disturbance of flying invertebrates (prey)	Probable	Negligible (possibly positive – provision of foraging opportunity)	None provided – no loss of habitat and no constraints to movement across the landscape.	Negligible
			Infrastructure [4]	Indirect – Disturbance of flying invertebrates (prey)	Probable	Negligible (possibly positive – provision of foraging opportunity)		
	Rainbow Bee-eater (*Merops ornatus*) (species present)		Pits	Direct – Loss of foraging habitat, loss of potential breeding habitat Indirect impact – disturbance of flying invertebrates (prey)	Certain	Negligible	None provided – no loss of important habitat and no constraints to movement across the landscape.	Negligible

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type [2]	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures	Residual Impact Assessment
			Infrastructure [4]	Direct – Loss of foraging habitat, Indirect – Disturbance of flying invertebrates (prey)	Certain	Negligible		
	Rufous Fantail (*Rhipidura rufifrons)* (breeding passerine – species present)		Pits	Direct – Loss of passage habitat	Certain	Negligible	None provided – no loss of important habitat and no constraints to movement across the landscape.	Negligible
			Infrastructure [4]	None – no habitat within area of disturbance	Not applicable	Negligible		
	Black-faced Monarch (*Monarcha melanopsis)* (breeding passerine – not recorded but predicted to occur occasionally)		Pits	Direct – Loss of passage habitat	Certain	Negligible	None provided – no loss of important habitat and no constraints to movement across the landscape.	Negligible
			Infrastructure [4]	None – No habitat within area of disturbance	Not applicable	Not applicable		
	Satin Flycatcher (*Myiagra cyanoleuca)* (non-breeding passerine – species present)		Pits	Direct – Loss of passage habitat	Certain	Negligible	None provided – no loss of important habitat and no constraints to movement across the landscape.	Negligible
			Infrastructure [4]	None – No habitat within area of disturbance	Not applicable	Not applicable		
	Australian Reed-Warbler (*Acrocephalus australis)* (breeding passerine – species present)		Pits	None – No habitat within area of disturbance	Not applicable	Not applicable	None provided – no loss of habitat and no constraints to movement across the landscape.	None
			Infrastructure [4]	None – No habitat within area of disturbance	Not applicable	Not applicable		

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type [2]	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures	Residual Impact Assessment
Feral Species of State Significance Objective: Manage existing pests and prevent new introductions.	(feral) Cat (*Felis catus),* Dingo/dog (*Canis lupus dingo/familiaris)* (feral predators – species present)	Declared Class 2 Pest under the LP Act	Areas disturbed for Project infrastructure [4]	Direct – Predation on native fauna	Probable	Moderate	Strategies for managing pest species will be maintained in the EM Plan.	Minor
	Red Fox (*Vulpes vulpes)* (feral predator – not recorded but predicted to occur sporadically)		Areas disturbed for Project infrastructure [4]	Direct – Predation on native fauna	Possible	Moderate	Strategies for managing pest species will be maintained in the EM Plan.	Minor
	Rabbit (*Oryctolagus cuniculus*) (species present)		Areas disturbed for Project infrastructure [4]	Indirect – Destruction of native vegetation	Possible	Minor	Strategies for managing pest species will be maintained in the EM Plan.	Negligible
	(feral) Pig (*Sus scrofa*) (species present)		Areas disturbed for Project infrastructure [4]	Direct – Predation on native fauna. Indirect – 1. Destruction of native vegetation, 2. Disturbance of waterbodies	Probable	Moderate	Strategies for managing pest species will be maintained in the EM Plan.	Minor
	(feral) Goat (*Capra hircus)* (species present)		Areas disturbed for Project infrastructure [4]	Indirect – Destruction of native vegetation	Unlikely	Minor	Strategies for managing pest species will be maintained in the EM Plan.	Negligible
Other Feral Species Objective: Manage	Cane Toad (*Bufo marinus*) (species present)	Non-native animal	Areas disturbed for Project infrastructure	Direct – 1. Predation of native fauna, 2. Competition with native fauna around	Possible	Minor	Strategies for managing pest species will be maintained in the EM Plan.	Minor

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type [2]	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures	Residual Impact Assessment
existing pests and prevent new introductions.			[4]	waterbody edges				
	House Sparrow (*Passer domesticus)* (species present)		Areas disturbed for Project infrastructure [4]	None	Not applicable	Not applicable	Strategies for managing pest species will be maintained in the EM Plan.	None
	House Mouse (*Mus musculus)* (species present)		Areas disturbed for Project infrastructure [4]	Direct – Competition with native fauna	Possible	Minor	Strategies for managing pest species will be maintained in the EM Plan.	Negligible
	Black Rat (*Rattus rattus)* (species present)		Areas disturbed for Project infrastructure [4]	Direct – Competition with native fauna	Possible	Minor	Strategies for managing pest species will be maintained in the EM Plan.	Minor
	Brown Hare (*Lepus capensis*) (species present)		Areas disturbed for Project infrastructure [4]	Direct – Competition with native fauna Indirect – Destruction of native vegetation	Possible	Negligible	Strategies for managing pest species will be maintained in the EM Plan.	Negligible
	(feral) Donkey (*Equus asinus)* (species present)		Areas disturbed for Project infrastructure [4]	Indirect – Destruction of native vegetation	Unlikely	Minor	Strategies for managing pest species will be maintained in the EM Plan.	Negligible

[1] Clearing refers to activities undertaken both during the construction and operational phases.

[2] All impacts listed in the tables should be considered as negative, unless otherwise stated.

[3].This note not utilised in the above table.

[4]. During the construction phase all infrastructure, other than for the pits, is combined.

Table 3.9.6 Fauna Operation[1] Impact Assessment

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [2]	Residual Impact Assessment
Nationally Significant Fauna (Endangered or Vulnerable) Objective: Minimise fauna injury and disturbance to natural processes and behaviour.	Brigalow Scaly-foot (*Paradelma orientalis)* (species not recorded - reasonable possibility of occurrence in project site	Vulnerable EPBC Act and NC Act	Pits	Direct – 1. Constraint to local movements, 2. Mortality from vehicle strike	Unlikely	Minor	Appropriate speed limits for vehicles. Awarenss of wildlife matters will be incorporated in the site induction.	Negligible
			Coal preparation infrastructure	None	Not applicable	Not applicable		
			Transport infrastructure	None	Not applicable	Not applicable		
	Yakka Skink (*Egernia rugosa)* (species not recorded - low possibility of occurrence in project site)		Pits	Direct – 1. Constraint to local movements, 2. Mortality from vehicle strike	Very Unlikely	Negligible	Appropriate speed limits for vehicles. Awarenss of wildlife matters will be incorporated in the site induction.	Negligible
			Coal preparation infrastructure	None	Not applicable	Negligible		
			Transport infrastructure	None	Not applicable	Negligible		
	Ornamental Snake (*Denisonia maculata*) (species present)		Pits	Direct – 1. Constraint to local movements, 2. Mortality from vehicle strike	Very Unlikely	Negligible	Appropriate speed limits for vehicles. Awarenss of wildlife matters will be incorporated in the site induction.	Negligible
			Coal preparation infrastructure	None	Not applicable	Not applicable		
			Transport infrastructure	None	Not applicable	Not applicable		
	Australian Painted		Pits	Direct – Light pollution	Unlikely	Negligible	None provided.	Negligible

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [2]	Residual Impact Assessment
	Snipe (*Rostratula australis*) (species not recorded, but predicted to occur occasionally)			(may affect movements at night)				
			Coal preparation infrastructure	Direct – Light pollution (may affect movements at night)	Unlikely	Negligible		
			Transport infrastructure	None	Not applicable	Not applicable		
			New Dams	Direct – creation of additional habitat.	Probable	Minor (positive impact)		Minor (positive impact)
	Squatter Pigeon (southern subspecies) (*Geophaps scripta scripta)* (species present)		Pits	Direct – Noise, dust and light pollution (on individuals in adjacent habitats)	Possible	Minor	Standard dust suppression techniques.	Negligible
			Coal preparation infrastructure	Direct – Noise, dust and light pollution (on individuals in adjacent habitats)	Possible	Negligible		
			Transport infrastructure	None	Not applicable	Not applicable		
			New Dams	Direct – creation of additional watering points	Probable	Minor (positive impact)		Minor (positive impact)
	Greater Long-eared Bat (*Nyctophilus timoriensis)* (species not recorded – low possibility of occurrence in		Pits	Direct – Noise, dust and light pollution (on individuals in adjacent habitats)	Unlikely	Negligible	Standard dust suppression techniques.	Negligible
			Coal preparation infrastructure	Direct – Noise, dust and light pollution (on individuals in adjacent habitats)	Unlikely	Negligible		

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [2]	Residual Impact Assessment
	project site)		Transport infrastructure	None	Not applicable	Not applicable		
State Significant Fauna Objective: Minimise fauna injury and disturbance to natural processes and behaviour.	Black-necked Stork (*Ephippiorhynchus asiaticus)* (species not recorded, but predicted to occur occasionally)	Rare NC Act	Pits	None	Not applicable	Not applicable		None
			Coal preparation infrastructure	None	Not applicable	Not applicable		
			Transport infrastructure	None	Not applicable	Not applicable		
			New Dams	Direct – creation of additional habitat.	Probable	Minor (positive impact)		Minor (positive impact)
	Short-beaked Echidna (*Tachyglossus aculeatus*) (species present)	Special Least Concern (Culturally Significant) NC Act	Pits	Direct – 1. Constraint to local movements, 2. Mortality from vehicle strike, 3. Noise, dust and light pollution (on individuals in adjacent habitats)	Probable	Moderate	Liaison with local Wildlife Carer for treatment of injured animals or young rescued from adults killed or injured by vehicles or activities associated with the Project. Appropriate speed limits for vehicles. Awarenss of wildlife matters will be incorporated in the site induction. Standard dust suppression techniques.	Moderate
			Coal preparation infrastructure	Direct – Noise, dust and light pollution (on individuals in adjacent habitats)	Possible	Minor		
			Transport infrastructure	Direct – 1. Constraint to local movements (if rail corridor fenced), 2. Mortality from vehicle strike	Possible	Minor		
	Koala (*Phascolarctos cinereus*)		Pits	Direct – 1. Constraint to local movements, 2. Mortality from vehicle	Probable	Minor	Liaison with local Wildlife Carer for treatment of injured animals or young rescued from adults killed	Minor

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [2]	Residual Impact Assessment
	(species present)			strike, 3. Noise, dust and light pollution (on individuals in adjacent habitats)			or injured by vehicles or activities associated with the Project. Appropriate speed limits for vehicles. Awarenss of wildlife matters will be incorporated in the site induction. Standard dust suppression techniques.	
			Coal preparation infrastructure	Direct – Noise, dust and light pollution (on individuals in adjacent habitats)	Possible	Minor		
			Transport infrastructure	Direct – 1. Constraint to local movements (if rail corridor fenced), 2. mortality from vehicle strike	Possible	Minor		
	Troughton's Sheathtail-bat *(Taphozous troughtoni)* (species present)	Endangered NC Act	Pits	Direct – Noise, dust and light pollution (on individuals in adjacent habitats)	Possible	Not appropriate – there is uncertainty concerning the validity of this species and of the reliability of Anabat as a means of identification.		Not applicable
			Coal preparation infrastructure	Direct – Noise, dust and light pollution (on individuals in adjacent habitats)	Possible	Not appropriate		
			Transport infrastructure	None	Not applicable	Not appropriate		

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [2]	Residual Impact Assessment
	Little Pied Bat *(Chalinolobus picatus*) (species present)	Rare NC Act	Pits	Direct – Noise, dust and light pollution (on individuals in adjacent habitats)	Possible	Minor	Standard dust suppression techniques.	Minor
			Coal preparation infrastructure	Direct – Noise, dust and light pollution (on individuals in adjacent habitats)	Possible	Minor		
			Transport infrastructure	None	Not applicable	Not applicable		
Nationally Significant Fauna (Migratory) Objective: Minimise fauna injury and disturbance to natural processes and behaviour.	Australian Cotton Pygmy-goose (*Nettapus coromandelianus albipennis)* Also listed as Rare under the NC Act (species present)	Migratory EPBC Act	Pits	None	Not applicable	Not applicable		None
			Coal preparation infrastructure	None	Not applicable	Not applicable		
			Transport infrastructure	None	Not applicable	Not applicable		
			New Dams	Direct – creation of additional habitat.	Probable	Minor (positive impact)		Minor (positive impact)
	Great Egret (*Ardea alba)* (species present)		Pits	Direct – Noise and dust pollution (on individuals in adjacent habitats)	Possible	Minor	Standard dust suppression techniques.	Negligible
			Coal preparation infrastructure	Direct – Noise and dust pollution (on individuals in adjacent habitats)	Possible	Negligible		
			Transport infrastructure	None	Not applicable	Not applicable		

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [2]	Residual Impact Assessment
			New Dams	Direct – creation of additional habitat.	Probable	Minor (positive impact)		Minor (positive impact)
	Cattle Egret (*Bubulcus ibis*) (species not recorded, but predicted to occur sporadically)		Pits	Direct – Noise and dust pollution (on individuals in adjacent habitats)	Unlikely	Negligible	Standard dust suppression techniques.	Negligible
			Coal preparation infrastructure	None	Not applicable	Not applicable		
			Transport infrastructure	None	Not applicable	Not applicable		
			New Dams	Direct – creation of additional habitat.	Probable	Minor (positive impact)		Minor (positive impact)
	White-bellied Sea-eagle *(Haliaeetus leucogaster*) (species present)		Pits	Direct – Noise and dust pollution (on individuals in adjacent habitats)	Possible	Minor	Standard dust suppression techniques.	Negligible
			Coal preparation infrastructure	Direct – Noise and dust pollution (on individuals in adjacent habitats)	Possible	Negligible		
			Transport infrastructure	None	Not applicable	Not applicable		
	Painted Snipe *(Rostratula benghalensis s. lat.*) and Latham's Snipe (*Gallinago hardwickii*) (species not recorded, but predicted to occur		Pits	Direct – Light pollution (may affect movements at night)	Unlikely	Negligible	Standard dust suppression techniques.	Negligible
			Coal preparation infrastructure	Direct – Light pollution (may affect movements at night)	Unlikely	Negligible		
			Transport infrastructure	None	Not applicable	Not applicable		

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [2]	Residual Impact Assessment
	occasionally)		New Dams	Direct – creation of additional habitat.	Probable	Minor (positive impact)		Minor (positive impact)
	Little Curlew *Numenius minutus* (non-breeding wader, not recorded but may occur sporadically)		Pits	Direct impact – noise and dust pollution (on individuals in adjacent habitats).	Unlikely	Negligible	Standard dust suppression techniques.	Negligible
			Coal preparation infrastructure	None	Not applicable	Not applicable		
			Transport infrastructure	None	Not applicable	Not applicable		
			New Dams	Direct – creation of additional habitat.	Probable	Minor (positive impact)		Minor (positive impact)
	Marsh Sandpiper *Tringa stagnatilis*, Common Sandpiper *Actitis hypoleucos*, Red-necked Stint *Calidris ruficollis*, and Sharp-tailed Sandpiper *Calidris acuminata* (non-breeding waders, species present)		Pits	Direct – Noise and dust pollution (on individuals in adjacent habitats)	Possible	Negligible	Standard dust suppression techniques.	Negligible
			Coal preparation infrastructure	None	Not applicable	Not applicable		
			Transport infrastructure	None	Not applicable	Not applicable		
			New Dams	Direct – creation of additional habitat.	Probable	Minor (positive impact)		Minor (positive impact)
	Caspian Tern		Pits	None	Not applicable	Not applicable	None provided	None

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [2]	Residual Impact Assessment
	Sterna caspia (species present)		Coal preparation infrastructure	None	Not applicable	Not applicable		
			Transport infrastructure	None	Not applicable	Not applicable		
			New Dams	Direct – creation of additional habitat.	Probable	Minor (positive impact)		Minor (positive impact)
	White-throated Needletail *Hirundapus caudacutus* and Fork-tailed Swift *Apus pacificus* (non-breeding aerial species – species present)		Pits	Direct – Noise and dust pollution (on individuals foraging above and over adjacent habitats)	Probable	Negligible	Standard dust suppression techniques.	Negligible
			Coal preparation infrastructure	Direct – Noise and dust pollution (on individuals foraging above and over adjacent habitats)	Probable	Negligible		
			Transport infrastructure	None	Not applicable	Not applicable		
	Rainbow Bee-eater *Merops ornatus* (species present)		Pits	Direct – Noise and dust pollution (on individuals in adjacent habitats)	Probable	Minor	Standard dust suppression techniques.	Negligible
			Coal preparation infrastructure	Direct – Noise and dust pollution (on individuals in adjacent habitats)	Possible	Negligible		
			Transport infrastructure	None	Not applicable	Not applicable		
	Rufous Fantail *Rhipidura rufifrons* (breeding passerine – species present)		Pits	Direct – Noise and dust pollution (on individuals in nearby riparian habitats)	Possible	Minor	Standard dust suppression techniques.	Minor
			Coal	Direct – Noise and dust	Possible	Minor		

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [2]	Residual Impact Assessment
			preparation infrastructure	pollution (on individuals in nearby riparian habitats)				
			Transport infrastructure	None	Not applicable	Not applicable		
	Black-faced Monarch *Monarcha melanopsis* (breeding passerine – not recorded but predicted to occur occasionally)		Pits	Direct – Noise and dust pollution (on individuals in nearby riparian habitats)	Unlikely	Negligible	Standard dust suppression techniques.	Negligible
			Coal preparation infrastructure	Direct – Noise and dust pollution (on individuals in nearby riparian habitats)	Unlikely	Negligible		
			Transport infrastructure	None	Not applicable	Not applicable		
	Satin Flycatcher *Myiagra cyanoleuca* (non-breeding passerine – species present)		Pits	Direct – Noise and dust pollution (on individuals in nearby riparian habitats)	Unlikely	Negligible	Standard dust suppression techniques.	Negligible
			Coal preparation infrastructure	Direct – Noise and dust pollution (on individuals in nearby riparian habitats)	Unlikely	Negligible		
			Transport infrastructure	None	Not applicable	Not applicable		
	Australian Reed-Warbler *Acrocephalus australis* (breeding passerine – species present)		Pits	Direct impact – noise and dust pollution (on individuals in adjacent habitats).	Unlikely	Negligible	Standard dust suppression techniques.	Negligible
			Coal preparation infrastructure	None	Not applicable	Not applicable		

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [2]	Residual Impact Assessment
			Transport infrastructure	None	Not applicable	Not applicable		
			New Dams	Direct – creation of additional habitat.	Probable	Minor (positive impact)		Minor (positive impact)
Feral Species of State Significance Objective: Manage existing pests and prevent new introductions.	(feral) Cat *Felis catus,* Dingo/dog *Canis lupus dingo/familiaris* (feral predators – species present)	Declared Class 2 Pest under the LP Act	Roads and tracks	Direct – Increased access to surrounding vegetation and resultant predation on native fauna	Probable	Moderate	Strategies for managing pest species will be maintained in the EM Plan.	Minor
	Red Fox *Vulpes vulpes* (feral predator – not recorded but predicted to occur sporadically)		Roads and tracks	Direct – Increased access to surrounding vegetation and resultant predation on native fauna	Possible	Minor	Strategies for managing pest species will be maintained in the EM Plan.	Minor
	Rabbit *Oryctolagus cuniculus* (species present)		Areas disturbed for Project infrastructure	None	Not applicable	Not applicable	Strategies for managing pest species will be maintained in the EM Plan.	None
	(feral) Pig *Sus scrofa* (species present)		Areas disturbed for Project infrastructure	None	Not applicable	Not applicable	Strategies for managing pest species will be maintained in the EM Plan.	None
	(feral) Goat *Capra hircus* (species present)		Areas disturbed for Project infrastructure	None	Not applicable	Not applicable	Strategies for managing pest species will be maintained in the EM Plan.	None
Other Feral	Cane Toad	Non-native	Areas	None	Not	Not	Strategies for managing	None

Element and Protection Objective	Species	Qualification	Source of Impact	Impact Type	Likelihood of Impact Occurring	Preliminary Impact Assessment	Mitigation and Compensatory Measures [2]	Residual Impact Assessment
Species Objective: Manage existing pests and prevent new introductions.	*Bufo marinus* (species present)	animal	disturbed for Project infrastructure		applicable	applicable	pest species will be maintained in the EM Plan.	
	House Sparrow *Passer domesticus* (species present)		Areas disturbed for Project infrastructure	None	Not applicable	Not applicable	Strategies for managing pest species will be maintained in the EM Plan.	None
	House Mouse *Mus musculus* (species present)		Areas disturbed for Project infrastructure	Direct – Source area for dispersal into adjacent native vegetation and resultant competition with native fauna	Possible	Minor	Strategies for managing pest species will be maintained in the EM Plan.	Negligible
	Black Rat *Rattus rattus* (species present)		Areas disturbed for Project infrastructure	Direct – Source area for dispersal into adjacent native vegetation and resultant competition with native fauna	Possible	Minor	Strategies for managing pest species will be maintained in the EM Plan.	Negligible
	Brown Hare *Lepus capensis* (species present)		Areas disturbed for Project infrastructure	None	Not applicable	Not applicable	Strategies for managing pest species will be maintained in the EM Plan.	None
	(feral) Donkey *Equus asinus* (species present)		Areas disturbed for Project infrastructure	None	Not applicable	Not applicable	Strategies for managing pest species will be maintained in the EM Plan.	None

3.9.3 Environmental Protection Objective

The environmental protection objective is to ensure that the integrity of the local and regional landscape character and the visual amenity of the area are not significantly adversely affected as a result of the project.

3.9.4 Performance Criteria

The performance criteria for terrestrial ecology are:

- Compliance with the requirements of the project's environmental authority.
- Protection of conservation significant species, communities and habitat;
- Minimal disturbance to flora and fauna during the construction and operation.
- No unplanned or unapproved disturbance/clearing of flora and fauna

3.9.5 Control Strategies

Flora

Mitigation Measures

The following mitigation and compensatory measures will be implemented to reduce identified impacts on flora to levels that will not cause permanent harm to significant ecosystems or flora and fauna populations:

- As much as possible, only areas absolutely necessary for the construction and the operation of the project will be cleared. Clearance will be controlled by a Permit to Disturb process, and go/no-go areas will be identified on site, and managed through a GIS system.
- Standard dust suppression techniques will be used.
- Disturbed areas will be rehabilitated progressively as practicable to minimise the net loss of vegetative cover.
- Vegetation offsets will be developed through negotiation with the DERM and DEWHA for communities listed as significant under the provisions of the VM Act and/or the EPBC Act not subject to existing surface area approvals for clearing. These offsets will be managed through an offsets management plan.
- Any Interference with watercourses and flows will be in accordance with the requirements of the *Water Act 2000*, including the development of a specific revegetation plan for creek diversions.

Biodiversity Offset Management Plan

A biodiversity offset management plan will be developed and implemented to manage the offsetting of cleared significant vegetation communities. The plan will be developed in keeping with the objectives of the current Commonwealth and State legislation for the offsetting of significant vegetation communities. The plan will also be in keeping with the principles of relevant policies and guidelines such as:

- Draft policy statement 'Use of environmental offsets under the EPBC Act 1999' (DEWHA, 2007)
- Queensland Policy for Vegetation Management Offsets (DNRW, 2007)
- Queensland Government Environmental Offset Policy.

The offset management plan will include criteria for offset suitability which where practicable, would include:

- The acquisition of a remnant/regrowth community that is equal to, or greater in area than that which will be impacted by the project.
- Support a comparable suite of plant species contained in RE types impacted by the project;
- Consider maximising biodiversity gains through site selection, (e.g. habitat requirements for migratory species that will be impacted by loss of foraging trees and water sources).
- Offset locations which are preferentially closer (at least within the locality) to communities impacted by the project.
- Offset sites which are preferentially larger contiguous stands of vegetation with connectivity to other habitat types to increase viability of ecological processes.
- Place potential offset(s) parcels under a secure protection such as a conservation covenant to ensure that protection runs with title.
- Management measures to ensure offset areas remain viable in the long term. Such measures may include the management of supplementary planting, weed, fire, feral animal, livestock management and restriction on access.
- Monitoring and maintenance activities to measure success and viability of the offset activities to measure success and viability of the offset.

Specific components of the offset management plan will include:

- A map detailing the location and extent of the proposed offset(s), the associated vegetation types and any infrastructure (e.g. fencing, vehicle access networks);
- Measures for the long-term management and protection of existing areas of the endangered ecological communities
  - Brigalow (*Acacia harpophylla* dominant and co-dominant) and
  - Natural Grasslands of the Queensland Central Highlands and the Northern Fitzroy basin native grasslands;
- Measures to survey and monitor the occurrence of flora and fauna species including but not limited to squatter pigeon (*Geophaps scrpita*) and brigalow scaly-foot (*Paradelma orientalis*);
- Where appropriate, measures for weed and feral animal control, supplementary fire management, erosion & sediment control, access restriction and livestock exclusion;
- The development of a process to review and report on the effectiveness of the performance of the management plan and on any unplanned events which may impact on the offset.

Weed Management

The following weed management control strategies will be implemented to achieve the environmental protection objectives.

- Develop and implement a weed management plan.
- Manage methods for declared plants on the project site in accordance with local management practice and or DNRW Pest Fact sheets.

The spread of weeds will be eliminated from rehabilitation areas by using weed-free soil from the open cut area and monitoring and controlling weed populations should they occur. Weed control, if required, will be undertaken in a manner that will minimise soil disturbance.

Fauna

Implementation of the following mitigation and compensatory measures is identified in Tables 3.9.5 and 3.9.6 as necessary to reduce identified impacts on fauna to levels that will not cause permanent harm to significant ecosystems or fauna populations:

- As much as possible, only areas absolutely necessary for the construction and the operation of the project will be cleared. Clearance will be controlled by a Permit to Disturb process, and go/no-go areas will be identified on site, and managed through a GIS system.
- Take into account habitat for significant fauna species when considering vegetation offset areas;
- Utilise standard dust suppression techniques and strategically rehabilitate available disturbed areas to minimise the net loss of vegetative cover.
- Develop and implement the site Environmental Management Plan, including appropriate pest animal management measures.
- Fauna spotter/catchers present during clearing operations in areas of high ecological value, such as remnant woodland.
- Interference with watercourses and flows will be in accordance with the *Water Act 2000*, including the development of a specific Revegetation Plan for creek diversions.
- Implement measures to reduce fauna mortality on roads and ensure appropriate treatment of injured/orphaned animals.
- Retention (or provision in surrounding habitat), where practical, of important habitat features such as large hollow-bearing trees (live or dead), nest boxes and log piles.

A contractor's construction environmental management plan will manage potential habitat impacts during the construction phase.

In terms of maintaining natural fauna movement, focus will be on roads that traverse areas of significant fauna habitat, including the haul road crossing of drainage lines (e.g. Cherwell, Nine Mile, Harrow and Horse Creeks) and any areas associated with Brigalow. Measures to be implemented include driver awarenss and reduction of speed limits in these areas.

3.9.6 Monitoring

Flora

Monitoring during the construction phase will include:

- Mapping of the distribution of declared and environmental weeds, particularly adjacent to roadways.
- Occurrences of erosion and sedimentation influencing vegetation and stream health.
- Dust effects on native vegetation.

Monitoring during the operations phase will include:

- The distribution of declared and environmental weeds around the perimeter of the open pits, CHPP, ROM, overland conveyor, rail route, new sediment basins, creek diversions and adjacent to new roadways and the dragline transport route.
- Habitat rehabilitation/restoration progress.
- Downstream riparian habitat.
- Monitoring of treated areas to assess the success of declared plant eradication.
- Monitoring of the project site to identify any new declared plant infestations.

Fauna

During the construction phase, a fauna monitoring program will include the following:

- Frequency of fauna spotting and catching.
- Native animal injuries from construction activities.
- Pest animal activity.

During the operations phase, a fauna monitoring program will include the following:

- Habitat rehabilitation/restoration progress.
- Fauna use of rehabilitated areas.
- Downstream riparian habitat.
- Pest animal activity.

3.9.7 Commitments

- Significant weed infestations will be controlled in all areas of the Caval Ridge Project site. Species targeted for control or eradication will include those declared under legislation in accordance with the Land Protection (Pest and Stock Route Management) Act 2001.
- Trees, shrubs and other vegetation will only be removed where required (and appropriate approvals sought where necessary). Vegetation outside mining and infrastructure areas will where ever possible remain undisturbed.

- Where possible, infrastructure will be placed in areas to minimise the disturbance of existing native vegetation. Existing tracks and cleared areas will be utilised, where possible.
- Cleared areas will be progressively rehabilitated in accordance with the methodology outlined in Section 3.7.6.
- Implementation of a fauna and flora habitat monitoring program to measure rehabilitation success.
- A biodiversity offset management plan will be developed and implemented to manage the offsetting of cleared significant vegetation communities. The plan will be developed in keeping with the objectives of the current Commonwealth and State legislation for the offsetting of significant vegetation communities. The plan will also be in keeping with the principles of relevant policies and guidelines such as:

  – Draft policy statement 'Use of environmental offsets under the EPBC Act 1999' (DEWHA, 2007)
  – Queensland Policy for Vegetation Management Offsets (DNRW, 2007)
  – Queensland Government Environmental Offset Policy.

The offset management plan will include criteria for offset suitability which where practicable, would include:

- The acquisition of a remnant/regrowth community that is equal to, or greater in area than that which will be impacted by the project.
- Support a comparable suite of plant species contained in RE types impacted by the project;
- Consider maximising biodiversity gains through site selection, (e.g. habitat requirements for migratory species that will be impacted by loss of foraging trees and water sources).
- Offset locations which are preferentially closer (at least within the locality) to communities impacted by the project.
- Offset sites which are preferentially larger contiguous stands of vegetation with connectivity to other habitat types to increase viability of ecological processes.
- Place potential offset(s) parcels under a secure protection such as a conservation covenant to ensure that protection runs with title.
- Management measures to ensure offset areas remain viable in the long term. Such measures may include the management of supplementary planting, weed, fire, feral animal, livestock management and restriction on access.
- Monitoring and maintenance activities to measure success and viability of the offset activities to measure success and viability of the offset.

Specific components of the offset management plan will include:

- A map detailing the location and extent of the proposed offset(s), the associated vegetation types and any infrastructure (e.g. fencing, vehicle access networks);
- Measures for the long-term management and protection of existing areas of the endangered ecological communities

  - – - Brigalow (*Acacia harpophylla* dominant and co-dominant) and
  - – - Natural Grasslands of the Queensland Central Highlands and the Northern Fitzroy basin native grasslands;

- Measures to survey and monitor the occurrence of flora and fauna species including but not limited to squatter pigeon (Geophaps scrpita) and brigalow scaly-foot (Paradelma orientalis);
- Where appropriate, measures for weed and feral animal control, supplementary fire management, erosion & sediment control, access restriction and livestock exclusion;

The development of a process to review and report on the effectiveness of the performance of the management plan and on any unplanned events which may impact on the offset.

3.9.8 Proposed Environmental Authority Conditions

There are no proposed environmental authority conditions for terrestrial ecology.

3.10 Cultural Heritage

3.10.1 Background

Non-Indigenous Cultural Heritage

Searches of relevant heritage registers and two field surveys were undertaken to identify any non-Indigenous cultural heritage values at the project site.

A search of DERM's Heritage Register was carried out in an attempt to locate any non-Indigenous sites that had already been identified as possessing a level of significance. No cultural heritage sites within the project site were identified on DERM's Heritage Register, the National and Commonwealth Heritage Registers, or the Register of the National Estate.

A non-indigenous cultural heritage survey was conducted in December 2007 and August 2008 under permitting arrangements with the DERM (then EPA) (EPA permit number CHST00240207). There were no historical sites of cultural heritage significance (i.e sites which contain suitable value to warrant a significance and impact assessment) located within the project site during the field surveys. Five places of historic interest (i.e. places which contribute to the broader discussion of historic cultural heritage sites and places but do not have a suitable level of cultural heritage significance in their own right to justify further assessment or specific mitigation strategies) were located at the project site. The location of the sites of historic interest (HI) is provided in Table 3.10.1 and shown on Figure 3.10.1.

3.10.1 Places of Historic Interest Identified within the Project Site

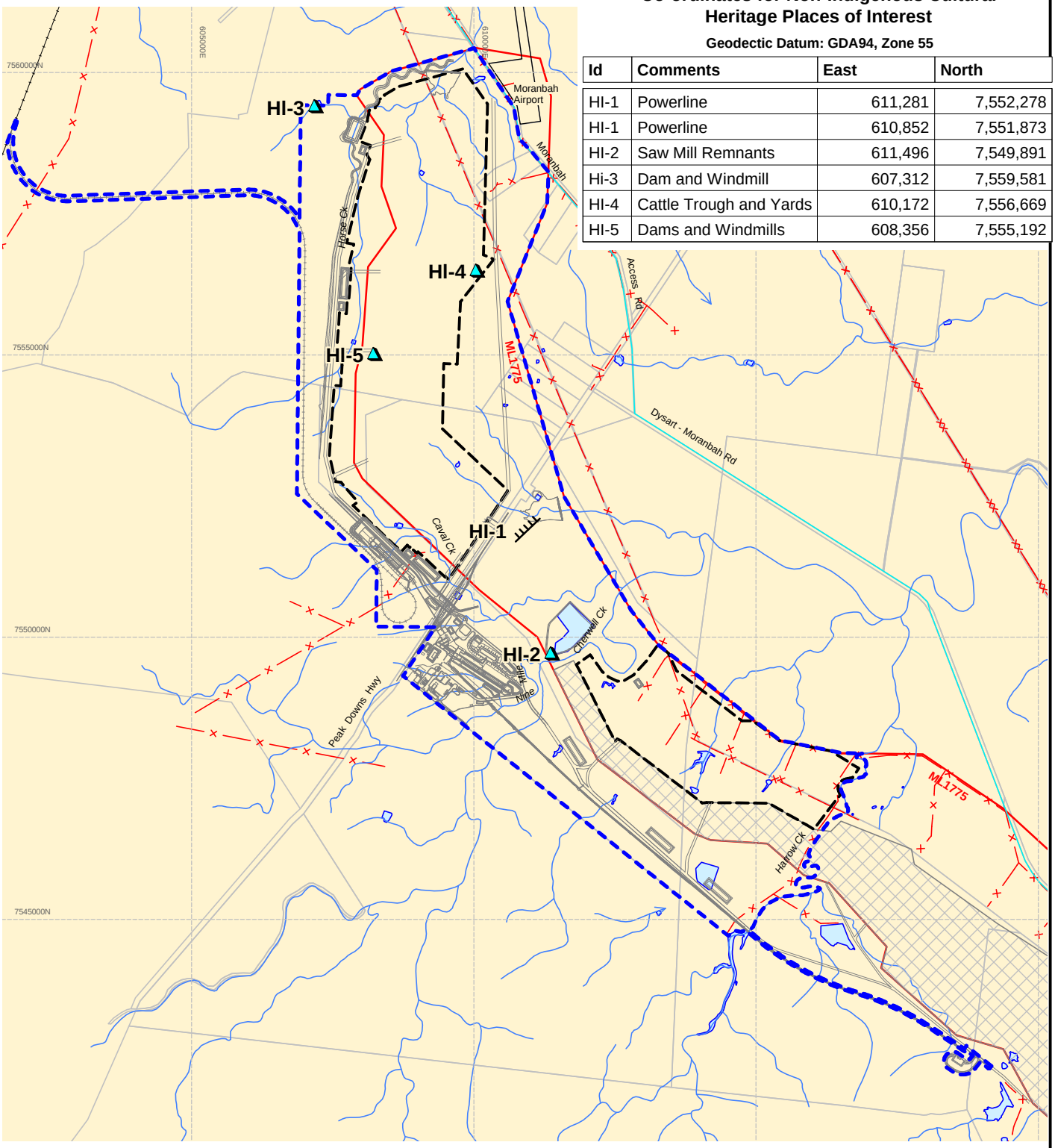
Place ID	GPS Coordinates[1]		Description
	Eastings	Northings	
HI-1	611281 610741	7552278 7551695	Telegraph line
HI-2	611496	7549891	Saw Mill Remnants
HI-3	607312	7559678	Dam and Windmill
HI-4	610172	7556669	Cattle Trough and Yards
HI-5	608356	7555192	Dams and Windmills

N.B [1]. Geodectic Datam: WGS84. Grid Zone 55K.

Co-ordinates for Non-Indigenous Cultural Heritage Places of Interest

Geodectic Datum: GDA94, Zone 55

Id	Comments	East	North
HI-1	Powerline	611,281	7,552,278
HI-1	Powerline	610,852	7,551,873
HI-2	Saw Mill Remnants	611,496	7,549,891
Hi-3	Dam and Windmill	607,312	7,559,581
HI-4	Cattle Trough and Yards	610,172	7,556,669
HI-5	Dams and Windmills	608,356	7,555,192



0 1.25 2.5km

Scale 1:100,000 (A4)

Datum: AGD84, AMG Zone 55

Project Site

HI-3 Place of Interest Location

Proposed Mine Infrastructure

Current Powerlines

Mining Lease

Mine Pit Outline

Existing Mined Area

Source: BMA Supplied Data (November 2007)

Note: Prepared by URS on behalf of ARCHAEO Cultural Heritage Services. Coordinates of "Points of Interest" were provided by ARCHAEO.

Client: BHP Billiton Mitsubishi Alliance

Project: CAVAL RIDGE MINE
DRAFT ENVIRONMENTAL MANAGEMENT PLAN

Title: **CAVAL RIDGE MINE FOOTPRINT AND PLACES OF HISTORICAL INTEREST**

Drawn: VH | Approved: RS | Date: 30-10-2009

Job No: **4262 6420**/6158 | File No: 42626158-g-2323.wor

Figure: **3.10.1** | Rev:B | **A4**

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HI – 1 Telegraph Line

An old telegraph line is located approximately 500 m south of the Peak Downs Highway, in the centre of the project site (Figure 3.10.2). The line of timber posts extends for at least 1.5 km in a north-east/south-west alignment. There are at least 15 thin timber posts, positioned approximately 100 m apart, on a fairly steep inclination, each with a ceramic conductor attached. The telegraph line is located outside the project footprint and will not be disturbed by the project.



Figure 3.10.2 North View. Telegraph Post

HI – 2 Saw Mill Remnants

Three piles of sawn timber and remains of a saw mill were located in the central and southern section of the project site (Figure 3.10.3). The mill is thought to have been built during the 1970s by a local landowner in response to the large amount of timber being cleared in preparation for the Peak Downs mining operation. Immediately east of the piles of sawn timber are stock piles of lumber. The saw mill remnants are located outside the project footprint and will not be disturbed by the project. If required back access roads will be aligned so that they do not disturb the site.



Figure 3.10.3 South-East View. Piles of Sawn Timber.

HI – 3 Dam and Windmill

The remains of two dams and a water pumping windmill are located on the north-western boundary of the project site (Figure 3.10.4). The windmill is damaged with the rotating blades lying on the ground at the base of the steel lattice tower. Evidence of the water pipeline used to feed the water from the dam can be seen emerging from one of the dam walls. The two dams and a water pumping windmill are located outside the project footprint and will not be disturbed by the project



Figure 3.10.4 South-East View. Damaged Windmill and a Nearby Dam.

HI – 4 Cattle Trough, Yards and Fence Lines

Timber and steel cattle yards, trough and timber fence lines are located in the northern section of the project site Figure 3.10.5). With gates in working order and cattle in and around this site, it is apparent the yards are still in use. This site is in good condition. The cattle trough, yards and fence lines are within the footprint of Horse pit and will be removed during the clearing activities.



Figure 3.10.5 Southern View. Timber and Steel Cattle Yards and Trough.

HI – 5 Dams and Windmills

Two water-pumping windmills and two associated dams are located in the northern section of the project site (Figure 3.10.1). The windmills are seemingly intact. The dams and windmills are within the footprint of Horse pit and will be removed during the clearing activities.

Indigenous Cultural Heritage

An Indigenous cultural heritage study was undertaken by Northern Archaeology Consultancies Pty Ltd in consultation with BBKY#4 Native Title Claimants (NAC 2009). The study was conducted in accordance with relevant provisions of the *Aboriginal Cultural Heritage Act 2003* (for pre-contact indigenous cultural heritage) and the *Queensland Cultural Heritage Act 1992* (for post-contact indigenous cultural heritage), and comprised a literature review, a field survey. The Indigenous cultural heritage found at the project site as discussed below was assessed for its 'significance' as provided for in the Queensland *Aboriginal Cultural*

Heritage Act 2003 (ACH Act) and the Burra Charter. The Burra Charter defines 'significance' as 'aesthetic, historic, scientific or social value for past, present or future generations' (Guidelines to *The Burra Charter* Section 2.1). The concept of significance is multi-faceted, and any one cultural heritage site may have different kinds of significance at different times and to different interest groups. Under the ACH Act, places may be significant because of a past event, because of association with a story, or because of an inherent spiritual quality associated with the place.

Indigenous cultural heritage surveys of the project site, undertaken by undertaken by Northern Archaeology Consultancies Pty Ltd and representatives of BBKY#4 between July and November 2008, resulted in the identification of numerous cultural heritage sites, items and significant natural features of indigenous origin, including:

- More than 1,200 surface stone artefacts of various types and raw materials (in disturbed and/or deflated low to high density concentrations and isolated finds) occurring mainly in association with creek and river terraces, gullies and drainage lines (Table 3.10.2);
- 13 scarred trees with a total of 14 scars of likely cultural origin;
- Aboriginal fireplaces;
- Artefact knapping floors;
- A silcrete extraction site;
- A cultural stone feature;
- Natural features with cultural significance; and
- A possible historic feature.

Table 3.10.2 Classification of Site Types (after Hatte 2004)

Isolated Find	Low Density Artefact Scatter	Medium/high Density Artefact Scatter
One or two artefacts lying 10 m or more from their nearest neighbours	A concentration of 3-30 artefacts Site area usually less than 50 m² Maximum density usually 2 or < 2/m²	Concentration of >30 artefacts Site area usually > 50 m² Maximum artefact density >2/m² May contain discrete activity areas such as knapping floors, hearth features, native wells etc

Cultural materials were identified in association with the following natural landforms and features:-

- Banks and alluvial terraces associated with Cherwell, Harrow, Nine Mile, Horse and Grosvenor Creeks and associated gullies and drainage lines, either in alluvium or on older ground surfaces that have been exposed by sheet or gully erosion; and
- The existing and cleared Acacia and Eucalyptus dominant forests.

Certain natural resources that supported the economic and cultural systems of Aboriginal people who lived in the area of the project were identified as follows:

- A variety of native plants with documented or orally reported Aboriginal uses (Table 3.10.3);
- Documented and orally reported lists of native animals that either provided food or were intimately linked with Aboriginal people in other ways; and
- Local supplies of silcrete, chert, sandstone, basalt and petrified wood and less commonly occurring raw materials such as rhyolite, chalcedony and quartz.

The distribution of artefacts across the project site was not random, with a clear concentration of occupation along the creeks. Some of the creeks appeared to have been more attractive for living than others. High density artefact scatters were found in erosion round the creeks just north of the Peak Downs Highway, although they did not appear to contain the same concentrations as found at Cherwell and Horse Creeks, though surface visibility was very similar. In spite of intensive surveys of the hillier country west of Horse Creek and the lengthy narrow strip west of the Peak Downs Mine, very little cultural material was found.

Table 3.10.3 List of Vegetation Species in the Project Site with known Traditional Uses

Botanical Name	Local Name	Traditional Use/s
Acacia cambageana	Bendee	Implements, fire
Acacia harpophylla	Brigalow	Implements, fire, medicine
Acacia rhodoxylon	Rosewood	Implements, medicine
Acacia salicina	Black wattle	Food, implements
Acacia shirleyi	Lancewood	Implements
Archidendropsis basaltica	Dead finish	Implements
Alphitonia excelsa	White myrtle, soap tree	Soap
Bauhinia spp.	Bauhinia	Implements
Brachychiton populneus	kurrajong	Food, water, implements, string
Capparis cansecens	Wild orange	Food
Capparis lasiantha	Split Jack, wait a while	Food
Carissa ovata	Native currant bush or 'burrum'	Food
Cassia brewsteri	Leichhardt bean	Medicine
Cymbidium canaliculatum	Black orchid or wild arrowroot	Food, medicine
Eremocitrus glauca	Native limebush	Food, medicine
Eremophila mitchelii	False sandalwood	Fuel, medicine, ceremonial
Erythroxylum australe	Native cherry	food, medicine
Erythrophleum sp.	Ironwood	Implements
Eucalyptus populnea	Poplar box	Implements
Corymbia sp.	Bloodwood	Implements, medicine
Geijera parviflora	Wilga	Implements

Botanical Name	Local Name	Traditional Use/s
Grewia retusifolia	Emu berries, dog balls	Food
Owenia acidula	Emu apple	Food, implements
Petalostigma pubescens	Quinine	Medicine, implements
Santalum lanceolatum (true sandalwood)	True or commercial sandalwood	Medicine
Terminalia oblongata	Yellowwood	Implements
Unknown	Possumberry	Food
Enchylaena tomentosa	Ruby saltbush	Food
Zehneria cunninghamii	Native cucumber	Food
Heteropogon sp.	White spear grass	Food

Stone Artefacts

The range of artefact types identified varied across the project site and consisted of cores, flakes (at primary, secondary and tertiary stages of reduction), broken and intact grindstones and mullers, blades, utilised scrapers of various kinds (including steep edge and tulas) and hammerstones. The greatest concentrations were found in erosion and mine-related exposures along the high banks and terraces of Cherwell Creek, Harrow Creek and Horse Creek where artefact densities at times exceeded 10 per square metre and were virtually continuous wherever there was erosion.

The area surrounding the existing Cherwell Creek diversion, a large dry dam north of the creek, and diggings on the north-eastern end of Heyford pit were also extremely rich in artefacts. It is likely that the disturbance had brought the material to the surface. Although a widespread salvage of artefacts had already been undertaken, artefacts were still appearing and will probably continue to do so in the future.

Although the concentrations of artefacts were disturbed to varying degrees, specific activity areas were identified within the more extensive sites. Fifty-three broken and intact grindstones and mullers were identified within 2 km along Horse Creek, suggesting an intensive local food grinding industry. There was evidence of some artefacts having been damaged recently and therefore larger artefacts found intact were removed from site and placed into the custody of the BBKY Traditional Owners. Further erosion will likely continue to expose more artefacts. The concentration of grindstones and mullers found in this survey parallels similar finds on the other side of, and further up, Horse Creek (Gorecki 2006). Evidence of similar activities has also been observed along certain creeks to the east on the mining leases of Peak Downs, Millennium, Carborough, Burton and Broadlea. The finds at the project site broaden the extent of this potential regional industry.

Along with the grinding implements along Horse Creek, 45 cores of mainly silcrete, but also petrified wood, basalt and quartz, were identified. These were identified within a particular concentration distance of 200 m. Approximately 70% of all artefacts found consisted of silcrete. Petrified wood (approximately 150) and chert (approximately 80) were also relatively common materials for flaked artefacts, while the least common materials were rhyolite (5 artefacts including a fragment of a finely ground axe) and crystal quartz (t3 artefacts). Twelve basalt artefacts were found distributed very sparsely throughout the project site but their use as mullers, anvils and hammerstones was confined to the northern section along Horse Creek, closer to the source of natural basalt. Almost 20% of flaked artefacts exhibit some kind of wear.

Knapping (Flaking) Floors

Within artefact scatters were several features identified as stone tool knapping floors, consisting of very small pieces of stone debitage or rejected fragments in the process of knapping flakes from a core. These features are generally difficult to identify because of small size of the debitage (mainly <2 cm). A concentration of debitage fragments indicates the presence of a knapping floor. In an undisturbed state they may still contain the core and the hammerstone that was used to strike the core. The sites along Horse Creek contained large numbers of cores and hammerstones, but knapping floors that would once have been there could not be specifically identified due to the disturbance by cattle.

Scarred Trees

Scarred trees are trees of species suitable for bark removal, where the bark has historically been levered off in sufficiently large quantities to be used for various purposes. Thirteen trees with 14 scars of cultural origin were found throughout the project site. Two situated in the south-eastern corner of the project site were recorded in earlier fieldwork (Woora 2005). Twelve of the trees were poplar box with only 4 of these living. The thirteenth tree was a dead coolabah tree. Most scars were subject to visible deterioration from the elements, insect activity or fire. The varied shapes of the scars recorded in the project site suggested that bark was removed to make shelters, canoes, shields and/or coolamons (containers). Some small scars in hollow trees suggested the removal of bark to gain access to possums or honey. Ten of the scars in the were between 1 and 2 m long suggesting a range of uses for the bark, while the three scars that were 2 m or more in length would most likely have been used as canoes due to the shape of the scar. Assemblages of scarred trees close to major rivers usually include a greater percentage of large scars, bark from which would have been used as canoes. The absence of very small scars indicates that cutting trees to extract honey or possums was uncommon. Extensive clearing has resulted in large old scarred trees being an increasingly rare cultural resource. Living scarred trees are even more rare, and are a direct, living link with the post-European contact past and traditional people. As well as being of high cultural significance to the Traditional Owners, their archaeological (scientific) significance is also increasing due to the scarcity.

Stone Extraction Site (Quarry)

A large open area with an exposure of grey silcrete nodules was recorded on a gentle slope near a small gully about 600 to 700 m west of Horse Creek. Many of the artefacts identified at this site were found in a pre-form (i.e. in a natural state before refinement). These would have likely been taken to be finished at a later stage or place.

Fireplaces

Ten suspected Aboriginal fireplaces were found in the project site, and eight of these (all less than 50 cm in diameter) were concentrated in one short section of Horse Creek. Some of these fireplaces contained burnt artefacts such as mullers and flakes. According to oral information from the Traditional Owners, these types of fireplaces were for ritual purposes rather than for heating or cooking and may be of significance. They have the potential to contain datable organic material (charcoal, burnt seeds, etc) which may assist in determining the age of these campsites.

Historic Feature

In the cleared northern section of the project site, a low basalt outcrop with an exposure of about 50 m by 10 m was identified. Loose, naturally occurring basalt stones were piled up on the eastern side to form a base filled with sand to a height of about 50 cm. The recent age of this feature was gauged when a concrete

besserblock and a piece of polythene water pipe were also identified. It was determined that this feature was probably a base for a tank, and of relatively recent origin.

Existing Impacts to Indigenous Cultural Heritage

Known Indigenous cultural heritage is currently being adversely impacted on by erosion caused by the Cherwell Creek diversion and clearing of the riparian zone of Horse Creek, and physical damage caused by cattle. Considering the archaeological evidence that has been recorded in various studies along both watercourses, unrecorded cultural heritage in the area may be currently being impacted also.

Landscape Significance

The survey identified that the spatial distribution and density of artefacts were directly proportional to the degree of disturbance in the environment. High densities of artefacts were identified in eroded sections of the creek environments, while little surface material was identified in similar and adjacent undisturbed locations along the same creeks. While few artefacts were identified in these adjacent areas, the undisturbed, intact banks and terraces of the watercourses within the project site retain high cultural value for their intact subsurface content. A rich cultural zone existed along all of the larger creeks in the project area. The sections between the creeks would have been exploitation zones where people may have camped for short periods when resources and water were available. The Traditional Owners of the area have identified the project site as a landscape with highly significant cultural attributes and values.

3.10.2 Environmental Value

The environmental value to be protected is the cultural heritage interest and significance (i.e. aesthetic, historic, scientific and social) of Indigenous and non-Indigenous use and occupation of the project site.

3.10.3 Potential Impacts on the Environmental Value

Non-Indigenous Cultural Heritage

The field survey identified no sites of cultural heritage significance and five places of historical interest within the project site. There is some potential for further historic items to exist within the project site as ground surface visibility, along with the nature of the survey did not allow for a complete survey of 100% of this area. In particular, potential exists for surface and/or subsurface road remnants along the old telegraph line (HI – 1) where an old road potentially passed through. Elements associated with older roads and stock routes from times past may also exist in this area. Other potential sites and places may include mile markers, survey trees, historic camp remnants and associated exotic vegetation, remote graves, old station dumps and remains of early mining activities.

It is concluded that the project site is likely to contain low levels of local cultural heritage significance. There were no sites or places located within the project site that contain levels of cultural significance important to Queensland under Section 35 of the *Queensland Heritage Act 1992*.

The field survey has identified five places of Historical Interest (HI). These places are not considered to contain enough heritage value to warrant further assessment or specific mitigation strategies, however, they will be subject to potential direct impact by the project. Potential direct impact by the project will generally be in the nature of surface and sub-surface disturbance and pre-stripping activities related to the mine's development and the construction of associated infrastructure. Indirect impacts may occur from the construction of roads and infrastructure associated with mining activities, including the day to day operation of vehicles across the broader site.

Indigenous Cultural Heritage

There is significant potential for the cultural values associated with the watercourses to be degraded due to erosion and sedimentation resulting from construction, diversion and operational activities. Control strategies to mitigate and manage adverse impacts on Indigenous cultural heritage are identified below within the context of the ACH Act and associated Duty of Care Guidelines. Section 11 of the ACH Act notes:-*If a particular object or structure is evidence of Aboriginal occupation, the area immediately surrounding that object or structure is also evidence of Aboriginal occupation to the extent the area cannot be separated from the object or structure without destroying or diminishing the object or structure¹s significance as evidence of Aboriginal occupation.* Section 12 notes:-*For an area to be a significant Aboriginal area, it is not necessary for the area to contain markings or other physical evidence indicating Aboriginal occupation or otherwise denoting the area¹s significance.* Protection of the area surrounding artefacts is consistent with provisions of the ACH Act, and is preferable to salvaging individual objects that are then removed from their contexts and lose much of their cultural and scientific value.

3.10.4 Environmental Protection Objective

The environmental protection objective is to preserve the cultural heritage values (Indigenous and non-Indigenous) of the project site.

3.10.5 Performance Criteria

The performance criteria for cultural heritage management are:

- Cultural Heritage Management Plan(s) (CHMP), to be developed in consultation with the traditional owners.
- Compliance with the requirements of the Aboriginal Cultural Heritage Act 2003 and the Cultural Heritage Management Plan (CHMP).
- Avoidance where possible of all heritage sites and places. A particular focus should be made to ensure that no disturbance of any place of State and National significance, including archaeological places or sites and places listed on the Queensland Heritage Register in accordance with the requirements of the Queensland Heritage Act 1992.

3.10.6 Control Strategies

Non-Indigenous Cultural Heritage

BMA will retain HI sites were possible, although HI places do not contain suitable levels of cultural heritage significance to warrant specific mitigation strategies. HI places 5 and 4 will be removed during the clearing activities for Horse pit. Strategies to mitigate potential impacts on unexpected cultural heritage material or sites found during the construction and pre-clearing activities include the following:

- All new employees will be provided with suitable training in how to identify cultural heritage sites or objects and report the find to the Site Environmental Advisor;
- All employees will be informed of their obligations to notify the Site Environmental Advisor of any cultural heritage finds;
- A permit will be required before any clearing or excavations activities are carried out.

- Cultural heritage policies will be developed for the management of existing cultural heritage sites or finds;
- Site Environmental Advisors will be informed of their obligations to notify the DERM of any relevant finds; and
- Regular cultural heritage educational sessions will be conducted and educational material distributed as appropriate. This material should inform the employees of what cultural heritage material may look like, and give them clear instructions on what to do if they find any such material.

Indigenous Cultural Heritage

Procedures will be implemented early in the planning stages of the project to manage and/or mitigate impact on areas containing cultural heritage in the project site from mining related activities. Specifically:

- A buffer zone of at least 100 m will be established along both banks of the major creeks. All subsurface disturbance caused by activities within this zone will be monitored by traditional owner representatives.
- Where it is proposed that creeks be diverted to allow for a mine pit, long term planning will consider the effect of the diversion on the cultural, as well as the physical and ecological, effects on the banks.
- Identified isolated artefacts and low density scatters, apart from those within specifically defined or protected zones, will be salvaged by traditional owner representatives prior to any development works.
- Livestock will be managed on leased properties, with no-go areas established at least 100 m along both banks of the major creeks. Traditional owner representatives will be commissioned to plot the width and length of the corridor containing cultural heritage significance to better establish appropriate no-go areas.
- Disturbance to the 13 scarred trees will be avoided where possible. Scar trees to be avoided will be marked and fenced as no-go areas. However, if disturbance is unavoidable, procedures established by the traditional owner representatives for dealing with scarred trees will be adopted.
- The fireplaces identified at the project site have the potential to provide valuable insights into past Aboriginal cultural practices by radiocarbon (C14) dating of burnt organic remains such as charcoal, wood and seeds. Further recording by the traditional owner representatives will be undertaken at these and other sites where disturbance is to take place from mine related activities. Such research could include archaeological excavations of any fireplaces if they will be directly impacted by mining or associated activity.
- Impact in the vicinity of the large area of Brigalow and Native Orange trees near the proposed rail extension and the Bower Bird nest will be minimised.
- Topsoil stripping for the rail extension will be monitored between the junction with the existing rail line to the eastern side of the gully.

In the event that unrecorded cultural heritage sites or materials are discovered in surface or sub-surface deposits during future operations, work at that particular location will cease and be cordoned off as a no-go area until traditional owner representatives are contacted to provide advice on significance of the finds and

management/mitigation options. A program of cultural heritage inductions will be implemented at the project and presented by traditional owner representatives for personnel and contractors involved in the construction and the subsequent day to day working of the mine.

Should skeletal material suspected of being of Indigenous human origin be discovered, all operations within 100 m of the skeletal material will cease immediately upon its discovery, and procedures outlined in relevant legislation and the project's Human Remains Draft Burial Policy (NAC 2008) will be followed.

A Cultural Heritage Management Plan (CHMP) will be developed and implemented in consultation with the traditional owners, and in accordance with the requirements of the ACH Act. When the traditional owners and BMA are negotiating a CHMP, the following items will be taken into account:

- Arrangements for the ongoing management and protection of cultural heritage after the mine is decommissioned;
- Assignment of responsibility for management measures and corrective action, to ensure that cultural values are included in the rehabilitation of creeks via plants and cultural items; and
- Associated with the above, a consideration of long term arrangements for the artefacts that will be salvaged from various areas and stored in preparation for their eventual return to the land. Consideration will be given in particular for their return to the approximate areas (ie. grid reference locations) from which they were collected (though the rehabilitated area may be dramatically altered in appearance).

Fossils

If fossils are located during the development and operation phases of the project, BMA will advise the Queensland Museum.

3.10.7 Commitments

- Control strategies in the EIS will be implemented to manage known and potential cultural heritage sites and values located within the project site.
- Conduct regular cultural heritage education sessions/trainings to employees.
- Development and implementation of a Cultural Heritage Management Plan (CHMP) in consultation with the traditional owners, and in accordance with the requirements of the ACH Act.

3.10.8 Proposed Environmental Authority Conditions – Cultural Heritage

There are no proposed conditions for cultural heritage.

3.11 Traffic

3.11.1 Background

The project site is accessed from the Peak Downs Highway. When travelling to and from the project site the majority of vehicles will utilise the:

- Peak Downs Highway – is a State-controlled road which extends approximately 276 km from Mackay to Clermont and functions as a major link between a number of townships and mines within Central Queensland and Mackay;
- Winchester Road (Saraji – Dysart Road); and
- Moranbah Access Road - runs from the Peak Downs Highway to its intersection with Mills Avenue in Moranbah and is the sole access route between Moranbah and the highway.

There are currently two school bus routes which utilise Peak Downs Highway to provide transport to the schools in Moranbah from Clermont and Coppabella. There are no school bus stops along the mine site frontage.

Crash analysis for the Peak Downs Highway (Queensland Transport, period of 2001-2006) indicated that 64% of crashes that have occurred involved a single vehicle and that 84% of crashes occurred at mid-block locations. The high proportion of these two crash types indicated that driver fatigue was a significant contributing factor, although the trend was consistent with a rural road environment. Road works scheduled on the Peak Downs Highway between Clermont and Nebo include isolated pavement reconstruction, rehabilitation and seal widening as well as driver fatigue measures (Roads Implementation Program 2008-09 to 20012-13 (RIP)). No upgrading works are detailed in the RIP for intersections relevant to the project.

Construction Traffic

Construction of the project is expected to commence in 2011 and be completed by the end of 2013. During the construction period there will be a maximum workforce of 1,200 staff during the peak six month construction period. This workforce includes the industrial area and mine construction teams who are anticipated to work one shift (7am – 6pm) and two shifts (7am -7pm, 7pm-7am) seven days a week respectively.

All construction personnel will reside in the Denham Village, south of Moranbah, which will be accessed from Moranbah Access Road. A privately-operated BMA bus service will transport 80% of the workforce, while the remaining 20% of staff will utilise private/company vehicles (assumed occupancy of two). During the construction phase it is anticipated that there will be approximately 5,128 two-way bus movements per annum with a maximum of 23 two-way bus movements per day during the peak six month construction period. There will be 140 two-way private vehicle movements associated with the Caval Ridge Mine during the peak six month construction period.

Delivery of materials and the removal of wastes will occur five days a week, and average deliveries by 12 trucks per day over two years (52 trucks per day during six month peak construction period). No site materials or wastes such as overburden are proposed to be relocated via the external road network during the construction phase. Table 3.11.1 summarises the expected type and quantity of heavy vehicle movements during the construction phase. The key transport routes to be used by construction traffic are shown on Figure 3.11.1.

Table 3.11.1 Construction Heavy Vehicle Movements

Material	Origin/ Destination	Heavy Vehicle Volume (two way)					
		Total Construction Requirement	Annual Construction Requirement	Transport Vehicle	Total Construction Deliveries	Ave Construction Deliveries	Peak 6 Month Construction Deliveries
Construction Inputs							
Building Materials & Fuels	Mackay	33,406 T	16.703 T	Various	1,145	573	864
Base and Sub-base materials & Aggregates	Dysart	365,200 T	182,600 T	Type 1 Road Train & Single articulated	7,460	3,730	4,082
Concrete	Moranbah	50,400 T	25,200 T	Concrete Transit Vehicle	4,200	2,100	1,800
Prefabricated Buildings - Offices	Clermont	400 T	200 T	Single Articulated	20	10	20
Total	**-**	***449,406T***	***224,703T***	**-**	***12,825***	***6,413***	***6,766***
Construction Outputs							
Waste (Oil + Sludge, Grease, Hydraulic fluid, metal, etc)	Mackay	47 T	24 T	Single Articulated	<3	<3	<1
General, Recyclable & Septic Waste	Moranbah	2,788 T	1.394 T	Single Articulated	276	138	138
Total	**-**	**2,835 T**	**1,418 T**	**-**	**279**	**141**	**139**
Total (Inputs & Outputs)	**-**	**452,240T**	**226,120T**	**-**	**13,104**	**6,552**	**6,905**

Operational Traffic

The road traffic movements generated during the operations phase will be almost entirely associated with the delivery of consumables, removal of wastes and the transportation of staff. Product coal will be transported via rail to Mackay for distribution and will not generate any external road traffic demands. The delivery of materials and removal of waste will occur five days a week averaging seven trucks per day.

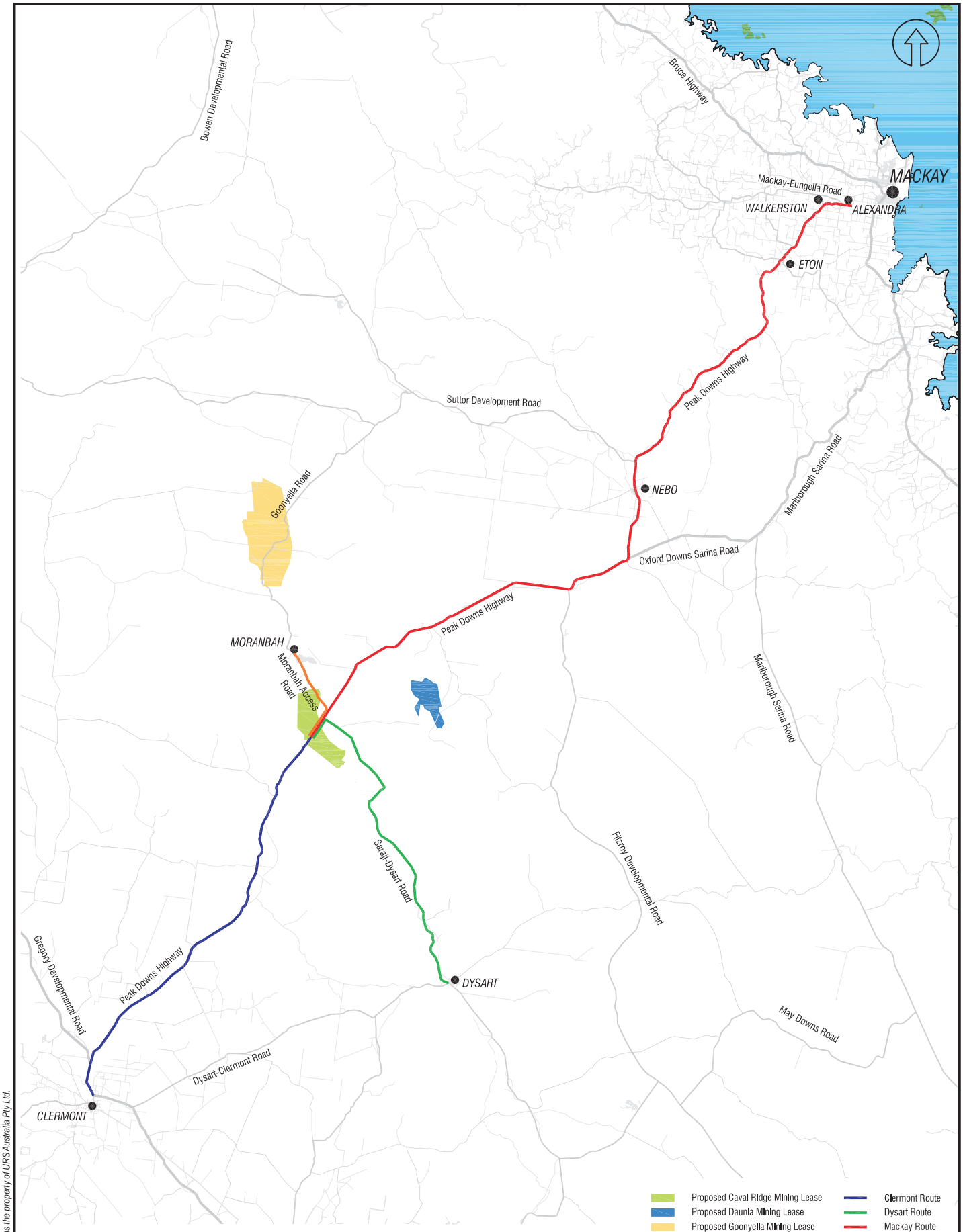
The site will operate seven days a week with two daily 12-hour shifts starting at 7.00am and 7.00pm. The average workforce will be 495 staff over 30 years. Approximately 95% of operations staff will be accommodated in Moranbah, with the remaining 5% lodging in Dysart. Approximately 70% of operations staff accommodated in Moranbah will travel to the site via a private bus service while the remaining 30% will travel via private/company vehicle. There will be an estimated 2,493 two-way bus movements per annum to/from the project site with an average of 7 two-way bus movements per day. The bus service will be

coordinated with the start and end of shifts such that all bus services are fully utilised. All staff housed in Dysart are anticipated to travel to the site via private/company vehicle. During the normal operations phase there will be 165 two-way private vehicle movements per day associated with the project.

The operational phase heavy vehicle movements are summarised in Table 3.11.2. The key transport routes to be used by operations traffic are shown in Figure 3.11.1.

Table 3.11.2 Operation Phase Heavy Vehicle Movements

Material	Origin / Destination	Heavy Vehicle Volume (two-way)			
		Annual Operations Requirement	Transport Vehicle	Annual Deliveries	Average Daily Deliveries
Operation Phase Inputs					
Fuel, Explosive & Additives	Mackay	26,752 T	Various	525	
Explosives	Dysart	14,000 T	Single Articulated	700	
Input Total	-	≈ 40,752 T	-	1,225	5
Operation Phase Outputs					
Waste Oil, Sludge, Grease, Hoses, Metals & Filters	Mackay	2,942 T	Single Articulated	147	
General and Recyclable Waste	Moranbah	6,555 T	Single Articulated	328	
Output Total	**-**	**≈ 9,497 T**	**-**	**475**	**2**
Total (Input & Output)	**-**	**≈ 50,249 T**	**-**	**1,700**	**7**



Source: Cardno Eppell Olsen, 2008.

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Client: BMA / BHP Billiton Mitsubishi Alliance	Project: CAVAL RIDGE MINE DRAFT ENVIRONMENTAL MANAGEMENT PLAN		Title: **KEY TRANSPORT ROUTES**
URS	Drawn: VH	Approved: RS	Date: 30-10-2009
	Job No.: **4262 6420** /6158	File No. 42626158-g-2324.cdr	Figure: **3.11.1** Rev. B A4

3.11.2 Environmental Value

The environmental value to be protected is the safety, health and well being of project employees, visitors and the community using State, local and mine-site road networks.

3.11.3 Potential Impacts on the Environmental Value

An assessment of the project's traffic impact on the State and Council controlled road network was carried out by Cardno Eppell Olsen (2009), in accordance with Department of Main Roads (DMR) *Guidelines for Assessment of Road Impacts of Developments*. Traffic conditions were assessed for the year 2012, which is the anticipated last year of construction, 2013 the year operations are anticipated to commence and 2023 the 10 year post completion design horizon. The traffic assessment was completed for both with and without Caval Ridge Mine traffic scenarios to determine the incremental impact of the project on the State and Council controlled road network. The adjacent road network, particularly the Peak Downs Highway and Moranbah Access Road, are expected to experience significant traffic growth due to other industrial activities planned for the vicinity. Other BMA Bowen Basin Growth Project components (e.g. Daunia Mine and Goonyella Riverside mine) were been considered in addition to the expected high background traffic growth. Given the extent of the expected traffic growth (in the order of 5 to 10% p.a. compound), it is unlikely that this will be sustained for more than about ten years. Moderate growth rates were assumed beyond 2021.

The assessment found that traffic associated with the project will likely adversely impact upon the operation of nearby intersections and road links. In addition, the impact of project heavy vehicle traffic is likely to necessitate additional pavement maintenance on the Peak Downs Highway. These impacts are discussed in more detail below.

Project traffic will not significantly impact the existing school routes as school start and end times do not correspond with the proposed shift start and end times and goods deliveries are expected to be spread throughout the day. The impact of movement of staff between the Denham Village and other regional centres such as Mackay at the start and end of recreational periods will be assessed as part of a separate planning application for the village development.

Impacts on Intersections

In accordance with DMR's scoping guidelines, the impact of the project was assessed at all significant intersections at which peak hour turning movement volumes are anticipated to increase by 5% or more beyond existing (2008) survey volumes as a result of construction or operation of the project, that is:

- Site Access/Peak Downs Highway (construction phase);
- Site Access/Peak Downs Highway (operation phase);
- Peak Downs Highway/Winchester Road; and
- Peak Downs Highway/Moranbah Access Road.

The operation of each study intersection was analysed with and without development using SIRDA Intersection 3.2. This program provides estimates for an intersection's Degree of Saturation (DOS), queues lengths and anticipated delays. DMR defines the following standard DOS thresholds:

- Priority-controlled intersections 0.80;
- Roundabouts 0.85; and
- Signalised intersections 0.90.

DOS exceeding these thresholds indicates that an intersection is nearing its practical capacity and upgrade works may be required. Above these threshold values, users of the intersection are likely to experience rapidly increasing delays and queuing.

It is anticipated that traffic associated with the project will have a significant impact on the traffic operation of the Peak Downs Highway/Winchester Road and Peak Downs Highway/Moranbah Access Road intersections.

Site Access/Peak Downs Highway (Construction Phase) Intersection

A new priority controlled access off the Peak Downs Highway will be constructed to service the project during the two-year construction phase. Once mining operations commence, this access will be gated and used infrequently by oversized vehicles. The intersection will comprise short protected turn lanes on both approaches of the Peak Downs Highway (Figure 3.11.2).

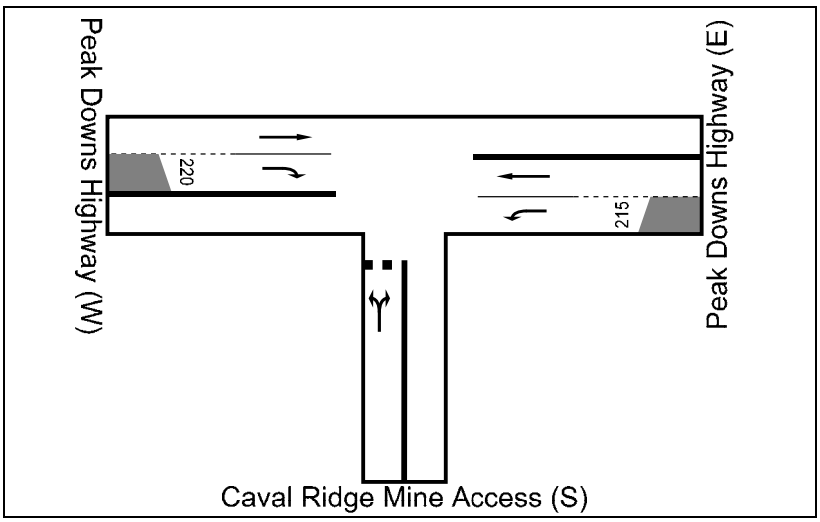


Figure 3.11.2 Site Access/Peak Downs Highway (Construction Phase - Intersection Layout)

Site Access/Peak Downs Highway (Operations Phase) Intersection

A new priority controlled access to the Peak Downs Highway will be constructed to service the project during the 30 year mine operation phase. The intersection will comprise short protected turn lanes on both approaches of the Peak Downs Highway (Figure 3.11.3).

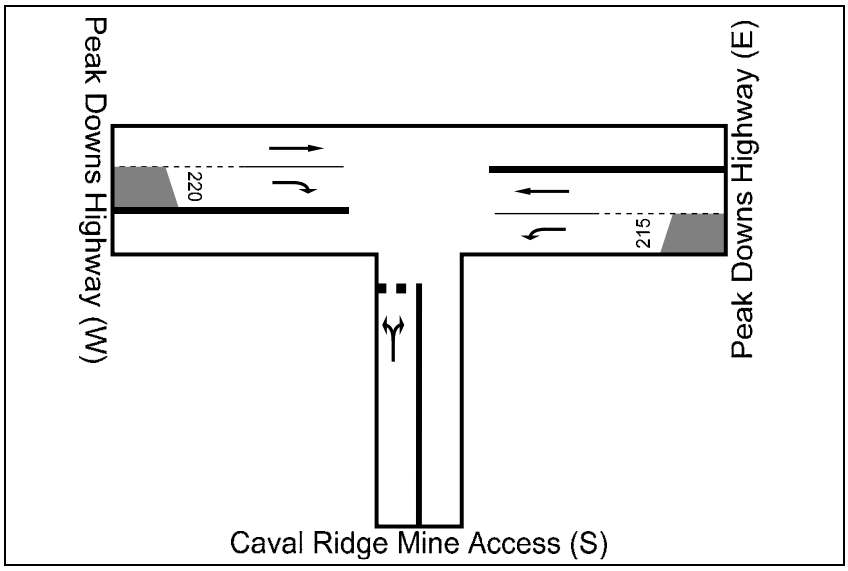


Figure 3.11.3 Site Access/Peak Downs Highway (Operations Phase -Intersection Layout)

Winchester Road/Peak Downs Highway Intersection

The Winchester Road/Peak Downs Highway intersection (Figure 3.11.4) is currently a priority-controlled intersection. Based on background growth rates, this intersection is anticipated to operate outside DMR's standard performance threshold prior to 2023 irrespective of the project proceeding. The project will generate significant additional through traffic at this intersection although only minor additional turning movements. With project traffic, the subject intersection will fail to meet DMR's standard DOS criteria during 2016, approximately 2.5 years earlier than if the project was not to occur. The impact on this intersection is therefore classified as significant based on standard industry practise (i.e. accelerates failure by one year or more).

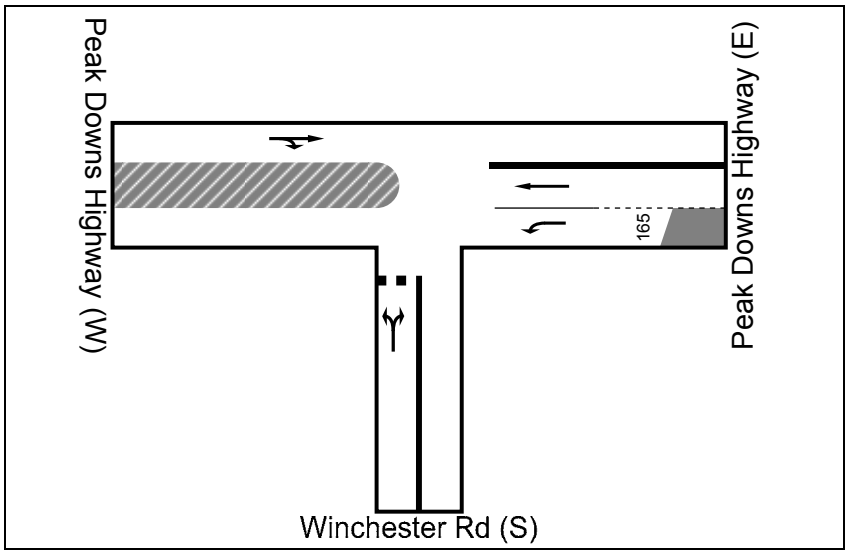


Figure 3.11.4 Winchester Road/Peak Downs Highway (Existing Intersection Layout)

Given current driver expectations and the current speed environment, the intersection will be converted to a seagull form (Chapter 13 of the *Road Planning and Design Manual)* as shown on Figure 3.11.5 by 2016 to mitigate development impacts. However, this form does not operate within DMR's standard thresholds at 2023 should traffic growth exceed 7.9% p.a. compound between 2008 and 2021.

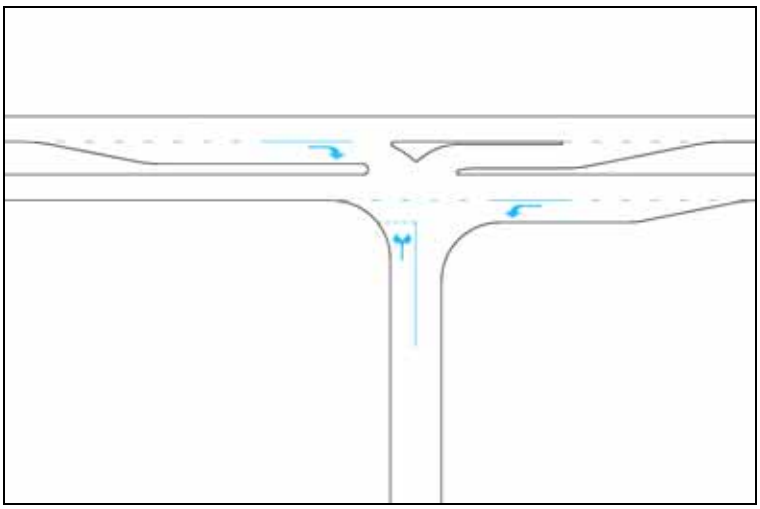


Figure 3.11.5 Winchester Road/Peak Downs Highway – (Proposed Seagull Layout)

Moranbah Access Road/Peak Downs Highway Intersection

The Moranbah Access Road/Peak Downs Highway intersection (Figure 3.11.6) is currently a priority-controlled intersection.

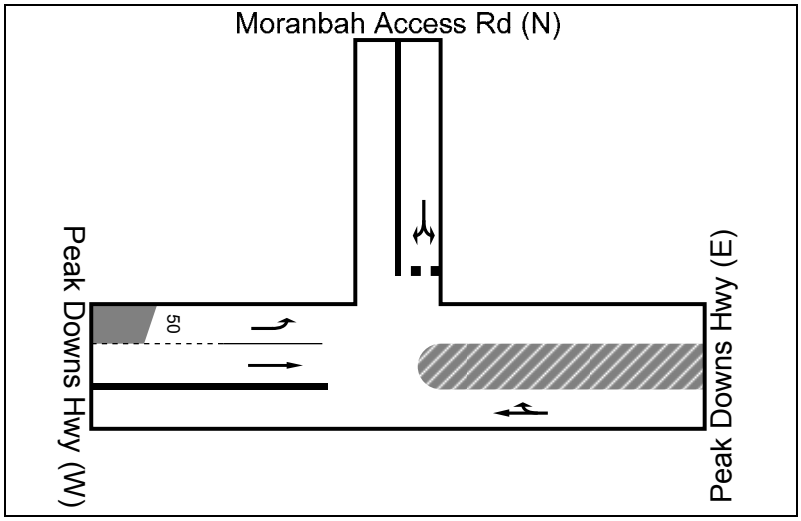


Figure 3.11.6 Moranbah Access Road/Peak Downs Highway (Existing Intersection Layout)

With project, the intersection will fail to meet DTMR's standard DOS thresholds in early 2014, approximately 1.5 years earlier than if the project was not to proceed. The impact on the intersection is therefore classified as significant based on standard industry practise (i.e. accelerates failure of intersection by one year or more). As no upgrading works are planned by DTMR, the BMA will be responsible for upgrading the intersection. Given existing driver expectations and the current speed environment, the intersection will be converted to a seagull form by early 2013 (Figure 3.11.7). The seagull intersection will operate outside

DTMR's standard DOS thresholds and industry standard critical delay criteria at 2023 irrespective of the proposed mine development proceeding. With project, the intersection in seagull form will operate within generally accepted performance criteria only if background growth does not exceed 6.9%p.a. compound between 2008 and 2021.

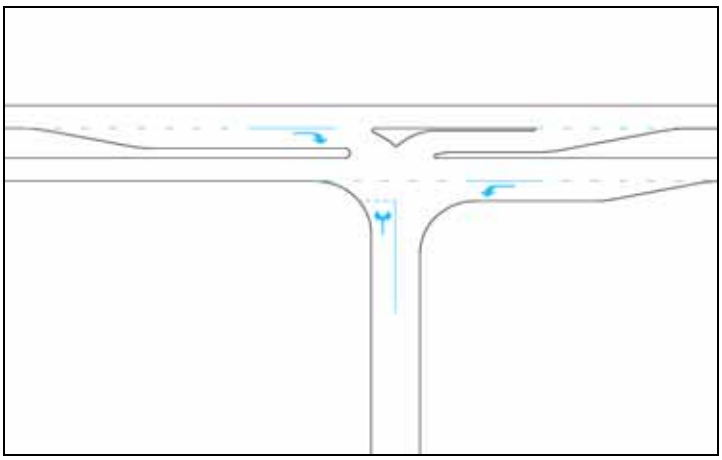


Figure 3.11.7 Moranbah Access Road/Peak Downs Highway – (Proposed Seagull Form)

Impacts on Road Links

Road Capacity

The impact on the State and Council controlled road networks for the following links was determined using DTMR's Guidelines for the Assessment of Road Impacts of Development:

- Link A - Peak Downs Highway between Mine Site Access and Winchester Road;
- Link B - Peak Downs Highway between Winchester Road and Moranbah Access Road; and
- Link C - Moranbah Access Road between Peak Downs Highway and Moranbah Railway Station Road.

Traffic conditions were assessed for the years 2012, 2013 and 2023, corresponding to the anticipated last year of construction, commencement of mining operations and the 10 year traffic design horizon. For all assessment years, analysis was completed for both with and without project traffic scenarios to determine the marginal impact of the project on the surrounding road network. DMR states that for rural state-controlled roads generally remedial measures are sought to maintain existing Level of Service (LOS). Link A is expected to operate within DTMR's standard LOS thresholds irrespective of the project proceeding. Links B and C are anticipated to operate outside accepted criteria prior to 2023 irrespective of the project. The impact of the project on the operation of these links is classified as insignificant in accordance with standard industry practice. No upgrade works or developer contributions are therefore warranted.

Road Alignment

The project site is bisected by Peak Downs Highway. To ensure the site can operate as a single integrated site with no requirement for mining vehicles to interact with the highway, grade separation of the internal mine haul routes and the highway is required. A vertical realignment of the highway will be undertaken, retaining the existing horizontal road corridor. The vertical realignment will therefore be entirely BMA's responsibility.

Impacts on Pavement

The pavement impacts of heavy vehicle movements on the State controlled road network, generated during the construction and operations phases, were assessed in accordance with DMR's "Guidelines for the Assessment of Road Impacts of Development and Notes for Contribution Calculations" prepared by the former DTMR Central District. The reduction in estimated service life on the Peak Downs Highway as a result of the proposed Caval Ridge Mine was calculated for the various sections of the highway. Reduction in estimated service life ranged from 0 – 0.8 years. Analysis indicated that, for all road segments, the increased heavy vehicle loading due to the project will be negligible and will not significantly impact the timing of pavement rehabilitation works (i.e. it will not accelerate works by one year or more). No developer contribution towards pavement rehabilitation is therefore warranted.

BMA's obligation towards routine maintenance of the Peak Downs Highway was calculated based on the percentage increase in Equivalent Standard Axels (ESA) for each road segment upon which the project will have significant impact from 2011 to 2043. Developer contributions towards maintenance of the Peak Downs Highway between the site access and the Moranbah Access Road/Peak Downs Intersection are warranted.

3.11.4 Environmental Protection Objective

The environmental protection objective is to protect the safety, health and well being of project employees, visitors and the community using State, local and mine-site road networks.

3.11.5 Performance Criteria

The performance criteria for traffic management are:

- Compliance with the requirements of the project's environmental authority.
- Minimisation of adverse impacts to traffic on the Peak Downs Highway brought about by the mine's construction and operation.
- Number of project related traffic health and safety incidents.

3.11.6 Control Strategies

Road works to mitigate the traffic impacts of the project comprise the following:

- Formation of a priority-controlled construction access on Peak Downs Highway to include a 220 m right turn bay and a 215 m left turn lane on the highway;
- Formation of a priority-controlled mining operations access on Peak Downs Highway to include a 220 m right turn bay and a 215 m left turn lane on the highway;
- Upgrade of the Peak Downs Highway/Winchester Road intersection to a seagull intersection in accordance with Chapter 13 of DTMR's Road Planning and Design Manual; and
- Upgrade of the Peak Downs Highway/Moranbah Access Road intersection to a seagull intersection in accordance with Chapter 13 of DTMR's Road Planning and Design Manual.

The assumed very high background traffic growths have a significant influence on the required works and joint infrastructure contributions will be considered at this location.

The additional heavy vehicle demands generated by the project do not warrant developer contributions towards pavement rehabilitation. Contributions towards pavement maintenance are however warranted for the section of the Peak Downs Highway between the site access and the Moranbah Access Road/Peak Downs Highway intersection.

Driver fatigue, particularly relating to personal driving to Mackay after completing a 12-hour shift, is a likely cause of crashes on the Peak Downs Highways. The Peak Downs Highway has been the focus of a number of fatigue measures including audible delineation, Driver Reviver awareness signage and regular rest areas. BMA will continue to review and improve their driver fatigue awareness program.

3.11.7 Commitments

- Control strategies in the EIS will be implemented.
- Implementation of road works identified in the control strategies to mitigate the traffic impacts of the project.
- A privately-operated BMA bus service will transport the workforce between the accommodation village and the mine.
- Continuing review of BMA's driver fatigue awareness program.
- Continue to work with DTMR to ensure a practical solution to intersection upgrades.

3.11.8 Proposed Environmental Authority Conditions

There are no proposed environmental authority conditions for traffic.

3.12 Community

3.12.1 Background

The project is located in a rural area with neighbours involved in grazing and coal mining activities. Relevant stakeholders are listed in Section 1. BMA is undertaking an extensive program of community consultation and stakeholder engagement, relating to the project and its broader growth plans. This program aims to:

- Identify community issues or concerns.
- Ensure BMA is responsive in addressing issues.
- Proactively work with stakeholders.
- Continue the long term relationship between BMA and the Bowen Basin community.

The community consultation process to date has engaged stakeholders at both local and regional levels, and provided project-specific information as well as information on the potential social, economic and environmental impacts, relating to the project. Key consultation activities included one-to-one discussions, information displays, hard copy and online information publications (such as fact sheets and newsletters), and consultation with service providers.

Opportunities for employment and growth are seen as key benefits of the project and community members consider the social amenities and connections as important features of the local area. Participants in the engagement process also highlighted that the cost of living and lack of facilities as ongoing issues for the

community. While generally the community showed support for the project and BMA's growth, key issues and concerns relating to the project included:

- Accommodation options and locations.
- Environmental issues such as noise, dust and vibration.
- Timeframes
- Proximity to the Moranbah community.
- Infrastructure location
- Impacts on the lifestyles and business opportunities of nearby and adjacent property owners.
- BMA's contribution to Moranbah lifestyles and community values.
- Where BMA would source employees from.
- Employment opportunities
- Opportunities to provide services
- Negative and positive impact of fly-in-fly-out workforces on the community.
- Pressures on social services and facilities including emergency and health services.
- Impacts on local roads.
- Mine rehabilitation
- The impact of the economic downturn on local employment.

3.12.2 Environmental Value

The environmental value to be protected is the lifestyle, including the wealth, health, safety, and wellbeing of the community surrounding the project site.

3.12.3 Potential Impacts on the Environmental Value

The project has the potential to adversely impact on community environmental values as a result of:

- Dust;
- Noise and vibration/overpressure;
- Surface and groundwater levels and quality;
- Traffic;
- Lighting; and
- Increased demand on housing and community facilities.

Economic Impact

The construction phase will have a short-term economic impact to the regional and national economy from increased spending and employment. Construction is expected to increase value added of all other industries in the Mackay Region by $479 to $599 million and raise output by $800 million to $1 billion in Australia on an annual basis. Expenditure during construction is expected to support the equivalent of approximately 7,009 to 9,285 full-time jobs in the Mackay Region and 3,675 to 4,900 full-time equivalent jobs in Australia on an annual basis. During operations, the value added to all industries in Mackay is increased by $133 to $167 million annually due to the project operation. Nationally, output is increased by

approximately $152 to $190 million on an annual basis. The operation of the project will generate an additional 804 to 1,082 jobs in the Mackay Region and 744 to 992 jobs in Australia annually.

3.12.4 Environmental Protection Objective

The environmental protection objective is to:

- Minimise adverse impacts on the lifestyle and wellbeing of the community (including environmental nuisance to neighbours caused by the project);
- Construct and operate the project in a manner beneficial to the community where possible (e.g. employ local contractors); and
- Respond to community concerns expeditiously.

3.12.5 Performance Criteria

The performance criteria for community are:

- Compliance with the requirements of the project's environmental authority.
- Expeditious response - number of days by which a complaint is practicably addressed.

3.12.6 Commitments

BMA has an established and operational complaints procedure that includes:

- Maintenance of a register of complaints held on site;
- A process for receiving, handling and investigating complaints;
- Investigation expeditiously by and a response as soon as practicable; and
- A non-compliance notification will be given to any party whose actions have caused a complaint as a result of non-compliance with site environmental requirements.
- Consultation is maintained with the Isaac Regional Council, which serves as a forum for progressing community based initiatives and infrastructure programs.

3.12.7 Proposed Environmental Authority Conditions: Schedule G - Community

Complaint response

(G1-1) All complaints received must be recorded including investigations undertaken, conclusions formed and action taken. This information must be made available to the administering authority on request.

(G1-2) The holder of this environmental authority must record the following details for all complaints received and provide this information to the administering authority on request:

a) time, date, name and contact details of the complainant;

b) reasons for the complaint;

c) conclusions formed; and

d) any actions taken.

(G1-3) In consultation with the administering authority, cooperate with and participate in any community environmental liaison committee established in respect of either the licensed place specifically or the industrial estate where the licensed place is located.

END OF CONDITIONS FOR SCHEDULE G

4 Environmental Management

4.1 Monitoring

Environmental monitoring will continue to occur in accordance with the requirements of the Environmental Authority.

The environmental monitoring will include rehabilitation success, surface water quality, groundwater quality and level, particulate and dust deposition and noise. Commitments and environmental authority conditions have been included in the relevant sections of this EM Plan.

An Environmental Monitoring Plan will be developed as part of Environmental Management System for the Project. The Monitoring Plan will outline the environmental monitoring to be undertaken, including monitoring sites, parameters and their frequency of measurement and also make reference to monitoring procedures and records. The Plan will be made available to the administering authority on request.

4.2 Reporting

External

The Proponent aims to provide timely, relevant and appropriately presented information to government authorities, the local community and the general public on the environmental performance of the Project.

Reporting commitments under the Environmental Authority and other legislation will be complied with and includes:

- Prepare Annual Returns as required under the Environmental Protection Act 1994 and BMA.
- Submit National Pollutant Inventory (NPI) reports as necessary.
- Report incidents that may potentially compromise compliance with the conditions of the Environmental Authorities immediately to operations management.

Internal

The site Environmental Manager will (in a timely manner) report any incidents or breaches of the EMP or EA conditions to the Site Senior Executive and report to the DERM in accordance with the requirements of the project's environmental authority. Any incidents, breaches or complaints will be recorded in the site EMS corrective action register (Section 4.3).

4.3 Environmental Management System

The project operations will take place under an environmental management system. BMA's approach will be to certify the EMS against the ISO14001 Standard within the first years of operation. This is a mandated BHP Billiton corporate requirement.

The EMS is the cornerstone of the operation's due-diligence approach to environmental management, and encompasses the measures used to prevent or minimise environmental harm, ensure compliance and promote continuous improvement.

BMA as part of its EMS has a corrective action system which logs and delegates responsibilities for the closing out of identified issues that require corrective action. It is through this system that all environmental and community identified issues will be handled for the project.

4.4 Research

BMA is a major contributor to mining related environmental research through contributions to the Australian Coal Association Research Program (ACARP), and the research conducted by the Australian Centre for Mining Environmental Research (ACMER) and The University of Queensland Centre for Mined Land Rehabilitation (CMLR).

4.5 Staff Training

BMA ensures that employees, contractors and visitors receive appropriate environmental awareness training. This is achieved through a variety of methods including induction training, formal presentations, and impromptu meetings.

Specifically, BMA requires that employees, contractors and visitors are aware of:

- Their roles and responsibilities (including environmental incident reporting);
- The environmental impacts, potential or actual, of their activities on site;
- The potential consequences of poor environmental performance; and
- Site emergency procedures.

Environmental awareness training occurs at induction, and is a regular feature of site-wide training. Records of training content and attendance are also be maintained. Employees and contractors required to undertake work at the site must undergo an environment, health and safety induction. Relevant environmental topics include:

- Environmental Policy;
- Duty of Care and Duty to Notify;
- Hazard / Incident Reporting;
- Environmental Awareness (Your Responsibility);
- Risk Management;
- Chemicals and Hydrocarbon management;
- Land Management;
- Water Management; and
- Waste Management

4.6 Environmental Auditing and Review

BMA will conduct environmental audits to assess compliance with regulatory requirements and the performance of the site EMS.

The objectives of the Environmental Auditing and Review programs are to:

- Monitor and report on compliance with statutes, EM Plan commitments and Plan of Operations, environmental policy, company standards, best practice guidelines and signatory codes;
- Monitor the EMS for consistency with the principles of ISO14001; and
- Ensure a senior management review of performance via consideration of the audit reports.

An environmental auditing program will continue to be implemented at the Mine. The program will include:

- Internal Environmental Audits - annually;
- Environmental Management System Review – annually;
- Plan of Operations Audits – with each Plan of Operations (usually annually); and
- Administering Authority Audits - at a frequency determined by DERM.

5 Definitions

Words and phrases used throughout this licence are defined below except where identified in the *Environmental Protection Act 1994* or subordinate legislation. Where a word or term is not defined, the ordinary English meaning applies, and regard should be given to the Macquarie Dictionary.

"acceptance criteria" means the measures by which the actions implemented to rehabilitate the land are deemed to be complete (same as completion criteria).

"**administering authority**" means the Department of Environment and Resource Management or its successor.

"anniversary day" means the anniversary day the authority is issued, whether or not it has been amended or transferred

"airblast overpressure" means energy transmitted from the blast site within the atmosphere in the form of pressure waves. The maximum excess pressure in this wave, above ambient pressure is the peak airblast overpressure measured in decibels linear (dB).

"ambient (or total) noise" at a place, means the level of noise at the place from all sources (near and far), measured as the Leq for an appropriate time interval.

"authority" means environmental authority under the *Environmental Protection Act 1994.*

"blasting" means the use of explosive materials to fracture –

a) rock, coal and other materials; or

b) structural components or other items to facilitate removal from a site or for reuse.

"bunded" means within bunding consistent with Australian Standard 1940.

"competent person" means the demonstrated skill and knowledge required to carry out the task to a standard necessary for the reliance upon collected data and/or protection of the environment.

"commercial place" means a place used as an office or for business or commercial purposes, other than a place within the boundaries of the operational land.

"contaminated land" has the meaning provided in schedule 3 of the *Environmental Protection Act 1994*

"control measures" means actions that can be taken in order to minimise environmental impacts or environmental harm. Control measures can be, but are not limited to, planning, procedural or engineering controls. Control measures has the same intent as risk treatment in AS 4360 (Risk Management).

"cover material" means soil, alluvium, weathered basalt or other suitable plant growth medium. Cover material is typically non-crusting and low in salinity.

"dam" means a containment or proposed containment whether permanent or temporary, which is designed to contain, divert or control flowable substances. However this does not include a fabricated or manufactured tank or container designed to a recognised standard.

"design plan" in the context of a dam design is the documentation required under the "Code of Environmental Compliance for High Hazard Dams Containing Hazardous Waste" to describe the physical dimensions of the dam, the materials and standards to be used for construction of the dam, the procedures and criteria to be used for operating the dam and the decommissioning and rehabilitation objectives in terms procedures, works and outcomes at the end of the dam life. The documents can include design and investigation reports, drawings, specifications and certifications.

"dust and noise sensitive place" means –

- a dwelling, mobile home or caravan park, residential marina or other residential place;
- a motel, hotel or hostel;
- a kindergarten, school, university or other educational institution;
- a medical centre or hospital;
- a protected area;
- a park or gardens; or
- a place used as an office or for business or commercial purposes and includes the cartilage of any such place.

"dwelling" means any of the following structures or vehicles that is principally used as a residence:

- a house, unit, motel, nursing home or other building or part of a building;
- a caravan, mobile home or other vehicle or structure on land; and
- a water craft in a marina.

"endangered regional ecosystems" as defined by Sattler & Williams in The Conservation Status of Queensland's Bioregional Ecosystems (1999).

"environment" has the meaning provided in Section 8 of the *Environmental Protection Act 1994*.

"environmental authority holder" means the holder of this environmental authority.

"environmental harm" has the meaning given in the *Environmental Protection Act 1994*.

"environmental impact" means changes that occur in the environment as a result of the mining activities. Impacts could be positive, negative or neutral.

"environmental management system" means the part of the overall management system that includes organisational structure, planning activities, responsibilities, practices, procedures, processes and resources for developing, implementing, achieving, reviewing and maintaining the environmental policy and achieving compliance with the environmental authority and the general environmental duty.

"environmental value" has the meaning given in the *Environmental Protection Act 1994*;

"expected impact" means the predicted changes under normal conditions of a value subject to the influence of an authorised activity. Methods available for the determination of expected impacts include:

- predictions based on historical data;
- knowledge based institution;
- numerical analysis; and
- modelling

"financial assurance" means a security deposit, either cash or a bank guarantee, that is held by the administering authority to cover the potential:

a) potential costs to rehabilitate areas disturbed by mining activities: and

b) costs or expenses, or likely costs or expenses, mentioned in section 367 of the *Environmental Protection Act 1994*

"flowable substance" means matter of mixture of materials which can be forced to or otherwise flow under any conditions possible in a situation. It includes water, other liquids or a mixture that includes water or any other liquid or suspended solids.

"foreseeable future" is the period used for assessing the total risk of an event occurring. Permanent structures and ecological sustainability should be expected to still exist at the end of a 150 year foreseeable future with an acceptable risk of failure before that time.

"hazardous dams" are dams which contain or could contain hazardous substances and,

- on failure of containment;
- on collapse of structures;
- on uncontrolled release of contained substances including dust and gas emissions; or
- on access to contained substances by fauna;
- would or could adversely impact on the environment and environmental values, including ecological health, public amenity and safety.

“hazardous substance” means any substance, whether liquid, solid, or gaseous that could or would destroy life or impair or endanger health and includes hazardous waste.

“hazardous waste” means any waste substance, whether liquid or gaseous, that tends to destroy life or impair or endanger health.

“infrastructure” means water storage dams, roads and tracks, buildings and other structures built for the purpose of mining activities but does not include facilities required for the long term management of mining impacts or the protection of potential resources. Such facilities include dams containing hazardous waste, waste rock dumps, voids, or ore stockpiles and buildings or other structures whose ownership can be transferred and which have a residual beneficial use for the next owner of the operational land or the background land owner.

"$L_{A\ 10,\ adj,\ 10\ mins}$" means the A-weighted sound pressure level, (adjusted for tonal character and impulsiveness of the sound) exceeded for 10% of any 10 minute measurement period, using Fast response.

"$L_{A\ 1,\ adj,\ 10\ mins}$" means the A-weighted sound pressure level, (adjusted for tonal character and impulsiveness of the sound) exceeded for 1% of any 10 minute measurement period, using Fast response

"$L_{A,\ max\ adj,\ T}$" means the average maximum A-weighted sound pressure level, adjusted for noise character and measured over any 10 minute period, using Fast response.

"land" in the 'land schedule' of this document means land excluding waters and the atmosphere.

"land capability" as defined in the DME 1995 Technical Guidelines for the Environmental Management of Exploration and Mining in Queensland "noise sensitive place" or a "commercial place"

"land suitability" as defined in the DME 1995 Technical Guidelines for the Environmental Management of Exploration and Mining in Queensland.

"land use" term to describe the selected post mining use of the land, which is planned to occur after the cessation of mining operations.

“mg/L” means milligrams per litre

“mineral” means a substance which normally occurs naturally as part of the earth’s crust or is dissolved or suspended in water within or upon the earth’s crust and includes a substance which may be extracted from such a substance, and includes –

a) clay if mined for use for its ceramic properties, kaolin and bentonite;

b) foundry sand;

c) hydrocarbons and other substances or matter occurring in association with shale or coal and necessarily mined, extracted, produced or released by or in connection with mining for shale or coal or for the purpose of enhancing the safety of current or future mining operations for coal or the extraction or production of mineral oil there from;

d) limestone if mined for use for its chemical properties;

e) marble;

f) mineral oil or gas extracted or produced from shale or coal by in situ processes;

g) peat;

h) salt including brine;

i) shale from which mineral oil may be extracted or produced;

j) silica, including silica sand, if mined for use for its chemical properties;

k) rock mined in block or slab for building or monumental purposes;

l) but does not include;

m) living matter;

n) petroleum within the meaning of the *Petroleum Act 1923*;

o) soil, sand, gravel or rock (other than rock mined in block or slab form for building or monumental purposes) to be used or to be supplied for use as such, whether intact or in broken form;

p) water.

"National Pollution Inventory" is a database designed to provide the community, industry and government with information on the types and amounts of certain substances being emitted to the land, air and water.

"noxious" means harmful or injurious to health or physical well being, other than trivial harm.

"non-standard" means a mining operation that if in the opinion of the administering authority does not have a low risk of serious environmental harm and the activities can not comply with the criteria for standard mining activities prescribed in schedule 1A of the *Environmental Protection Regulation 1998*. The standard mining activity trigger criteria are as follows;

- the mining activities do not or will not cause more than 10 ha of land to be significantly disturbed at any one time;
- the mining activities do not or will not cause more than 5 ha of land to be significantly disturbed at any one time;

a) in a riverine area;

b) because of mine workings;

- the mining activities are not or will not be carried out in, or within 2 km of a category A Environmentally Sensitive Area;
- the mining activities are not or will not be carried out in, or within 1 km of a category B Environmentally Sensitive Area;
- the mining activities do not include a level 1 environmentally relevant activity;
- no more than 20 persons are carrying out or will, at any one time, carry out mining activities.

“NTU” means nephelometric turbidity units.

“nuisance sensitive place” includes –

- a dwelling, residential allotment, mobile home or caravan park, residential marina or other residential premises; or
- a motel, hotel or hostel; or
- a kindergarten, school, university or other educational institution; or
- a medical centre or hospital; or
- a protected area under the Nature Conservation Act 1992, the Marine Parks Act 1992 or a World Heritage Area; or
- a public thoroughfare, park or gardens; or
- a place used as a workplace, an office or for business or commercial purposes.

and includes a place within the curtilage of such a place reasonable used by persons at that place.

“offensive” means causing reasonable offence or displeasure; is disagreeable to the sense; disgusting, nauseous or repulsive, other than trivial harm.

"peak particle velocity (ppv)" means a measure of ground vibration magnitude which is the maximum rate of change of ground displacement with time, usually measured in millimetres/second (mms)

"protected area" means

- a protected area under the Nature Conservation Act 1992; or
- a marine park under the Marine Parks Act 1992; or
- a World Heritage Area.

"progressive rehabilitation" means rehabilitation (defined below) undertaken progressively OR a staged approach to rehabilitation as mining operations are ongoing.

“referable dams” means dams which, on collapse or failure, could impact on life and are authorised by the *Water Act 2000*. Dams containing hazardous waste are not referable dams even though many such dams were once authorised as referable dams, either because of their size or hazard potential, under the Water Resources Act 1989 (now repealed). The terms of license of these dams have become conditions under an Environmental Authority or other permit under the *Environmental Protection Act* with the proclamation of the *Water Act 2000*.

“reference site” (or analogue site) may reflect the original location, adjacent area or another area where rehabilitation success has been completed for a similar biodiversity. Details of the reference site may be as photographs, computer generated images and vegetation models etc.

"rehabilitation" the process of reshaping and revegetating land to restore it to a stable landform and in accordance with the acceptance criteria set out in this environmental authority and, where relevant, includes remediation of contaminated land.

"representative" means a sample set which covers the variance in monitoring or other data either due to natural changes or operational phases of the mining activities.

“residual void” means a void that has been excluded from further mining activity.

“risk assessment” means the overall process of risk analysis and risk evaluation as shown in the Australian Standard for Risk Management (AS/NZS 4360:1999).

“risk evaluation” means the process used to determine risk management priorities by comparing the level of risk against predetermined standards, target risk levels or other criteria.

“risk evaluation criteria” means the level of change in an environmental value that exceeds the tolerable limits and initiates a risk management response to prevent environmental harm.

“risk management” means the culture, processes and structures that are directed towards the effective management of potential opportunities and adverse effects.

“risk treatment” means selection and implementation of appropriate options for dealing with risk, as described in the Australian Standard for Risk Management (AS/NZS 4360:1999).

"self sustaining" means an area of land which has been rehabilitated and has maintained the required acceptance criteria without human intervention for a period nominated by the administering authority.

“sensitive place” means;

- a dwelling, residential allotment, mobile home or caravan park, residential marina or other residential premises; or
- a motel, hotel or hostel; or
- a medical centre or hospital; or
- a protected area under the Nature Conservation Act 1992, the Marine Parks Act 1992 or a World Heritage Area; or

- a public park or gardens.

"significant disturbance" includes land

- if it is contaminated land; or
- it has been disturbed and human intervention is needed to rehabilitate it

a) to a state required under the relevant environmental authority; or

b) if the environmental authority does not require the land to be rehabilitated to a particular state – to its state immediately before the disturbance.

Some examples of disturbed land include:

- areas where soil has been compacted, removed, covered, exposed or stockpiled;
- areas where vegetation has been removed or destroyed to an extent where the land has been made susceptible to erosion; (vegetation & topsoil)
- areas where land use suitability or capability has been diminished;
- areas within a watercourse, waterway, wetland or lake where minig activities occur;
- areas submerged by tailings or hazardous containment storage and dam walls in all cases;
- areas under temporary infrastructure. Temporary infrastructure includes any infrastructure (roads, tracks, bridges, culverts, dams, bores, buildings, fixed machinery, hardstand areas, airstrips, helipads etc) which is to be removed after mining activities have ceased; or
- areas where land has been contaminated and a suitability statement has not been issued.

However, the following areas are not included:

- areas off lease (e.g. roads or tracks which provide access to the mining lease);
- areas previously significantly disturbed which have achieved the rehabilitation outcomes.;
- by agreement with the DERM, areas previously significantly disturbed which have not achieved the rehabilitation objective(s) due to circumstances beyond th control of the mine operator (such as climatic conditions).
- areas under permanent infrastructure. Permanent infrastructure (roads, tracks, bridges, culverts, dams, bores, buildings, fixed machinery, hardstand areas, airstrips, helipads etc) which is to be left by agreement with the landowner. The agreement to leave

permanent infrastructure must be recorded in the Landowner Agreement and lodged with the DERM;

- disturbances that pre-existed the grant of the tenure unless those areas are disturbed during the term of the tenure.

"stable" means geotechnical stability of the rehabilitated landform where instability related to the excessive settlement and subsidence caused by consolidation / settlement of the wastes deposited, and sliding / slumping instability has ceased.

“vibration sensitive place” means a noise sensitive place or a commercial place.

"waters" includes river, stream, lake, lagoon, pond, swamp, wetland, unconfined surface water, unconfined water natural, bed and bank of any waters, dams, non-tidal or tidal waters (including the sea), and any under groundwater, any part-thereof "licensed vehicle"