BHP Mitsubishi Alliance

Appendix O

CVM Environmental Management Plans

BHP Mitsubishi Alliance

CVM-PRO-0043

CVM PLAN

Erosion and Sediment Control

Status: Approved

Version 4.0 (20 March 2020)

Business Owner: CVM Superintendent HSE

Document ID # 000197419

Table of Contents

1 Introduction

1.1 Purpose

1 This Erosion and Sediment Control Plan (ESCP) outlines the processes and activities at Caval Ridge Mine (CVM) to minimise erosion and the release of sediment to receiving waters as a result of mining and ancillary activities.

1.2 Objectives

2 The objective of this ESCP include:

- **a** to satisfy Conditions F26 and F27 of the Environmental Authority (EA) EPML00562013.
- **b** to minimise and mitigate erosion and sedimentation resulting from operations as well as erosion impacts associated with clearing of vegetation along banks of drainage lines;
- **c** to prevent the degradation of water quality resulting from erosion and sedimentation through continued monitoring and improvement measures;
- **d** separation of runoff from disturbed and undisturbed areas where practicable;
- **e** diversion of water from disturbed catchments into mine water storages or sediment dams;
- **f** diversion of clean water away from areas of existing or planned disturbance;
- **g** rehabilitation of disturbed areas to allow vegetation propagation and regrowth;
- **h** improvement to the integrity of areas prone to erosion through temporary and permanent erosion control techniques; and
- **i** the provision of information necessary to implement effective erosion control measures.

1.3 Scope

3 The plan addresses, but is not limited to:

- **a** management of surface water flow from operational areas;
- **b** operational measures and mitigation techniques to manage erosion and sedimentation impacts; and
- **c** measures to minimise the release of sediment to receiving waters.

1.4 Application

4 This ESCP covers all activities at CVM and applies to all BMA employees and contractors. The ESCP forms part of the CVM Environmental Management System (EMS).

2 Legal and other Requirements

2.1 Regulatory Framework

1 Legislation relevant to this ESCP includes:

- **a** *Environmental Protection Act 1994* (EP Act);
- **b** *Environmental Protection (Water) Policy 2009***;**
- **c** *Water Act 2000* and relevant Water Resources Plans

d *Vegetation Management Act 1999* and *Vegetation Management Regulation 2000*;

e *Soil Conservation Act 1986* and *Soil Conservation Regulation 1998*; and

f State Planning Policy July 2017 (Department of Infrastructure Local Government and Planning (DILGP).

2.2 Relevant Guidelines

2 Guidelines relevant to this ESCP include:

a IECA (2008). Best Practice and Sediment Control. International Erosion Control Association, Australasia;

b Department of Natural Resources and Mines (2017). State Development Assessment Provisions (SDAP) Guidance – State Code 16: Native Vegetation Clearing. November 2017;

c Department of Environment and Heritage Protection (DEHP) (2014). Stormwater Guideline: Environmentally Relevant Activities. Department of Environment and Heritage Protection, Brisbane;

d DEHP (2013). Isaac River Sub-Basin Environmental Values and Water Quality Objectives. Basin No.130 (part). DEHP, Queensland;

e CVM EIS Appendix F Soil Survey and Land Resource Assessment Report (GSS Environmental 2009);

f Coordinator General's (CG) evaluation report *(August 2010); and*

g Technical Guidelines for Environmental Management for Exploration and Mining in Queensland *(1995).*

2.3 Environmental Authority

3 Under the *Environmental Protection Act 1994* (EP Act), CVM must adhere to Environmental Authority EPML00562013 (EA). The EA includes a condition requiring BMA to develop an Erosion and Sediment Control Plan for CVM, as described in ***Table 1***.

4 This ESCP is designed to satisfy condition F26 of the EA and was developed in collaboration with a Certified Professional of Erosion and Sediment Control (CPESC).

Condition	Requirement
F26	An Erosion and Sediment Control Plan must be developed by an appropriately qualified person and implemented for all stages of the mining activities on the site to minimise erosion and the release of sediment to receiving waters and contamination of storm water.

Table 1: EA condition requiring an erosion and sediment control plan

2.4 Environmental Commitments

5 This ESCP is also designed to satisfy internal BHP policies and commitments set out in the following documents:

a Our Requirements: Environment and Climate Change

b Our Requirements: Health, Safety, Environment and Community Reporting

3 Site Description

3.1 Climate

1 The climatic conditions of CVM are classified as subtropical climate, characterised by warm, dry winters and hot humid wet summers. Long term climate data used to assist with the statistical description of prevailing climatic conditions has been sourced from the Australian Bureau of Meteorology (BoM) climate data at the Moranbah Water Treatment Plant.

2 BoM rainfall for Moranbah (17km away) are contained in Table 2. Rainfall is seasonally distributed with a distinct wet season from November to March.

3 BoM reports the two–year, 6-hour rainfall event as 10.7mm/hr for CVM based on the latest 2016 IFD rainfall intensity. This translates to a Revised Universal Soil Loss Equation (RUSLE) R-Factor of 2500 which is moderate.

4 Localised flooding can also occur in tributaries of the Isaac River due to high intensity thunderstorms or long duration rain events.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann-ual
Rainfall (mm)	103.8	100.7	55.4	36.4	34.5	22.1	18	25	9.1	35.7	69.3	103.9	614.2
Mean no of days with rain >1mm	6.5	6.4	3.9	3.1	2.6	2.1	1.8	1.7	1.4	3.1	4.9	5.9	43.4
Mean maximum temperature (°C)	33.8	33.1	32.1	29.5	26.5	23.7	23.7	25.5	29.2	32.3	33.1	34	29.7
Mean minimum temperature (°C)	21.9	21.8	20.2	17.6	14.2	11.2	9.9	11.1	14.1	17.6	19.4	21.1	16.7

Table 2: Monthly climate averages for Moranbah (BoM Station 034038)

3.2 Hydrology and Topography

5 Topography across the Isaac River Valley in the vicinity of the site varies from approximately 200 metre elevation along the Isaac River east of CVM to approximately 450 metres elevation along portions of the Denham Range that define the western edge of the Isaac River Valley.

6 Site topography is predominantly gently undulating rises, with surface slopes typically less than 1% grading East-North East towards the Isaac River which is part of the Fitzroy River Basin.

7 CVM is located within the Isaac River catchment, a major drainage area of the Fitzroy Catchment (within the Bowen Basin). The ephemeral Isaac River flows south for approximately 230 km to join the McKenzie River, which flows onwards for approximately 150 km to the Fitzroy, a major river which enters the sea east of Rockhampton.

8 All surface water sources in and around CVM are tributaries of the Isaac River. The significant watercourses are:

a Cherwell Creek;

b Horse Creek;

c Nine Mile Creek;

d Harrow Creek; and

e Caval Creek.

9 The various catchment drainage at CVM is shown in Figure 1.

10 The mine operation covers approximately 103 km² 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 is drained by Caval, Nine Mile and Cherwell Creeks which then flow into the Isaac River (Figure 1).

11 The hydrogeological regime of the CVM area can be divided into the following shallow and deep aquifer zones:

a Shallow aquifers:

i Quaternary- and Tertiary-aged alluvial sediments and

ii Tertiary-aged basalt

b Deeper (regional) aquifer:

i Permian-aged strata

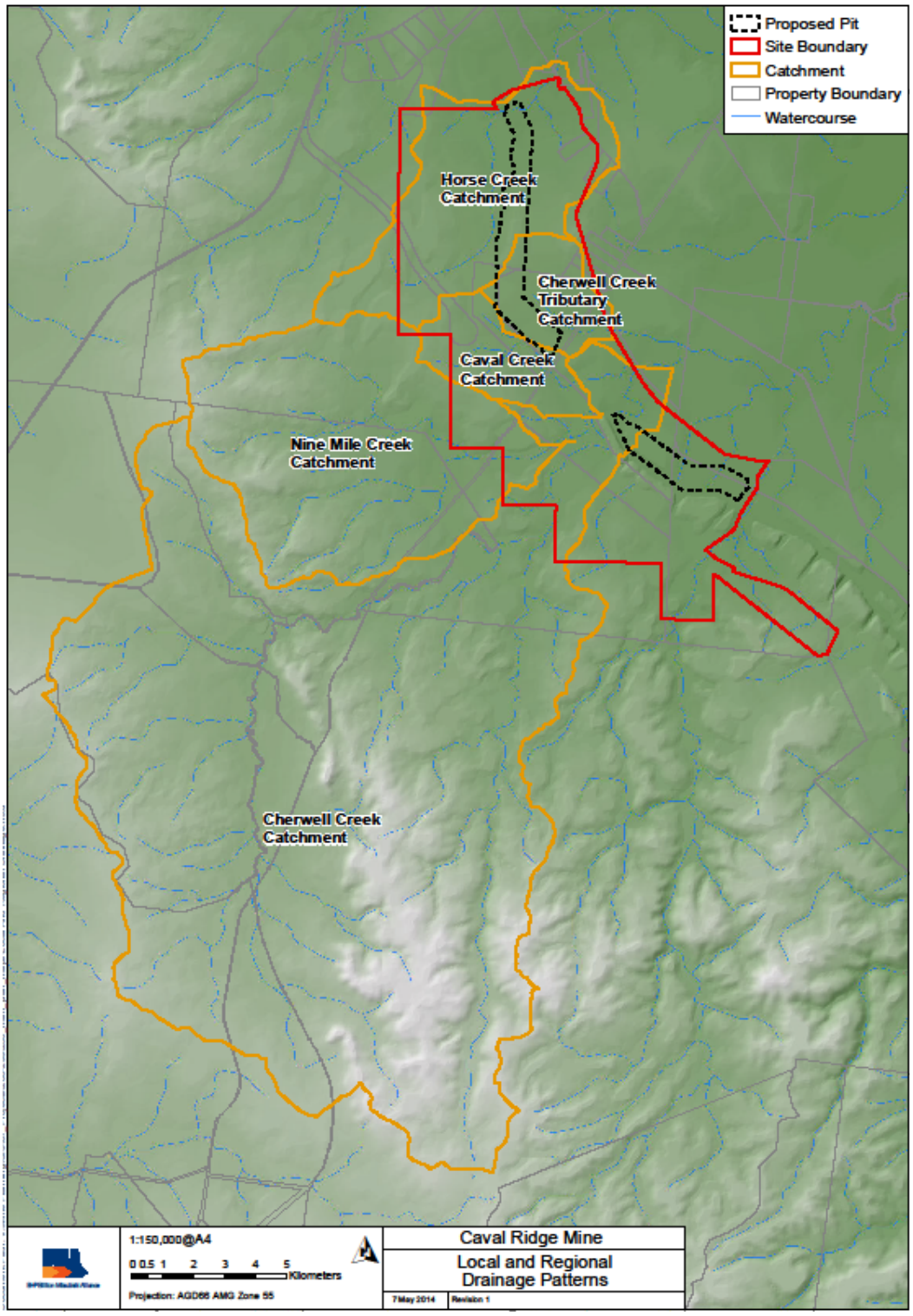


Figure 1: Local and Regional Drainage Catchments

3.3 Geology and Soil Characteristics

12 The natural topography of CVM areas is characterised by a range of topographic settings ranging from level to gently undulating plains to gravely ridgelines and low hills. The two main surface geological groups are the erosional surfaces of highly weathered Permian sediments and depositional surfaces within the Tertiary zone.

13 Soils of the area have formed from weathered parent materials under the influence of time, land relief, moisture, temperature changes and organisms. The mine site consists of the following geomorphological land zones of Cainozoic age:

a Alluvial plains and piedmont fans adjoining the Cherwell and Heyford Pits;

b Clay deposits under gently undulating plains within the Cherwell Pit area;

c Sand deposits on extensive flat or gently undulating plains adjoining the Heyford Pit; Igneous rocks, flood basalts forming extensive plains and occasional low scarps to the north of the Cherwell Pit; and

d Duricrusts formed on a variety of rock types.

14 CVM is located on the western flank of the northern part of the Bowen Basin. A relatively thin accumulation of surficial sediments is present in the area. The strata dips gently to the east in the vicinity of CVM, towards the axis of a local syncline that is truncated by the north-south trending Isaac thrust fault. Minor faulting occurs in the coal seams of the CVM site.

15 The stratigraphy of the CVM area is summarised in Table 4. The dominant feature of the area is a thick sequence of Permian Coal Measures. Mining at CVM primarily targets three coal seams of the Late Permian-aged, Moranbah Coal Measures: the Q seam - P seam zone, the Harrow Creek (H) group of seams and the Dysart (D) seams. The Permo-Triassic sediments are overlain by poorly consolidated Tertiary sediments and, in places, Tertiary-aged basalt and unconsolidated Quaternary alluvium and colluvium.

16 A summary of the major soils types is included in Table 3. An assumed value for the K-factor (soil erodibility factor) for use in the RUSLE in included, based on data in IECA (2008) Hazelton and Murphy (2007). The EIS mapped the soils found at CVM and are shown in Figure 2.

Soil type	Approximate extents	Soil description	
Uniform Clays	North Western areas of the site Approximately 41% of the site.	Topsoil: Yellowish and reddish brown to light brownish and reddish uniform clays. Texture include clay loam to light clay. Clay content 17% - 39%. Emerson ratings 2(1) – 3(1) to some areas with 6 and 8. Non-saline (EC0.04 to 0.032 dS/m). Total CEC is high. Subsoil: Yellowish brown to brown and reddish yellow to yellowish red. Texture includes clay loams to clays. Emerson ratings of 4 to 2(1). Slightly alkaline (pH 7.1-9). Clay content 29% - 44%. Non-saline.	0.03
Yellow Duplex Soils	Associated with floodplain areas. Approximately 10% of the site.	Topsoil: Generally dark yellow to brown in colour. Single grained with underlying horizon formed by moderate angular-blocky peds. Texture is generally loam to a clay loam. Clay content approximately 22% and sand content 60%. Structurally stable Emerson rating 8/3(1). Low salinity (EC 0.09 dS/m). Slightly alkaline (pH 7.1). Total CEC is high. Exchangeable NA% is low.	0.04

		Subsoil: Yellowish brown showing strong consistence and are massive in structure.	
Brigalow Clays	Occurs on lowlands and plains up to 1% slope. Approximately 6% of the site.	Topsoil: Generally light brown with a weak platy structure. Clay content approximately 25%. Non-saline (EC of 0.11 dS/m) and moderately alkaline (pH 8/0). Emerson rating of 3(1). Subsoil: Generally brown with moderate sub-angular blocky pedality and light clay texture. Clay content approximately 31%. Non-saline (EC 0.11 dS/m) and moderately alkaline (pH 9.9). Emerson rating of 4.	0.025
Skeletal Soils	Steeper eroded side slopes and ridgelines. Approximately 3% of the site.	Topsoil: Generally light reddish/brown with a weak angular-blocky pedal structure. Surface stones observed over the surface of the soil unit. Subsoil: Generally light reddish brown with a moderate angular blocky structure going to massive below 45cm.	0.03
Shallow Heavy Clays	Occurs on undulating plains and low hills. Approximately 9% of the site.	Topsoil: Generally very dark grey/black. Crumby structure and heavy clay texture. Stones were noticeably minimal in the soil profile. Subsoil: Generally black with a moderate sub-angular blocky pedality and heavy clay texture. Stone content increased below 100cm depth.	0.012
Dark Heavy Clays	Located mostly between Cherwell Creek and Harrow Creek. Approximately 26% of the site.	Topsoil: Generally black with a moderate sub-angular blocky pedality and heavy clay texture. Clay content is approximately 61%. Non-saline (EC 0.12 dS/m) and moderately alkaline 9pH 8.7). Emerson rating 4 and does not exhibit dispersion potential.	0.012

Table 3: Summary of soil types (from BMA, 2009, Hazelton and Murphy, 2007, and IECA, 2008).

Characteristic Lithology	Description	Erosion Potential
Quaternary Alluvium		
Fine sandy or silty materials	Recent sandy or silty Quaternary alluvium associated with current streams.	Moderate sediment contribution expected when freshly disturbed.
Unconsolidated Tertiary – Quaternary Calcareous Sediments and Clayed Alluviums		
Reactive Clays	Reactive basaltic influenced tertiary-quaternary clays and/or recent clayey Quaternary alluvium associated with current streams. Materials include reactive basaltic influenced clays developed from transported sediments of mixed origin (basaltic as well as erosion products or Tertiary and Permian landscapes); as well as heavy alluvial clay deposits on major floodplains. This group also includes boxcut type	High sediment contribution expected.

	materials with similar characteristics and behaviour that are dominated by unconsolidated calcareous sediments and/or basaltic reactive clays.	
Unconsolidated calcareous sediments	Unconsolidated, basaltic derived, relict alluvial/colluvial calcareous Tertiary- Quaternary sediments. Deposits are typically whitish or fawn coloured, powdery calcareous (basaltic derived) materials characterized by rounded basaltic/sandstone gravel inclusions.	High sediment contribution expected.
Unconsolidated Cainozic Sediments		
Fine Sandy Clays	Unconsolidated, relict alluvial/colluvial Cainozoic sediments sourced from the dissection of Tertiary and Permian sedimentary landscape. Deposits are typically fine sandy, either loamy or clayey materials that are typically neutral to alkaline, dispersive and saline.	High sediment contribution expected. Soils can be difficult to revegetate effectively.
Tertiary Basalt		
Fresh or weathered basalt	Restricted unit. Occurs either as relatively pure insitu fresh/weathered Tertiary basalt rock, or more commonly as boxcut type materials dominated by fresh or weathered Tertiary basalt but with a mix of weathered Permian and/or unconsolidated Cainozoic sediments. Basaltic derived boxcut type materials exhibit better characteristics and behaviour than other boxcut type materials.	Sediment generation from disturbed areas would be considered low.
Permian Sedimentary Rocks (Predominantly Fresh)		
Labile mudstones, siltstones and shales	Predominantly fresh, labile, fine grained Permian sedimentary rocks (mudstones, siltstones and/or shales) that weather readily to produce clayey materials.	High sediment contribution expected. Soils can be difficult to revegetate effectively.
Semi competent siltstones and fine to medium grained sandstones	Predominantly fresh, relatively stable, grey Permian siltstones and interbedded fine to medium grained, lithic, semi-competent sandstones, or less commonly interbedded, relatively labile feldspathic sandstones and/or fine grained, calcareous sedimentary rocks (sandstones/shales).Weathers readily to produce relatively clayey spoil materials.	Moderate sediment contribution expected when freshly disturbed, but this would decline with time and rock armouring.
	This group also includes boxcut type materials with poorer characteristics and behaviour that are dominated by weathered, fine grained, lithic sandstones/siltstones.	Disturbed areas have high levels of dispersion and moderate runoff and erosion. Some rock armouring occurs with time.
Acid-forming sedimentary rocks	Fresh Permian sedimentary rocks characterized by a mineralogical suite with significant pyrite content. Acid generation is normally higher than neutralising capacity of the materials and net spoil acidity is expressed.	Moderate sediment contribution expected when freshly disturbed, but this would decline with time and rock armouring.
Coal Enriched Materials		
Carbonaceous materials	Dark, carbonaceous Permian siltstones and shales or coal enriched spoil/waste products.	The clay and silt fraction is easily mobilised, however only moderate sediment contribution is expected, mainly due to dissociation of the clay with the strong acidity present.

Table 4: Predominant geology units and soil erodibility

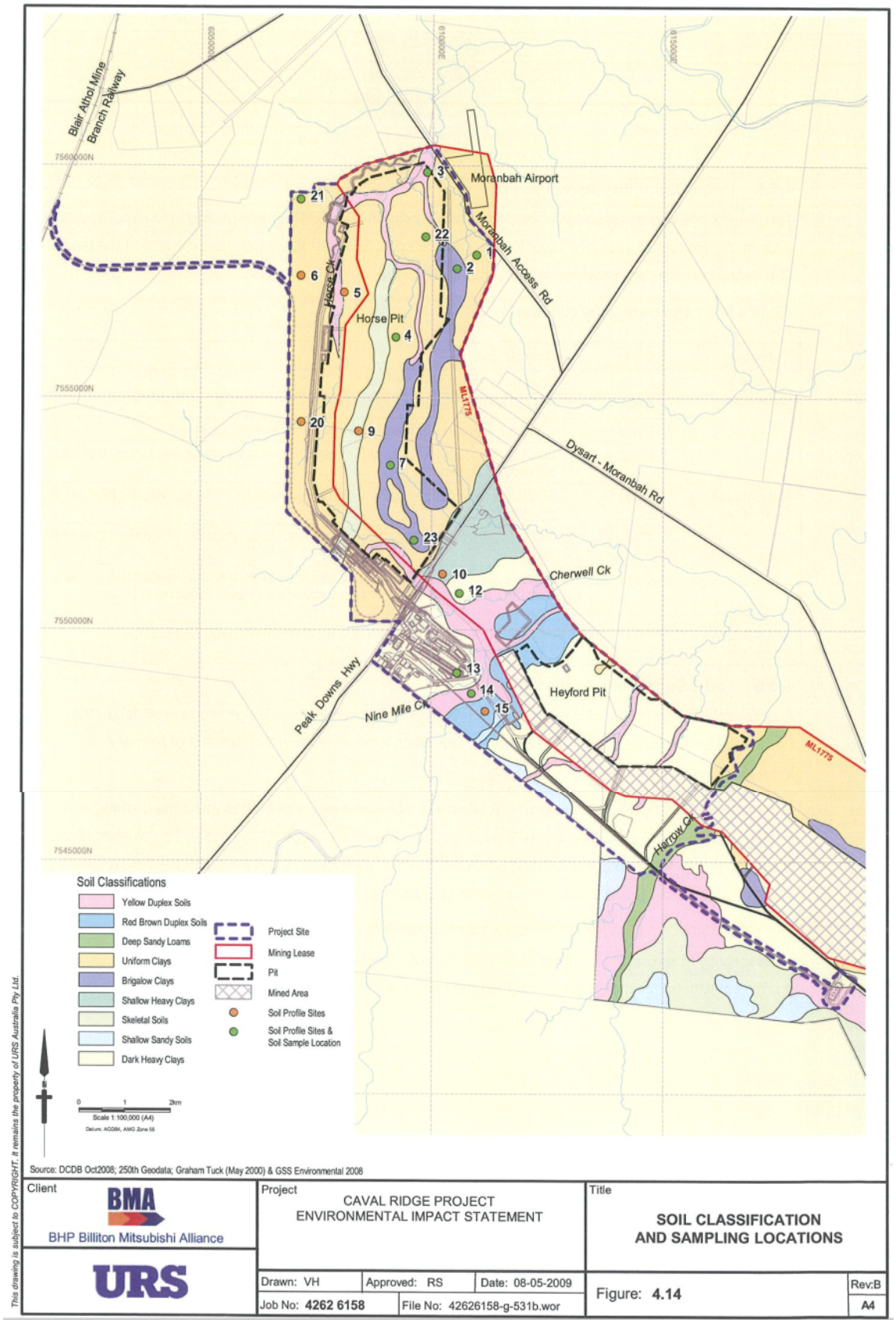


Figure 2: Soil Classification

4 Planning

1 Erosion and Sediment Control (ESC) should be incorporated into and considered during the planning stages of any activity or project that includes ground disturbance.

2 Activities which may cause erosion and sedimentation impacts include, but are not limited to:

- **a** vegetation or land clearing;
- **b** stockpiling of topsoil, coal, imported aggregate or other material;
- **c** earthworks and machinery movement;
- **d** mine development resulting in any exposed surfaces; and
- **e** grading of roads and associated traffic.

3 The Permit to Disturb (PTD) process is used to control and minimise new disturbances, pre-mature disturbance and disturbance to rehabilitated land. Refer to the BHP-PRO-0056 Permit to Disturb Procedure. The PTD includes consideration of erosion and sediment impacts and determination of appropriate controls.

4.1 Stormwater or Mine Affect Water (MAW)

4 The crucial first step in ESC planning is to determine whether the water from the catchment associated with the activity or project can be managed as stormwater. That is, that the water is not Mine Affected Water (MAW) in accordance with the definition of MAW in the EA.

5 As such, the following steps should be undertaken in ESC management to facilitate the correct design process:

- **a** Collect relevant data on the area of the activity or project, including location, size/extent, duration of the activities and the associated catchment.
- **b** Consult with CVM HSE to determine if the associated water can be managed as stormwater. This step may require the collection/review of water quality data.
- **c** If the water can be managed as stormwater, consult with the relevant stakeholders to determine the appropriate controls and design requirements.
- **d** If the water is determined to be MAW, refer to the Water Management Plan for further guidance on management of the water. However, erosion controls should still be implemented to reduce sedimentation of MAW structures.
- **e** Water management at CVM is a key component to ensure best-practice erosion and sediment control is effectively applied. Accordingly, water is defined into two categories as detailed in Table 5.

Type of water	Definition
Clean water	Surface water from an area that is either unaffected by mining activities or is effectively stabilised so that erosion is minimal.
Mine-affected water	Sediment-laden water – Surface or ground water from an area that is exposed or disturbed, and that is not mine-affected.
	Surface or ground water that has come into contact with coal products, or areas where coal products are handled.

Table 5: Classification of water at CVM

4.2 Stakeholder Engagement

6 Various stakeholders should be engaged when planning for ESC, including but not limited to:

- **a** Mine Planning (particularly tactical and strategic planning);
- **b** Engineering;
- **c** Governance and Technical Stewardship – Dams;
- **d** Water Planning;
- **e** Closure Planning;
- **f** Mine Services; and
- **g** Health Safety and Environment (HSE).

4.3 Principles of Erosion and Sediment Control (ESC)

7 The key guiding principles of ESC focus on both minimising erosion and controlling sediment. It is critical that both are considered during planning rather than just focusing on sediment control in isolation (i.e. sediment dam or basins).

8 Table 6 outlines the key guiding principles, derived from the Best Practice Erosion and Sediment Control Guidelines (International Erosion Control Association (IECA)) that should be considered during the planning stage of an activity or project

ESC Principles (Derived from IECA)	**Example Applications for Mining ESC**
Plan for and design suitable ESC for each site/project prior to disturbance	Development and implementation of site ESCP's
Minimise the extent and duration of soil disturbance and exposure to erosion	Minimising disturbance footprint Scheduling/timing of works Progressive rehabilitation
Control water movement through the site	Clean water diverted around disturbed areas Permanent and temporary drainage features Design of allowable flow velocities to minimise soil erosion/bulk sediment transfer
Minimise soil erosion and conservation of topsoil	Design of erosion control features to minimise soil loss (e.g. slope grades and length, soil surfaces, scour protection) Conservation of topsoil resources to use for rehabilitation post disturbance.
Maximise sediment retention on the site	Design of sediment dam/basins, traps, fences etc for sediment entrapment
Promptly stabilise/rehabilitate disturbed areas	Scheduling of rehabilitation/revegetation Rehabilitation plant species selection
Monitoring and maintenance of ESC to maintain required performance standards	Scheduling and budgeting of maintenance strategies (e.g. desilting) Monitoring of ESC performance

Table 6: Key guiding principles of ESC

5 Design

5.1 Commencement of Design Standards

1 The design standards set out in this ESCP take effect on and from 30 September 2019 (Design Standards Effective Date).

2 For CVM infrastructure designed or constructed prior to the Design Standards Effective Date, BMA has developed a works program to bring this infrastructure into compliance with the design standards set out in this ESCP.

5.2 Relevant Guidelines

3 The design of erosion and sediment control measures should be generally designed considering the guiding principles within:

- **a** Best Practice Erosion and Sediment Control Guidelines (International Erosion Control Association (IECA), 2008); and
- **b** DEHP Manual for Assessing Consequence Categories and Hydraulic Performance of Structures.

4 Whilst the IECA Guideline is generally intended for urban environments or short-term disturbance activities, it encompasses strategies that can be adapted for the mining environment. This includes providing design criteria more suitable for permanent ESC controls that takes into account sensitive receiving environments.

5.3 Key Considerations

5 The design of ESC is generally influenced by a number of site and project specific characteristics. These include:

- **a** The scale and type of the disturbance.
- **b** The soil types and/or slopes.
- **c** The locality of the disturbance.
- **d** Any site-specific legislative requirements or hydraulic/structural design requirements.
- **e** Other constraints such as available space, agreed maintenance frequencies and any sensitive receptors.

6 The design of erosion and sediment control structures is to be determined through engagement with the relevant stakeholders. Where a sediment basin or dam is required, a flow chart has been developed by CVM to assist with determining the steps required in the design and construction of a water storage structure (Refer to Appendix A). This includes consultation with the G&TS Dams team and potentially review of the DEHP Manual for Assessing Consequence Categories and Hydraulic Performance of Structures to determine whether the structure will be considered a regulated structure. Table 7 is an assessment of the construction catchment size that would trigger the need for constructing a sediment dam/basin for that catchment, in compliance with IECA (2008).

Parameter	Definition	Assumed or adopted value		
		Slopes up to 2%	Slopes >2% up to 4%	Slopes 5% or more
A	Total calculated soil loss (t/ha/yr)	64 t/ha/yr	102 t/ha/yr	185 t/ha/yr
R	Rainfall erosivity factor (refer to Section 3.1)	2500	2500	2500
K	Soil erodibility factor (refer to Section 3.2)	0.048	0.048	0.048
LS	Slope length and gradient factor	2% and 80m (LS of 0.41)	3% and 80m (LS of 0.65)	5% and 80m (LS of 1.19)
P	Conservation practice factor	1.1 assumed	1.1 assumed	1.1 assumed
C	Ground Cover	Maximum of 1.0 assumed	Maximum of 1.0 assumed	Maximum of 1.0 assumed
Erosion hazard (from IECA, 2008)		Very Low	Very Low	Maximum of 1.0 assumed
Catchment size trigger for sediment dams/basins		N/A	1 ha	0.25 ha

Table 7: RUSLE definitions and assumptions – typical conditions

5.4 Erosion Control

7 Erosion control is the action of minimising the potential for soil erosion. General principles to manage soil erosion include controlling the flow rate of runoff before it develops into an erosive force and protecting soil surfaces with some form of cover.

8 The application of temporary erosion control can be implemented to reduce short term impacts as part of the 'wet weather management plan'. However, this is not a long-term solution due to the nature of mining operations and further controls are required to mitigate this risk. Examples include:

a Minimise the area of disturbance where possible and schedule the disturbance such that it is not exposed for longer than is necessary.

b Where the surface is to be disturbed, topsoil should be stripped and stockpiled in line with *CVM-PRO–0053 Topsoil Management.*

c Clean water should be diverted around the disturbed and/or sensitive areas where possible.

d Exposed surfaces should then be protected with surface cover as soon as practical after works to assist in reducing surface erosion.

e Rehabilitation should be undertaken to provide a stable and vegetated landform and should be completed in accordance with the *BMA Sustainable Landform Guideline* and *CVM–PRO-0054 Rehabilitation Management*. Surface treatment must consider the type of material/rock suitable for the required slope and velocity to ensure the selected material is fit for purpose. Table provides guidance on selecting an appropriate surface cover based on slope.

f Where disturbance has occurred within a waterway, the area should be revegetated as soon as possible. Consideration should be given to the use of a soil binder, coir mesh or rock/topsoil matrix, depending on the significance of the waterway, to stabilise the surface during vegetation establishment. In accordance with Chapter 4.4 of IECA (2008), the Erosion Control Standard for CVM is detailed in Table 8.

Month	Relative Risk (VL, L, M, H, E)	Number of weeks ahead of works for clearing	Percentage cover required for rehab of finished areas	Number of days to achieve the cover on completed areas	Cover must be applied on exposed areas if no works occur for (no. of days)	Stockpiles require covering within (no. of days)
January	H	4	75	10	10	10
February	H	4	75	10	10	10
March	M	6	70	20	20	28
April	L	8	70	30	30	28
May	L	8	70	30	30	28
June	VL	8	60	30	30	28
July	VL	8	60	30	30	28
August	VL	8	60	30	30	28
September	VL	8	60	30	30	28
October	L	8	70	30	30	28
November	M	6	70	20	20	28
December	H	4	75	10	10	10

Table 8: Erosion Control Standard for CVM (from IECA, 2008)

Flatland (flatter than 1 in 10)	Mid Slopes (1 in 10 – 1 in 4)	Steep Slopes (steeper than 1 in 4)
Minor works (e.g Construction of site facilities, temporary topsoil stockpile)		
Gravelling Mulching Revegetation Rock mulching Erosion control blankets	Revegetation Rock mulching Rock armouring Mulching well anchored Erosion control blankets, mats and mesh	Revegetation Hydro mulch Rock armouring Erosion control blankets, mats and mesh
Major works (e.g Overburden emplacement, creek diversion, major creek crossing)		
Revegetation	Revegetation Mulching well anchored Rock armouring	Revegetation Hydro mulch Rock armouring

Table 9: Typical surface treatments for erosion control

5.5 Drainage Control

9 Runoff can be controlled in a number of ways to reduce the risk of erosion. Table 10 outlines the options, criteria and principles that should be considered in the design of drainage controls. Designs should consider velocity and the material type and sizing required to manage those velocities.

Drainage Control	Function	Minimum Design Criteria	Justification
Low Gradient Drainage Controls (Gradient < 10%)		The minimum design criteria for drainage conveyance is the 1 in 10-year Average Reoccurrence Interval (ARI). Drains near MAW catchments and high-risk areas should consider whether a more conservative design event is required.	Designed to have a non-erosive hydraulic capacity to convey. The design criteria is aligned with IECA Guidelines for maximum design life.
Catch Drain	Intercept and convey runoff from disturbed areas into sediment control structure or reduce runoff entering disturbed areas		
Major Diversion Channel	Generally permanent diversion of large concentrated flows		
Flow Diversion Bank	Diversion (if materials are available) of minor flows at the base of fill slopes and/or cross drainage on unsealed roads		
Steep-gradient Drainage Controls (Gradient > 10%)			
Chute	Discharge of concentrated flows down steep slopes and control of flow into sediment dams/basins		
Level Spreader	Conversion of minor concentrated flows into sheet flow		
Slope Drain	Discharge of minor flows down steep slopes and into bushland/receiving environment		

Table 10: Drainage Control options and criteria

10 In accordance with Chapter 4.3 of IECA (2008), The Drainage Control Standard for CVM is detailed in Table 11.

Temporary drainage feature – number of months of operation	*Required design event*
< 12 months	1 in 2 year ARI
12 to 24 months	1 in 5 year ARI
>24 months	1 in 10 year ARI

Table 11: Drainage Control Standard for CVM (from IECA, 2008).

5.6 Sediment Control

11 In Queensland, due to higher intensity (concentrated) rainfall and the dispersive nature of soils, the preferred and most effective sediment control are sediment basins/dams (Type 1). Type 1 controls are the most conservative and are considered the most effective in long-term sediment entrapment.

12 Small-scale sediment controls (Type 2 and 3) like silt fences and berms may be appropriate controls on a temporary basis during small-scale, short-term construction/exploration stages prior to implementing erosion protection measures such as revegetation.

13 Due to the magnitude in size for many mining activities, Figure 3 provides guidance on determining sediment control requirements, based on the disturbance catchment size.

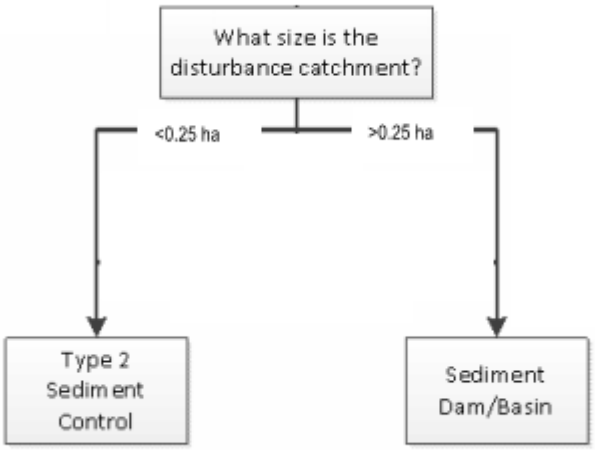


Figure 3: Sediment Control Flow Chart

14 The Type 1, 2 and 3 sediment controls are defined and discussed in IECA. Table 12 below outlines some typical Type 1 and 2 sediment controls and applications on mine sites.

Control Type	Sediment Control	Example Applications
Type 1	Sediment Basin/Dam	Overburden emplacement
Type 2	Mulch Berm Rock Filter Dam Sediment Fence Sediment Sump	On site facilities (e.g. new administration building, carpark etc.) Temporary topsoil stockpiles

Table 12: Type 1 and 2 Sediment Controls

15 For larger scale projects a sediment dam or basin will be required. Any proposed sediment basin or dam should be assessed against the DEHP Manual for Assessing Consequence Categories and Hydraulic Performance of Structures in consultation with the G&TS team. The correct naming convention for sediment dams/basins should be adhered to:

a If the storage is designed/constructed to be pumped it is a sediment dam.

b If the storage is designed/constructed as a passive system it is a sediment basin.

16 The dam or basin will act to capture eroded or disturbed soil that is entrained in surface water runoff during rain events. IECA outlines a number of Type 1 sediment controls which are summarised in 13.

17 In accordance with Chapter 4.5 of IECA (2008), The Sediment Control Standard for CVM is detailed in Table13.

Slope conditions	Catchment area of disturbance	Type of sediment control required	Suggested control(s)*
Up to 2% slope	All	3	• Sediment fences; or • Mulch bunds
Less than 5% slope	Up to 1,000m2	3	• Sediment fences; or • Mulch bunds

	Up to 1 hectare	2	• Mulch bund; or • Excavated sediment traps
	1 hectare or more	1	• Sediment basin
Slope 5% or greater	Up to 1,000m2	3	• Sediment fences; or • Mulch bunds
	Up to 2,500m2	2	• Mulch bunds; or • Excavated sediment traps
	Up to 1 hectare	1	• Sediment basin
	1 hectare or more	1	• Sediment basin

Table 13: Sediment Control Standard for CVM (from IECA, 2008)

* Note that a higher level of sediment control can be applied if so desired. For example a catchment less than 1 ha on slopes of less than 5% could report to a sediment basin (a Type 1 control) if so desired.

Sediment Control Type	Soil and/or catchment conditions
Type A	The duration of soil disturbance within a given discharge catchment exceeds 12 months. Most effective basin for clayey soils.
Type B	The duration of soil disturbance within a given discharge catchment, does not exceed 12 months
Type C	Less than 33% of soil finer than 0.02mm and no more than 10% of soil is dispersive Most effective within non-dispersive, low clay sandy soils.
Type D	An alternative to Type A or Type B when it is demonstrated that automatic chemical flocculation is not reasonable or practical.

Table 14: Type 1 Sediment Controls

18 Sediment dams or basins should be designed in an accordance with the principles and criteria outlined in Table 14 in conjunction with IECA. The minimum total volume of a sediment basin or dam equates to the sum of the settling volume and the sediment volume. Consideration should also be given to providing sufficient freeboard between the top of embankment and the settling volume maximum water level. Sediment Control.

5.7 Sediment basin sizing

19 Sediment basin sizing is determined by three guiding documents as detailed in Table 15.

Publisher	*Guidance document*	*Basin sizing requirements*
IECA, 2008 (and 2018 update)	Best Practice Erosion and Sediment Control	If using Type A basins, design for the 5-year event.
DEHP, 2014	Stormwater Guideline: Environmentally Relevant Activities	Design basins for the 10-year, 24-hour event.
DILGP, 2017	State Planning Policy, 2017	Required to capture and treat 80% of the annual average runoff volume.

Table 15: Sediment basin sizing requirements

20 For CVM, sediment basins in catchments subject to mine-affected or sediment-laden water will be designed as Type D basins based on the 10-year, 24 hour rainfall depth, which is 136mm (based on the 2016 IFD values from the Bureau of Meteorology). By using Type D basins, CVM has access to the detained water for rehabilitation, processing and dust suppression.

Design Parameter	Minimum Design Criteria	Justification	Alternative Design Criteria
Sediment Dam/Basin Type	Type D	Type D have traditionally been used on mine sites to capture sediment. Type D do not require flocculation, specialist services and excessive up keep which is generally why they are used on mine sites.	Type A or B can apply if there is data to support this type being effective for the catchment.
Settling Volume	The settling volume should be designed for the 95th percentile, 5-day rainfall volume where $R_{(95\%, 5\text{-day})}$ = 65.6mm for CVM	IECA recommends an x-percentile 5-day event settling volume for Type D structures. The 95th percentile has been selected as a conservative approach as it is applied to long-term sediment dams/basins and/or when discharging to sensitive receiving environments.	85th percentile, 5-day volume is justifiable for use if there are volume or cost constraints.
Sediment Volume – for runoff from catchments with steep grades and/or long slopes (e.g. spoil dumps)	Sediment volume can be calculated using the Revised Universal Soil Loss Equation (RUSLE). The sediment volume should be based on a 12-month period. For information on calculating the soil-loss volume refer to IECA.	A sediment volume based on a 12-month RUSLE calculation is appropriate for a mining environment to align with agreed maintenance frequencies whilst maintaining adequate storage for sediment control.	
Sediment Volume – for runoff from catchments without steep grades (<1 in 10) and/or long slopes	50% of the settling dam/basin volume	Aligned with IECA and for relatively flat catchments, 50% of the settling dam/basin volume is approximately equivalent to the 12-month RUSLE volume	
Settling Zone Depths and Length to Width Ratios	Min. settling depth= 0.6m Length/width ratio=3:1.	In accordance with requirements of a Type D. For more guidance refer to Book 1, Appendix B of IECA BPESC.	Note that the length to width ratio is a desirable standard and therefore, where space restrictions apply, it is acceptable if these criteria are not met.
Emergency Spillway	1 in 50 year ARI event	In accordance with Book 1, Appendix B of IECA.	

Table 16: Design criteria for sediment basins

5.8 Soil Management

21 Sodic soils

Sodic soils are common across CVM with most sodic soils being dispersive. Sodicity in the soil is caused by the presence of a high proportion of sodium ions relative to other soil cations, particularly calcium. This impacts the soil structure as it weakens the bonds between soil particles when wetted. The breakdown of the soil structure can also cause the small clay particles to move through the soil and clog pores spaces restricting the movement of water which can lead to an increase in salt concentration.

Sodic soils need to be managed to limit sediment mobilisation and, where required, ensure sediment is captured and retained on-site. Sodic soils are highly erosive and frequently exhibit deep, narrow rilling (fluting) on batter slopes and drains, gully erosion and tunnel erosion from concentrated overland flows.

22 Identification

Sodic soils can be identified from landscape features and local knowledge, or based on soil sampling and laboratory testing. Prior to obtaining samples and sending them away for testing (which can be time consuming and expensive), an initial aggregate immersion test can be undertaken on-site to indicate the potential for dispersive sodic soils.

The test is described in IEXA (2008) Book 4 OST-1 and is reproduced below:

The testing procedure involves filling a dish or jar with distilled or de-mineralised water to a depth sufficient to cover the soil samples. Several dry, hard clumps of soil (about 5mm square) are gently placed in the water. The sample is then observed after being left undisturbed for an hour.

After an hour observe the dish and compare against the following photos in Table 17 to determine if the soil shows the potential to be sodic/dispersive.

	**Non – dispersive** Water remains clear though particles may slightly collapse. The boundary of the clumps remains clearly defined.
	**Slightly dispersive** Discolouration surrounding particles or distinct cloudiness surrounding some. Boundary of clumps vaguely defined.
	**Dispersive** Dispersive and cloudiness surround most or all particles (extending vertically). Boundary of clumps not able to be defined. **Highly dispersive** Discolouration extending vertically throughout most or all water. Highly dispersive or slaking soils will collapse in less than 10 minutes. A cloudy ring will be seen around the collapsed soil when it is dispersive.

	**Slightly slaking** Water remains clear. Boundary of clumps vaguely defined. **Slaking** Water remains clear. Boundary of clumps not able to be defined. The clumps completely collapse and spread horizontally.

Table 17: Sodic Soil On-Site Field Test

If the soils clump completed disperse it can be assumed to be a Class 1 dispersive soil. Class 1 soils are unstable, sodic soils that disperse spontaneously in water and can have severe erosion problems.

If the soil shows some dispersion it can be assumed to be a Class 2 dispersive soil. Class 2 soils are potentially dispersive soils that disperse after the application of mechanical work (e.g. earthworks) either by raindrop impact or irrigation.

If the soil shows no sign of dispersion, remould a small portion of soil at a water content equivalent to field capacity and redo the test. If it disperses it would be assumed to be a Class 3 dispersive soil. Class 3 soils are potentially dispersive soils that disperse after the application of mechanical work (e.g. earthworks).

Note that a laboratory test is required to confirm any assumptions made from an on-site test. It is anticipated that over time a number of on-site tests can be roughly calibrated with laboratory testing to correlate and provide confidence with the on-site tests. Laboratory testing can include the Emmerson Aggregate Test (EAT), Exchangeable Sodium Percentage (ESP) or the Sodium Adsorption Ration (SAR). Soils with an ESP between 6 and 14 are classified as sodic. Less than 6 is non-sodic while greater than 15 is strongly sodic.

Once a soil is determined to be sodic it will require amelioration to limit dispersion potential. Existing on-site practices include the use of gypsum which is added to soil. Gypsum contains calcium sulphate which allows the calcium to swap with the sodium that is held on the soil particles, allowing the sodium to slowly leach out of the soil. Gypsum is readily available, has a relatively low cost and has minimal negative side effects. However it can be slow acting, taking up to several years to percolate through a soil and become effective.

An alternative to gypsum amelioration is the capping of dispersible soils with a non-dispersive soil. The non-dispersive soil cap should be at least 300mm thick and sufficiently compacted to limit erosion and exposure of the underlying dispersive material.

Note that gypsum can be leached out of soils over time, even when applied at a high rate if the subsoils are highly permeable. Therefore the reapplication of gypsum may be require in some locations to maintain a positive effect.

Gypsum has a relatively low solubility and is therefore more effective when added directly to irrigation water than when applied to the soil surface. However the cost of dissolution generally makes this unattractive and gypsum is added directly to the soil. The gypsum then percolates through the soil after irrigation or rainfall. Alternatively it can be initially mixed ensuring good coverage over the required depth of soil or the soil can be ripped and filled with gypsum which is allowed to be dispersed through the soils after rainfall.

Gypsum application rates vary based on a number of site specific characteristics including:

a Landscape/topography

b Climate and rainfall frequency

c Water quality

d Dissolution rate of the Gypsum

e Specific soil type

f Various ions within the soil.

Various gypsum application rates have been trialled at CVM with varying success, which may be attributable to the factors listed above.

The adjacent mine at Peak Downs has adopted a gypsum application rate of up to 40t/ha. Although this is a relatively high rate, it has proven effective and highlights the inherent issues with sodic soils in this region.

The application rate and process to ameliorate sodic soils will vary depending on the situation/location. The following table provides an initial framework for dealing sodic soils on site. It is expected that the suggested values are a first pass of trial gypsum rates. They should be amended over time based on site observations.

Table 18 – Suggested Treatments for Sodic Soils

Location	EAT Class based on on-site testing	ESP (based on laboratory test)	Volume of gypsum	Gypsum Application Method	Soil Lining	Maintenance
Rehab areas (slopes up to 15%)	1	> 10	40t/ha subsoil 15 t/ha topsoil	Deep ripping parallel to the contours with gypsum concentrated within the rip lines.	Topsoil is to be seeded with a temporary light-grade jute mat, biodegradable polymer, hydromulch or site mulch.	Review performance and if necessary, repeat after 3 years
	2, 3	>5 and < 10	2-5 t/ha			
Channel batters and beds	1	> 10	8 t/ha	Thoroughly mixed into the batter material and compacted sufficiently to stay in place yet allow vegetation growth. Note that sodic soils could also be buried with 300mm non-sodic material as an alternative to gypsum dosing.	Lining to be dependent on expected flow velocities. Vegetation up to 1.8m/s. Topsoil is to be seeded with a temporary light-grade jute mesh.	Repair and replace vegetation as required.
	2, 3	>5 and < 10	4 t/ha			
Sediment basins	1	> 10	12 t/ha	Thoroughly mixed into the batter material and compacted sufficiently to stay in place yet allow vegetation growth. Note that sodic soils could also be buried with 300mm non-sodic material as an alternative to gypsum dosing.	Basin batters to be lined with grassy vegetation. Topsoil is to be seeded with a temporary light-grade jute mesh or sprayed with polymer soil binder. Any concentrated flows to be directed down a lined batter chute.	Repair and replace vegetation as required.
	2, 3	>5 and < 10	6 t/ha			
Batter chutes	1	> 10	N/A	N/A. Sodic soils are to be buried with 300mm non-sodic material and not dosed with gypsum.	Channels will be steep so are to be lined with rock, concrete or rip rap	Review any rock movement and potential for undermining. If needed repair and replace.
	2, 3	>5 and < 10				

6 Construction

1 Disturbance activities will be conducted in accordance with a variety of administrative processes that will guide the implementation of ESC, including:

- **a** This ESCP and any relevant Contractor plans and procedures;
- **b** Type 1 sediment dams will require assessment against the DEHP Manual for Assessing Consequence Categories and Hydraulic Performance of Structures in consultation with engineering and/or the G&TS Dams team;
- **c** The design of any Type 1 structure will be assessed by the required engineering or G&TS team who will decide if external certification is required;
- **d** Permit to Disturb;
- **e** Project specific approvals; and
- **f** Inspections.

2 Erosion and sediment control measures should be put in place prior to disturbance to reduce sediment laden stormwater discharging to the receiving environment. The scheduling and timing of works is an important element of any construction activity. Where possible, construction should be undertaken in the dry season to limit the likelihood of rainfall events impacting construction or the effectiveness of ESC measures as they are established.

6.1 Sediment Dams

3 Dam details, including sediment dams, are outlined in the *CVM-PLN-0009 Water Management*.

4 CVM has six sediment dams (Table 9) to capture sediment-laden runoff from the disturbed areas and provide an area where settlement of suspended sediment in runoff can occur. The sediment dams are designed to capture the sediment volume calculated from the catchment area for a 24 hour 10 year annual recurrence interval (ARI) storm event.

5 Sediment shall be excavated from the sediment dams as required to maintain design capacity.

Storage Name	Easting (GDA94)	Northing (GDA94)	Contributing catchment and inflow sources	Function	Catchment Size (ha)	Existing Capacity (ML)
Sediment Dam S1	611533	7548663	Captures runoff from Heyford Pit spoil stockpiles and haul road	Pumps to 12N Dam CWC	66.8	75
Sediment Dam S2	613414	7546536	Captures runoff from Heyford Pit spoil stockpiles and haul road	Pumps to MIA Sediment Dam 1	89.7	111
Sediment Dam S3	614352	7545715	Captures runoff from Heyford Pit spoil stockpiles and haul road	Pumps to MIA Sediment Dam 1	179.7	86
MIA Sediment Dam 1	609852	7549232	Captures runoff from the administration and workshop industrial areas	Pumps to 12N Dam CWC	29.1	40
MIA Sediment Dam 2	610030	7549274	Captures runoff from the administration and workshop industrial areas	Pumps to MIA Sediment Dam 1	13.0	17

Storage Name	Easting (GDA94)	Northing (GDA94)	Contributing catchment and inflow sources	Function	Catchment Size (ha)	Existing Capacity (ML)
Mine Water Dam 12N CWC			Accepts water from all sediment dams. No Pit water	Pumps water to Process Water Tank – Supplies CHPP and haul road dust suppression demands	0	1000

Table 19: Sediment Dam Design Information

7 Inspection, Monitoring and Maintenance

7.1 Inspections and Monitoring

1 Inspections of ESC controls are crucial to their ongoing effectiveness.

18 The inspections should assess the condition of the structure and turbidity water quality data should be obtained where possible to monitor the effectiveness of the control.

19 All inspections must be documented in a register. Required maintenance works will be included in the register.

20 The CVM HSE Team shall conduct routine inspections of erosion and sediment controls only following rainfall events of 30mm or more in a 24 hour period (refer to Table 1). New aerial photos could be used to identify changes to erosion and sediment deposition prone areas.

21 All operational personnel have an ongoing responsibility to ensure that daily visual inspections, maintenance and reporting to the CVM HSE Team is undertaken to assist in ensuring the effectiveness of environmental controls. Where inspections identify non-conformances, corrective actions shall be raised. All corrective actions shall be logged as per the *CVM PRO Event Reporting, Response and Notification*. The CVM HSE Team shall work with relevant personnel to ensure all items are closed out in a timely manner.

22 Table 20 defines the routine inspections required to be completed at CVM.

ESC Control	Minimum Frequency
Erosion controls	Annually
Drainage controls	Quarterly
Sediment controls	Quarterly

Table 20: Routine inspections

Action	Frequency	Performance criteria
Visual Inspection of erosion & sedimentation controls	• Active permit to disturb compliance checks. • Frequently during the wet season if previous inspection identified issues or in the event of major rainfall.	Erosion and sedimentation mitigation measures are well maintained, appropriately positioned and deemed effective.
Visual Inspection of sediment dams	• Following rainfall events of 30mm or more in a 24 hour period.	Dam capacity, structural integrity and effectiveness maintained.

Action	Frequency	Performance criteria
Visual Inspection of watercourses	• Active permit to disturb compliance checks or Activities in Watercourses assessment. • Frequently during the wet season if previous inspection identified issues or in the event of major rainfall.	No visual discharge of sediment or contaminated water, no noticeable increase in turbidity or visible hydrocarbon sheens.
Visual Inspection of topsoil stockpiles	• Active permit to disturb compliance checks. • Frequently during the wet season if previous inspection identified issues or in the event of major rainfall.	Stockpiles are located an adequate distance away from watercourses; are stabilised; and have appropriate controls in place.
Visual inspection of cleared vegetation areas & exposed soils	• Active permit to disturb compliance checks. • Frequently during the wet season if previous inspection identified issues or in the event of major rainfall.	No erosion, rills, gullies or areas of concentrated or obvious sediment flow.
Culverts and drains	• At the end of the wet season.	Check that no debris is in culverts & drains. Check drains maintain capacity and aren't blocked by sediment build-up.

Table 21: Site Inspection Requirements

23 In addition to routine inspections, inspections are also required following a rainfall event exceeding the containment capacity of a drainage or Type 1 sediment control structure.

24 Table 22 defines the event-based inspections required to be completed at CVM.

Structure Containment Capacity	Trigger for Event based Inspection
<50% AEP	1 in 1.58-year event (e.g. Annually or 71mm in 24 hours)
50% AEP	1 in 2-year event (e.g. 81mm in 24 hours)
20% AEP	1 in 5-year event (e.g. 115mm in 24 hours)
10% AEP	1 in 10-year event (e.g. 130mm in 24 hours)
5% AEP	1 in 20-year event (e.g. 164mm in 24 hours)
1% AEP	1 in 100-year event (e.g. 233mm in 24 hours)

Table 22: Event-based inspections

25 Sediment dams should be managed such that the discharged water is not significantly different to upstream conditions. To assist with sediment dam management, consideration should be given towards dewatering structures prior to a rain event that is likely to produce runoff using a pump, siphon or floating decant.

7.2 Maintenance

26 Maintenance that is identified by an inspection will be carried out in a timely manner. Examples of deficiencies that will trigger maintenance activities include, but are not limited to:

a Damage to soil stabilization controls;

b Damage/deterioration of earthen embankments/walls that has the potential to affect its structural integrity;

c Sediment deposition in sediment basins/dams/drains that is approaching or exceeding engineered limits/tolerances;

d Sediment deposition in the inlets and outlets of structures;

e Damage to erosion and/or sediment controls;

f Damage/deterioration of access tracks or the ability to inspect/monitor, or maintain and/or

operate area/infrastructure/equipment;

g Spill, contaminated or waste materials accumulated/deposited in controls or their associated catchment areas; and

h Performance of controls/devices is apparently diminished, or compromised.

8 Performance Indicators

1 To assess and determine the effectiveness of ESC management on site, the performance indicators defined in Table 23 should be adopted.

Parameter	Performance Indicators
Compliance is maintained with EA Conditions.	Erosion and Sediment Control Plan developed and implemented in accordance with the EA. Historical records of monitoring reports and inspections are maintained. Historical records of release and discharge water quality, where recorded, is maintained on EnviroSys or similar environmental database.
Community complaints	No complaints received regarding erosion and sediment control impacts. All complaints received from the community or workforce related to erosion and sediment impacts will be recorded and investigated in accordance with EA requirements for investigating complaints.
Visual Inspection	Sediment basins and dams must not contain waters that have visual or odorous evidence of slick, hydrocarbons and/or coal.

Table 23: Performance indicators

9 Data Management and Reporting

1 Any deficiencies observed that require remedial action will be raised in 1SAP to ensure the ESC remains in accordance with the intent of the design.

9.1 Event Investigations and Reporting

2 In the event of emergencies, exceptions or incidents, all reasonable actions must be taken by Operations to minimise potential or actual environmental harm and notification must be given to the regulator (DES) in accordance with the requirements of the EA and the Environmental Protection Act 1994 (Qld).

3 Investigation and reporting of events must occur as per the *BMA Event Notification Procedure*, *BMA Event Investigation Protocol* and *BMA HSEC Reporting Procedure*.

9.2 Complaints

4 Complaints should be managed in accordance with *BMA-PRO-0005 Community Complaints and Grievance Procedure.*

10 Awareness and Training

1 Mandatory Environmental Awareness Training will be provided to all site personnel as part of site inductions and will address general environmental compliance as well as topics relevant to water quality including the site water management system, erosion and sediment controls and spill prevention and response.

2 Site personnel responsible for the installation and maintenance of erosion and sediment control

devices will be provided copies of this ESCP and other engineering drawings/documents containing details of elements of the Mine Water Management System (MWMS).

11 Roles and Responsibilities

1 General requirements and responsibilities of roles are found in various elements of BMA systems including but not limited to

a Position Descriptions;

b Organisational Design Protocols; and

c BMA management system elements such as Standards, Procedures and Work Instructions.

2 Roles and Responsibilities specific to this ESCP are outlined in Table 24.

Role	Responsibilities
General Manager	• Overall responsibility for the implementation of the ESCP at CVM.
Mine Planning	• Integrating water management and ESC in the mine planning process. • Submit erosion and sediment control plans with Permit to Disturb applications (when applicable). • Determining and scheduling when sediment shall be excavated from sediment dams to ensure they maintain design capacity. • Including erosion and sediment controls in designs, as per design and construction criteria. • Ensuring designs consider the flow and end point of sediment laden runoff.
Engineering	• Provide guidance on the design and associated requirements of ESC structures.
Governance & Technical Stewardship – Dams	• Provide guidance on the design and associated requirements of ESC structures in respect of the DEHP Manual for Assessing Consequence Categories and Hydraulic Performance of Structures. • Inspect unregulated ESC structures pre- and post-wet season
HSE	• Provide advice to operations and contractors on ESC and assist in use of the definition of MAW. • Actively define areas where ESC measures are needed, including through the Permit to Disturb process. • Conduct site inspections of areas requiring ESC measures pre- and post-wet season and after significant rainfall events where required. • Coordinate with the other departments where compliance issues are identified and corrective actions are needed.
Mine Services	• Conduct the inspections defined in this ESCP, including documenting the inspection outcomes and any maintenance activities required in SAP. • Complete maintenance activities in a timely manner.
RPEQ	• May be consulted in the design and construction of sediment dam/basins.
Contractors, Site	• Ensure stipulated and planned erosion and sediment controls are implemented.

Supervisors, or Project Teams	• Inspect/monitor the effectiveness and condition of erosion and sediment controls during and/or after works. If required, implementing additional controls or maintenance works. • Report any erosion and sediment control issues or non-compliance to the CVM HSE Team.

Table 24: Roles and responsibilities

12 Terms and Definitions

Term	Definition
BMA	BM Alliance Coal Operations Pty Ltd
DES	Department of Environment and Science
EA	Environmental Authority EPML00862313
RPEQ	Registered Practicing Engineer in Queensland, either internal or external consultant.
Mine water	Means process water and contaminated stormwater.
Stormwater	Means surface water runoff from rainfall.

Table 25: Terms and Definitions

13 References

References	Title
KM#10046030	*CVM–PRO-0054 Rehabilitation Management*
KM#10046093	*CVM-PRO–0053 Topsoil Management*
KM#14156044	CVM PRO Event Reporting, Response and Notification
KM# 9873142	*CVM-PLN-0009 Water Management*
KM#5021650	BMA Incident Notification Procedure
KM#8363039	BMA 1SAP BMA Event Investigation Protocol
KM#5913900	*BMA-PRO-0005 Community Complaints and Grievance Procedure*
KM#7322001	BMA HSEC Reporting Procedure
KM# 11086839	BHP-PRO-0056 Permit to Disturb Procedure
KM# 7391767	BMA Sustainable Landform Guideline
KM# 14958088	CVM Environmental Authority EPML00562013
KM# 10320164	CVM EIS (Environmental Impact Statement) Appendix K – Ecological Assessment (URS 2009)
KM# 10320180	CVM EIS Appendix F Soil Survey and Land Resource Assessment Report (GSS Environmental 2009).
	Technical Guidelines for Environmental Management for Exploration and Mining in Queensland (1995)
	Guideline—Activities in a watercourse, lake or spring associated with a resource activity or mining operations WAM/2008/3435
	Best Management Practices for managing water, erosion and sediment control on construction sites (IECA, 2008)

References	Title
	Department of Natural Resources and Mines (2017). State Development Assessment Provisions (SDAP) Guidance – State Code 16: Native Vegetation Clearing. November 2017
	Department of Environment and Heritage Protection (DEHP) (2014). Stormwater Guideline: Environmentally Relevant Activities. Department of Environment and Heritage Protection, Brisbane
	DEHP (2013). Isaac River Sub-Basin Environmental Values and Water Quality Objectives. Basin No.130 (part). DEHP, Queensland
	Coordinator General's (CG) evaluation report *(August 2010)*
	Environmental Protection Act 1994 (EP Act)
	Environmental Protection (Water) Policy 2009
	Water Act 2000 and relevant Water Resources Plans
	Vegetation Management Act 1999 and *Vegetation Management Regulation 2000*
	Soil Conservation Act 1986 and *Soil Conservation Regulation 1998*
	State Planning Policy July 2017 (Department of Infrastructure Local Government and Planning (DILGP)

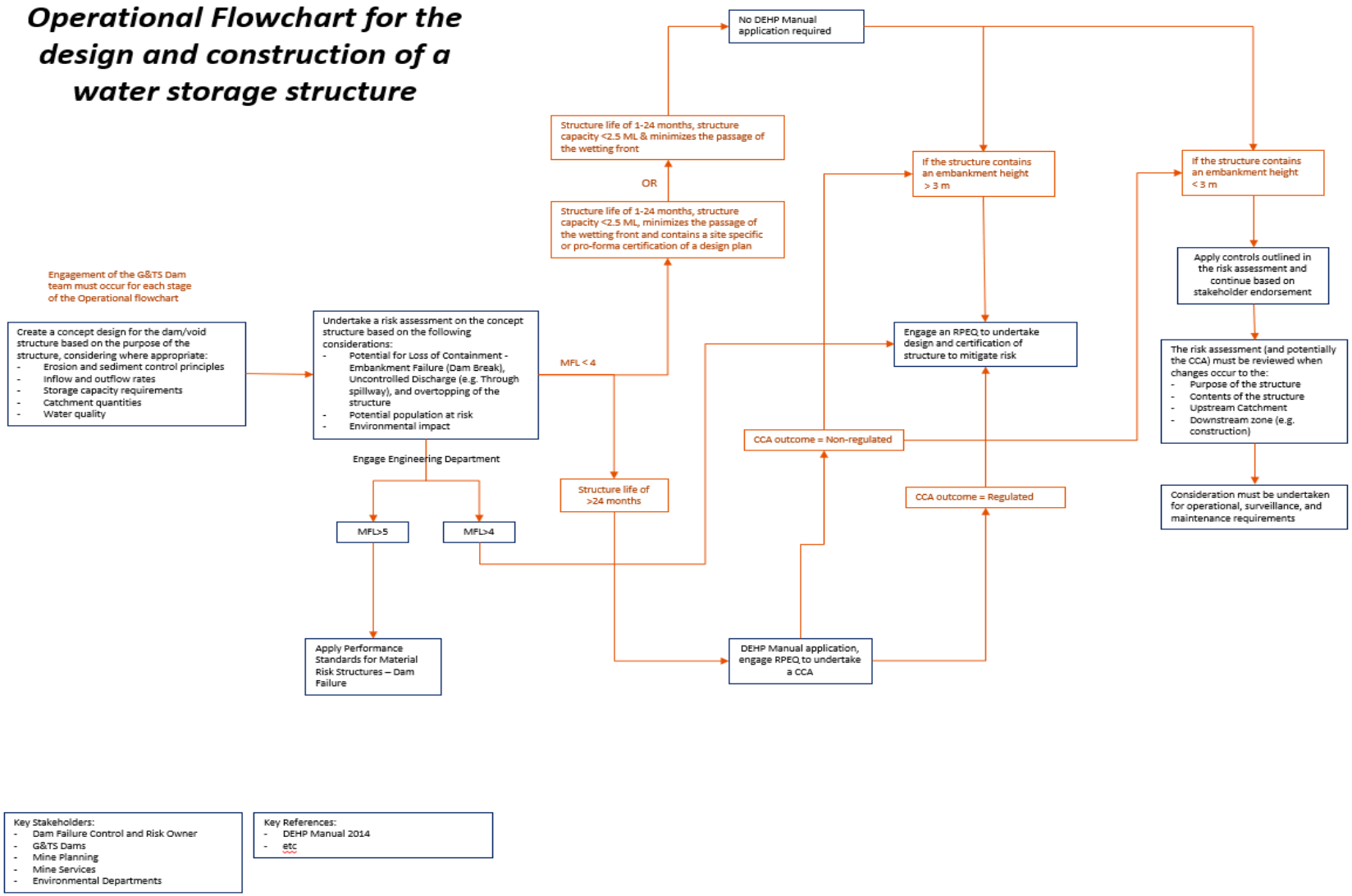
Table 26: References

14 Version Management

Version	Details	Date
4.0	Major update to design standards and inspection requirements as per our EA.	20 March 2020
3.3	Updated SSC/Site Compliance Coordinator to OCE/Open Cut Examiner, BMA logo, document ID # and version number – Refresh only.	
3B	Document called for review. Update to reference documents.	
3A	Annual review	
3	Erosion and sediment control plan template	
1 – 2	Initial reviews	

Table 27: Version Management

15 Appendix A – Flowchart: Design of a Water Storage Structure



BHP Billiton Mitsubishi Alliance

CVM-PLN-0021

CVM ENV Plan

Land and Biodiversity Management

Status: Review

Version: 7A (4 October 2016)

Business Owner: Superintendent HSE

KM#9982421

Table of Contents

1 Introduction

Purpose

1 The primary purpose of this Land and Biodiversity Management Plan (LBMP) is to identify the potential environmental risks from land use and the controls necessary to mitigate any impacts. The LBMP aims to minimise the release of contaminants to the receiving environment and ensure land resources use does not adversely impact the local and regional environment.

2 Effective land resource management is essential for achievement of ecologically sustainable development. Caval Ridge Mine (CVM) is committed to promoting successful land rehabilitation post mining and related activities in accordance with legislative requirements.

3 CVM LBMP is strategically designed to effectively manage the potential impacts of disturbance and contamination of land, the surrounding environment and biodiversity.

4 The contents of this plan are intended to meet obligations of the ***CVM Environmental Authority EPML00562013 (EA)*** and the ***BHP Billiton Group Level Document (GLD) Environment & Climate Change***.

Scope

5 This LBMP describes or provides references to the planning, operational and reporting requirements for the rehabilitation of land disturbed as a result of activities at CVM.

6 It covers all operations at CVM and forms part of CVM's Environmental Management System (EMS).

7 The scope of this Land Management Plan incorporates the requirements of ***BHP Billiton GLD Environment & Climate Change***.

8 Generic system components and relationship to the CVM LBMP are depicted in Figure 1.

Risk Management

9 Risks associated with operations at CVM have been assessed in accordance with the ***CVM STD Risk Management***.

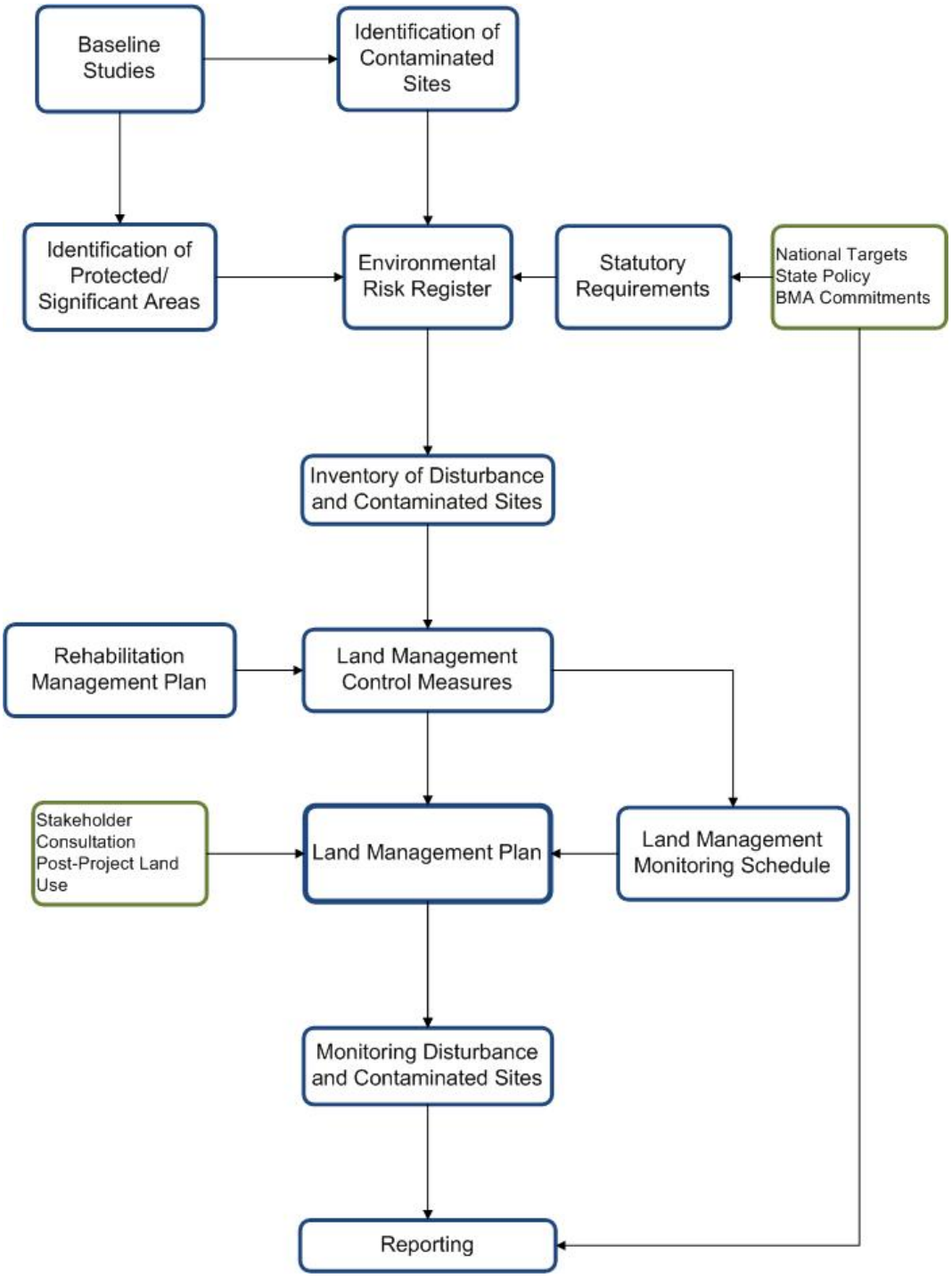


Figure 1: Overview of CVM Land and Biodiversity Management Plan

2 Project Description

Overview of Operations

1 CVM is an open cut coal mine north of and adjacent to BMA's existing Peak Downs Mine (PDM) situated in the Bowen Basin of Central Queensland (Figure 2). The mine covers an area approximately 17 km long and 4 km wide (excluding the rail loop and southern conveyor). CVM 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).

2 Open cut mining operations using dragline and truck/shovel equipment are proposed to produce hard coking coal product. The life of mine is expected to be 30 years.

3 Mining (in both pits) commenced on the western side of the lease and is progressing in an easterly direction. The mining sequence generally progresses as follows:

- **a** Progressively clearing any vegetation occurring on required areas;
- **b** Stockpiling topsoil from disturbed areas for rehabilitation of the site;
- **c** Pre-stripping/excavation of unconsolidated/soft overburden waste using shovel, excavators and trucks;
- **d** Drilling and blasting of upper & lower competent overburden waste;
- **e** Removal of waste rock using a combination of dozers, excavators and trucks;
- **f** Coal mining of upper & lower seams using a combination of dozers, excavators, loaders and trucks;
- **g** Side casting of lower overburden into the previously mined strip using a dragline; and
- **h** Rehabilitating the site by re-shaping the waste rock dumps, topsoiling and revegetation using native vegetation.

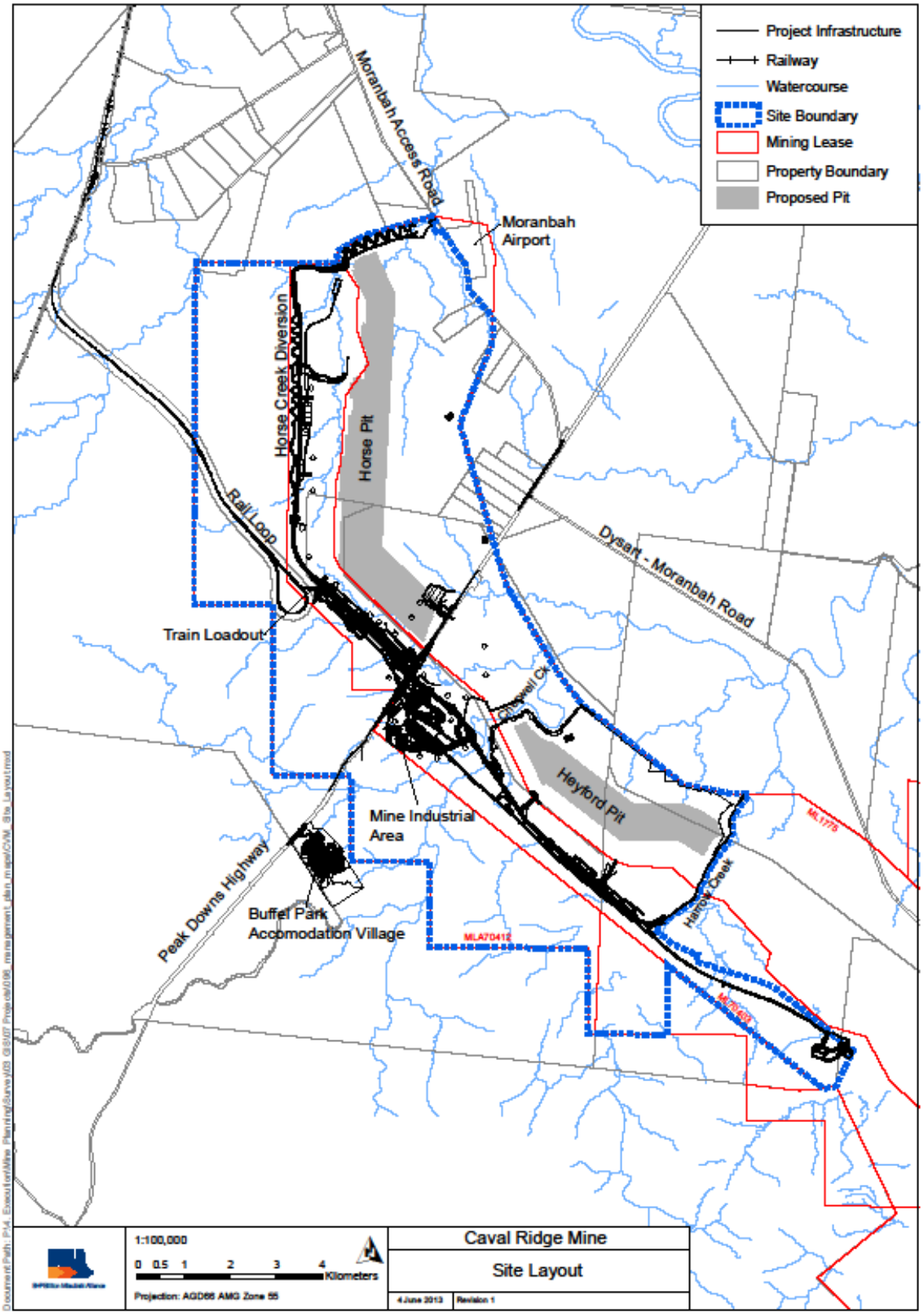


Figure 2: Caval Ridge Mine Site Layout

3 Legal and Other Requirements

1 Details of CVM's legal obligations in regards to land and biodiversity management are specified in ***Environment Essentials***.

2 Relevant legislation includes:

- **a** Environmental Protection Act 1994 and Regulation (Qld);
- **b** Aboriginal and Torres Strait Islander Heritage Protection Act 1984 (Cth);
- **c** Aboriginal Cultural Heritage Act 2003 (Qld);
- **d** Forestry Act 1959 and Regulation (Qld);
- **e** Land Act 1994 (Qld);
- **f** Land Protection (Pest and Stock Route Management) Act 2002 (Qld);
- **g** Nature Conservation Act 1992 (Qld);
- **h** Nature Conservation (Wildlife Management) Regulation 2006 (Qld);
- **i** Soil Conservation Act 1986 (Qld);
- **j** Vegetation Management Act 1999 (Qld); and
- **k** Environment Protection and Biodiversity Conservation Act (EPBC Act) 1999.

Environmental Protection Act 1994

3 The *Environmental Protection Act 1994* (EP Act) requires projects to state the environmental protection objectives and the standards and measurable indicators, including, for example, objectives for progressive and final rehabilitation and management of contaminated land.

4 A rehabilitation program for land proposed to be disturbed by mining activities is required. The details are provided in the ***CVM PRO Rehabilitation Management***.

EHP's Guideline - Rehabilitation requirements for mining resource activities

5 CVM considers a hierarchy for rehabilitation supported by the Administering Authority, which, in order of decreasing capacity to prevent or minimise environmental harm, is to:

- **a** Avoid disturbance that will require rehabilitation;
- **b** Reinstate a "natural" ecosystem as similar as possible to the original ecosystem;
- **c** Develop an alternative outcome with a higher economic value than the previous land use;
- **d** Reinstate previous land use (e.g. grazing or cropping);
- **e** Develop lower value land use; or
- **f** Leave the site in an unusable condition or with a potential to generate future pollution or adversely affect environmental values.

6 In determining whether it is feasible to achieve levels (a) – (c) above CVM and the Administering Authority should consider:

- **a** The pre-project land use;
- **b** Any compensation or other agreements regarding the land;
- **c** The potential uses of likely rehabilitated landforms; and
- **d** Existing use or environmental values of surrounding land.

Environmental Authority

7 The main regulatory tool at CVM used by the Administering Authority to implement the *EP Act 1994* is the ***Environmental Authority EPL00562013*** (***EA***). The ***CVM EA*** includes a comprehensive range of conditions to protect the environment.

8 The rehabilitation management controls and procedures presented in this LBMP must be implemented to ensure compliance with the regulatory requirement for progressive rehabilitation of disturbed lands following operations.

Environmental Commitments

9 The objectives and targets set out for land management in this LBMP take into account the legal requirements but also BMA's environmental policies and commitments.

10 CVM commitments are detailed in the following documents and licenses:

- **a** Bowen Basin Coal Growth Project: Caval Ridge Mine, Coordinator-General's evaluation report for an Environmental Impact Statement, August 2010 (Coordinator General's Report);
- **b** BMA Commitments within the Caval Ridge Mine Project – Environmental Impact Statement (EIS);
- **c** BMA Commitments within the Caval Ridge Mine Project – Supplementary Environmental Impact Statement (SEIS);
- **d** Environmental Authority – EPML00562013; and
- **e** ***CVM Threatened Flora, Fauna and Ecological Communities Management Plan***.

11 Environmental commitments for CVM include***:***

- **a** Prior to disturbance, the ***BMA Permit to Disturb Process*** shall be followed taking into account environmental values and cultural significance;
- **b** Records will be maintained of all forms of land disturbance on a scheduled basis;
- **c** Topsoil resources that are suitable for use in rehabilitation shall be salvaged ahead of mining disturbance. Topsoil inventories shall be reconciled on a scheduled basis;
- **d** Potentially contaminated areas will be assessed and remediated as the areas become available throughout the life of the mine;
- **e** Disturbance as a result of exploration and test drilling will be rehabilitated, if outside the two year Mine Plan;
- **f** Declared plant (weed) infestations will be managed during and after the course of mining and exploration activities; and
- **g** Progressive rehabilitation will produce a stable landform of beneficial land use.

12 CVM also has the following targets for performance:

- **a** Nil actual Level 2 Environmental Events/year.
- **b** Disturbance categories within 10% of annual Plan of Operations forecast.

4 Baseline Environment

Pre-Project Land Use

1 The mine site and adjoining areas have historically and are currently used for cattle grazing, extractive industries (coal mining) and commercial uses. As a result of this land use, there has been extensive tree clearing throughout the area. 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.

2 Other land uses within the lease boundary 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. Local land use is shown in Figure 3.

3 The town of Moranbah is located 6.2 km north of the most northern point of the project site. Moranbah lies within the northern part of the Isaac Regional Council Area, with a population of approximately 7,500 people and is a key support centre for the surrounding mining industry. The Isaac Regional Council was formed after the amalgamation of the Belyando, Broadsound and Nebo Shires in March 2008. Regional land use is shown in Figure 4.

4 The Belyando Planning Scheme (local planning scheme) (October 2006) still applies in the area that was previously the Belyando Shire. The CVM site is zoned as rural under the planning scheme. The intent of this is to preserve rural zones (areas supporting agricultural or grazing activity) surrounding Moranbah from urban development areas. Within the rural zone, extractive industries must be located and operated in an appropriate area to ensure there are no unacceptable detrimental impacts on surrounding land uses and/or on the environment.

5 For further details regarding pre-mining land use, refer to ***CVM EIS Section 4 - Land Resources***.

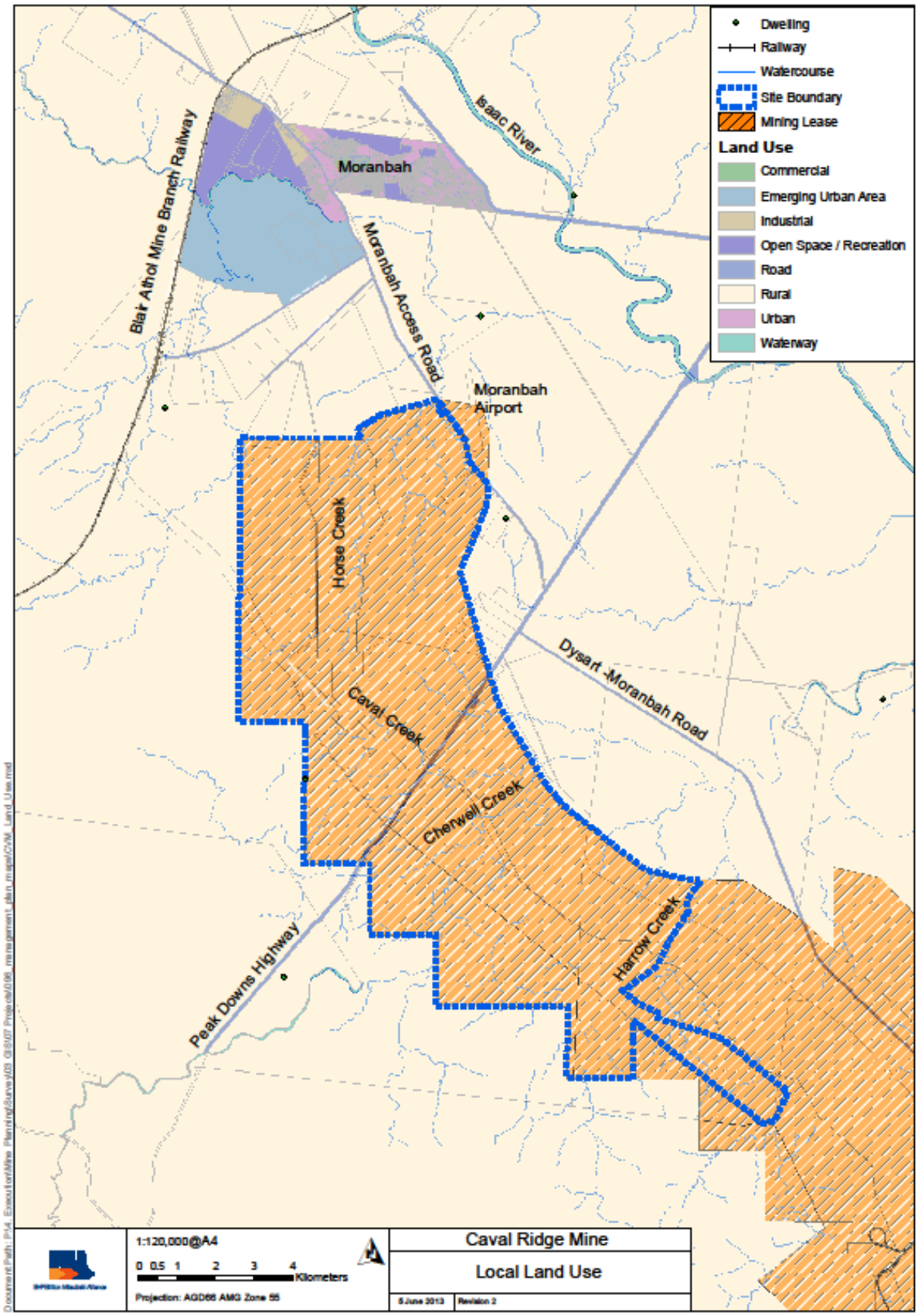


Figure 3: Local Land Use

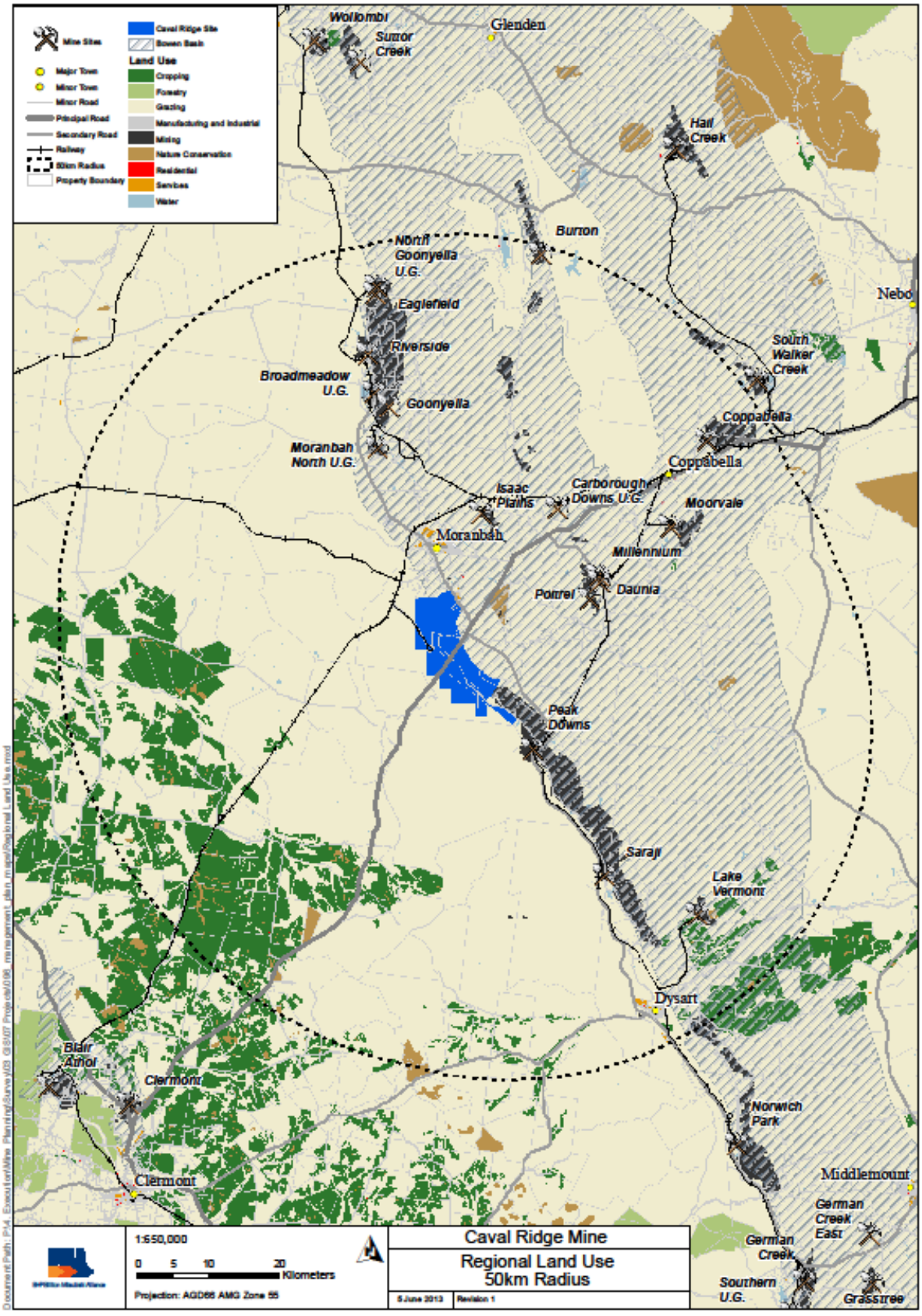


Figure 4: Regional Land Use - 50 km Radius

Geology and Soils

6 The Moranbah area is located within the Bowen Basin of Central Queensland, a coal resource area of international significance. The Bowen Basin is approximately 600 km long, up to 250 km wide and contains significant resources of Permian black coals. Of these black coals, the later Permian coals of the Moranbah Coal Measures are favoured, as they provide uniformly high grade coking coals.

7 CVM is situated over a section of the Moranbah Coal Measures, which range in thickness from 250 m to 300 m, and variably consist of sandstone, shale, mudstone and coal. The aggregate thickness of coal in the Moranbah Coal Measures ranges from 12 m to 24 m, and may consist of up to eight seams.

8 The topography of the mine site is generally flat to undulating. Elevation across the mine site ranges from 220 mAHD to 274 mAHD, and surface slopes are typically <1% grading to east northeast towards the Isaac River which is the most prominent regional drainage feature.

9 The mine site consists of the following geomorphological land zones of Cainozoic age:

- **a** Alluvial plains and piedmont fans adjoining the Cherwell and Heyford Pits;
- **b** Clay deposits under gently undulating plains within the Cherwell Pit area;
- **c** Sand deposits on extensive flat or gently undulating plains adjoining the Heyford Pit;
- **d** Igneous rocks, flood basalts forming extensive plains and occasional low scarps to the north of the Cherwell Pit; and
- **e** Duricrusts formed on a variety of rock types.

Land systems mapped and soil units identified on mining leases (ML) ML1775 and ML70403 are summarised in

10 Table 1.

11 Baseline soil surveys, conducted as part of EIS studies provide descriptions of soil types within the CVM mining areas. (Refer to ***CVM Topsoil Strip Investigation 2013***).

12 An inventory of topsoil resources is maintained and recorded in Geographic Information System (GIS), and is reported as a component of the ***CVM Plan of Operations***.

13 For further information regarding geology of the area, refer to ***CVM EIS Section 4 - Land Resources.***

Table 1: CSIRO Land Systems and Units on the Mine Site

Land System	Land Unit	Description
Connors	2	Deep sandy loam recent alluvia
	3	Texture contrast levees and floodplains – older alluvia
Daunia	5	Brigalow with associated species with cracking and non-cracking clays
	1	Sandy rises of Ironbark and polar box
Durrandella	1	Flat and undulating mesa tops up to 3% slope with uniform sandy and shallow soils
	3	Jump-ups, breakaways and low stony hills
	4	Undulating, foot-slopes below mesas
Humboldt	3	Undulating plains of texture contrast soils with thin sandy surface over alkaline clays of brigalow, blackbutt and polar box
	4	Cracking and non-cracking soils with brigalow blackbutt
	5	Melanhole cracking clays of brigalow
Monteagle	3	Undulating plains and lowlands with texture contrast soils poplar box and ironbark
Oxford	1	Shallow cracking clays on basalt

Source: Galloway, R.W, Gunn, R.H, Fitzpatrick, E.A. and Story, R. 1967, Lands of the Isaac Comet Area, Queensland. CSIRO Land Research Series No 19, CSIRO, Australia.

Vegetation and Flora

14 Nineteen distinct vegetation communities have been identified within CVM ML1775 and ML70403 (Figure 5). Fourteen of these communities are currently mapped as remnant under the provisions of the VM Act.

15 As part of EIS studies, a total of 176 flora species were recorded of which 157 (89.2%) were native and 19 (10.8%) were exotic. Further vegetation and flora descriptions can be found in the ***CVM EIS Section 8 - Terrestrial Ecology*** and ***CVM EIS Appendix K - Ecological Assessment.***

16 The vast majority of the CVM site has been cleared of the original vegetation cover.

Regional Ecosystems

17 Regional ecosystem (RE) and remnant maps are certified under the *Vegetation Management Act 1999* (VMA) and are used to determine whether clearing vegetation on a property requires a permit.

18 Under the QLD VM Act activities on mining leases are exempt from requiring a permit; however, consideration with regard to the Commonwealth and Queensland Governments approval conditions for the project (as detailed in the ***CVM PLN Threatened Flora, Fauna and Ecological Communities Management***) is required.

19 RE mapping indicates that CVM ML1775 and ML70403 support no areas designated as Essential Habitat for species listed as threatened under the provisions of the NC Act.

20 A total of 20 RE's have been identified as potentially occurring within the CVM ML1775 and ML70403. Of these, 14 have been or will be disturbed as a result of the CVM mining activities (Figure 6). The approximate extent of the RE's within the Bioregion, Local Government area and CVM are summarised in Table 2.

21 The RE map and remnant map are available from the website of the Administering Authority. Vegetation mapping can also be found on Mine2Map.

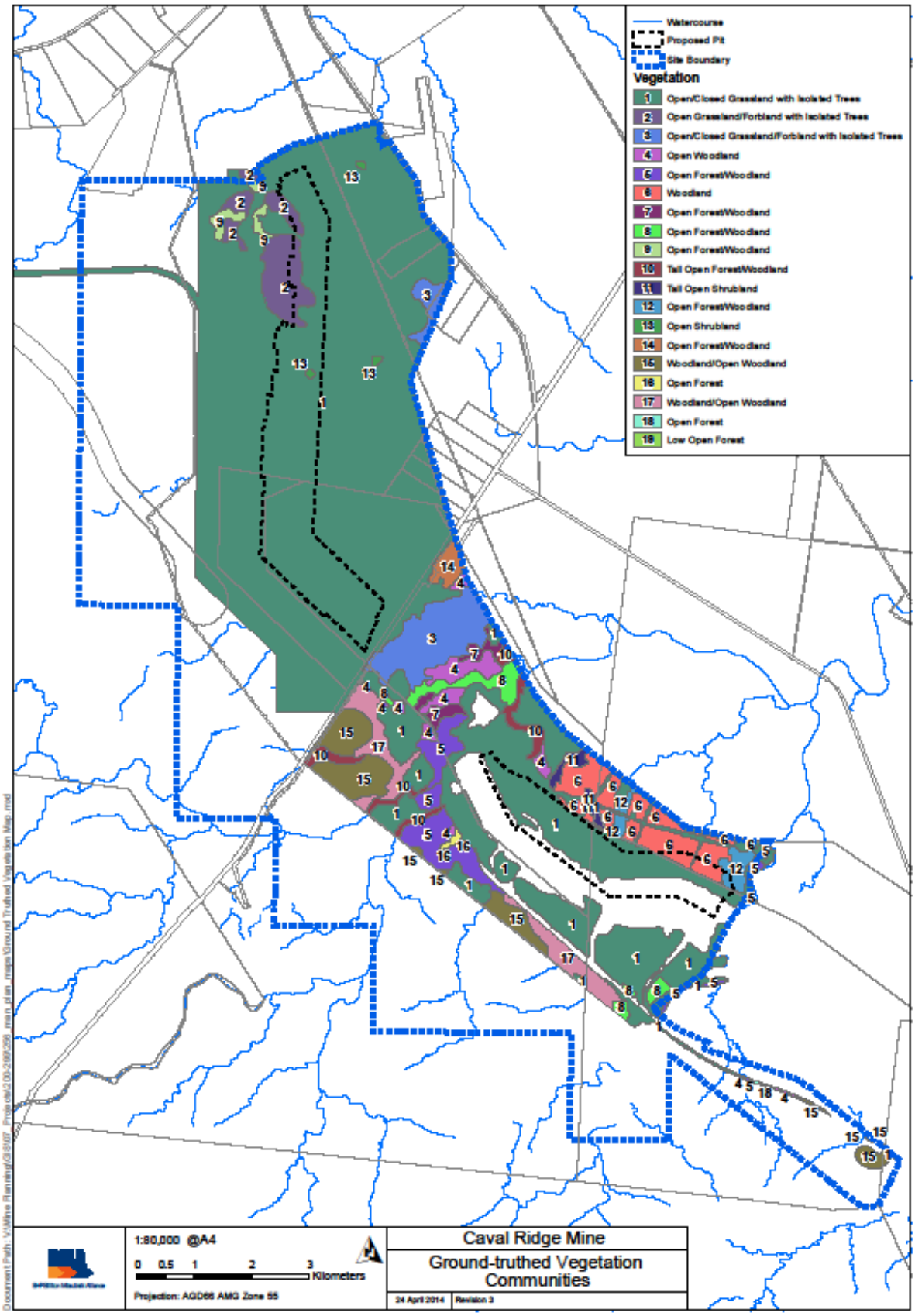


Figure 5: CVM Ground-truthed Vegetation Communities

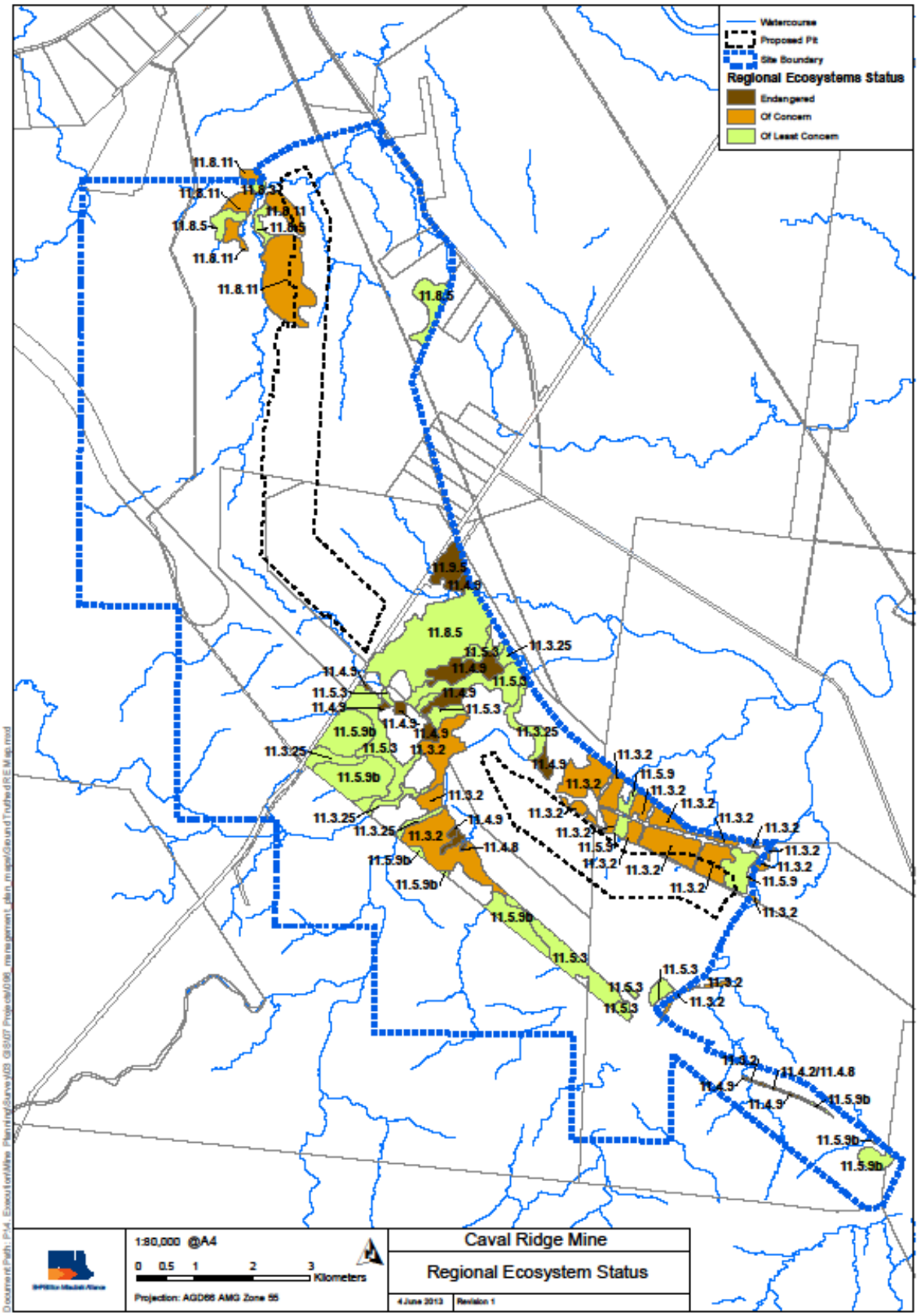


Figure 6: Ground-truthed Regional Ecosystems and Biodiversity Status

Conservation Significant Species – Endangered Ecological Communities

22 Of the 14 RE's disturbed by CVM, 5 are encompassed by endangered ecological communities (EEC) under the provisions of the EPBC Act. The following two EEC are found on site (Figure 6):

- **a** Brigalow (*Acacia harpophylla* dominant and co-dominant)
  - **i** In Queensland, the Brigalow EEC that has been listed as endangered under the EPBC Act and is relevant to CVM is defined by reference to 4 REs, 11.4.3, 11.4.8, 11.4.9 and 11.9.5, all of which are listed as Endangered under the Queensland VM Act.
- **b** Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin
  - **i** In Queensland, the RE relevant to CVM that contains the Natural Grasslands EEC that has been listed as endangered under the EPBC Act is RE 11.8.11, which is listed as of concern under the VM Act.

23 These communities are analogous to Vegetation Communities 2 (Natural Grassland), 4 (Brigalow), 14 (Brigalow), 16 (Brigalow) and 18 (Brigalow) and their distribution on site is indicated in Figure 5.

Conservation Significant Species - Flora

24 No flora species listed as significant under the provisions of the NC Act and/or the EPBC Act were recorded within CVM ML1775 and ML70403, as part of EIS surveys.

25 Two significant flora species listed under the EPBC and NC Acts were identified as having potential to occur. These species are:

- **a** King Bluegrass (*Dichanthium queenslandicum*) – listed as Vulnerable under both the EPBC Act and NC Act. It grows in heavy black soil, open downs or blue grass open downs with scattered Bloodwood on black cracking clay; and
- **b** Finger Panic Grass (*Digitaria porrecta*) –listed as Endangered under the EPBC Act and Rare under the NC Act. It occurs in grasslands on extensive basaltic plains and in undulating woodland and open forests.

26 Although neither species has ever been recorded on site, there is a reasonable probability of occurrence on site in Regional Ecosystems 11.8.5 and 11.8.11.

Table 2: Approximate extent of RE's within the Bioregion, Local Government Area and CVM ML1775 and ML70403 (2008)

RE	Analogous Vegetation Community (see Figure 4)	Description (REDD)[5]	Management Status and Analogous RE	Approximate Total Extent (ha)		
				Within BBN Bioregion[1]	Within Local Government Area[1]	Within CVM[2]
11.3.2	5, 6	*Eucalyptus populnea woodland on alluvial plains*	Of Concern (VM Act)	545,265	30,830	351.8
11.3.25	10	*Eucalyptus tereticornis or E. camaldulensis woodland fringing drainage lines*	Not Of Concern (VM Act)	498,414	28,566	75.94
11.4.2	18	*Eucalyptus spp*. and/or *Corymbia spp*. grassy or shrubby woodland on Cainozoic clay plains	Of Concern (VM Act)	37,135	514	4.51[4]
11.4.8	16, 18	*Eucalyptus cambageana* woodland to open forest with *Acacia harpophylla* or *A. argyrodendron* on Cainozoic clay plains	Endangered (VM Act and EPBC Act) *Analogous to EEC[6]: Brigalow (*Acacia harpophylla* Dominant and Co-dominant) Community	80,904	30,910	10.05[4]
11.4.9	4	*Acacia harpophylla* shrubby open forest to woodland with *Terminalia oblongata* on Cainozoic clay plains	Endangered (VM Act and EPBC Act) *Analogous to EEC[6]: Brigalow (*Acacia harpophylla* Dominant and Co-dominant) Community	105,656	39,723	92.14
11.5.3	7, 8, 17	*Eucalyptus populnea* and/or *E. melanophloia* and/or *Corymbia clarksoniana* on Cainozoic sand plains/remnant surfaces	Not Of Concern (VM Act)	413,237	183,023	245.55
11.5.9	12, 15	*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	259.43
11.8.5	3, 9	*Eucalyptus orgadophila* open woodland on Cainozoic igneous rocks	Not Of Concern (VM Act)	348,697	39,976	255.01
11.8.11	2, 3	*Dichanthium sericeum* grassland on Cainozoic igneous rocks	Of Concern (VM Act), Endangered (EPBC Act) *Analogous to EEC[6]: Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin	188,169	37,194	153.12
11.9.5	14	*Acacia harpophylla* and/or *Casuarina cristata* open forest to woodland on fine grained sedimentary rock.	Endangered (VM Act and EPBC Act) *Analogous to EEC[6]: Brigalow (*Acacia harpophylla* Dominant and Co-dominant) Community	149,368	499	31.69

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 into 60% analogous RE 11.4.2 and 40% analogous RE 11.4.8.
5 REDD: EPA's Regional Ecosystem Description Database v5.0.
6 EEC: Endangered Ecological Community.

Fauna

27 EIS ground surveys recorded a total of 153 terrestrial vertebrate species on CVM ML1775 and ML70403 or nearby, including 20 species of mammal, 113 birds, 10 reptiles and 10 amphibians. The complete list of terrestrial vertebrate species recorded during the survey is provided in ***CVM EIS Appendix K - Ecological Assessment***.

Conservation Significant Species - Fauna

28 A number of significant fauna species have been identified as having potential to occur or being known to occur within CVM mining lease (Table 3). Further detail regarding significant fauna species can be found in the ***EIS Section 8 – Terrestrial Ecology*** and ***EIS Appendix K - Ecological Assessment***.

29 Although twelve species have been identified as having potential to occur, only 4 species were recorded within the vicinity of CVM. The location of EVR (endangered, vulnerable or rare) status species found within or around CVM are mapped in Figure 7.

Table 3: Significant Fauna Species Relevant to CVM

Species	Conservation Status			Location	Likelihood of Occurrence
	NC Act Status	EPBC Act Status	IUCN Red List		
Squatter Pigeon (*Geophaps scripta*)	Vulnerable (M)	Vulnerable	Least Concern	C/A	Known
Australian Painted Snipe (*Rostratula australis*)	Vulnerable (M)	Vulnerable	Endangered	C/A	Potential
Little Pied Bat (*Chalinolobus picatus*)	Rare (M)		Near Threatened	C	Known
Ornamental Snake (*Denisonia maculata*)	Vulnerable (M)	Vulnerable	Vulnerable	C	Known
Brigalow scaly-foot (*Paradelma orientalis*)	Vulnerable (M)	Vulnerable	Vulnerable	C/A	Potential
Allan's lerista (*Erista allanae*)	Endangered (H)		Critically Endangered	A	Potential
Yakka skink (*Egernia rugosa*)	Vulnerable (M)	Vulnerable	Least Concern	C/A	Potential
Cotton Pygmy-Goose (*Nettapus coromandelianus albipennis*)	Rare (L)		Least Concern	C/A	Potential
Black-necked Stork (*Ephippiorhynchus asiaticus*)	Rare (L)		Near Threatened	A	Potential
Troughton's Sheath-tail bat (*Taphozous troughtoni*)	Endangered (L)		Least Concern	C	Known
Greater Long-eared Bat (South-eastern) (*Nyctophilus timoriensis*)	Vulnerable (M)	Vulnerable	Data Deficient	C/A	Potential
Dunmall's Snake (*Furina dunmalli*)	Vulnerable (M)	Vulnerable	Vulnerable	A	Potential

Note:

- C = Caval Ridge Coal Mine Site;
- A = Accommodation Villages;
- H = Ranked as a high priority under the Administering Authority's 'Back on Track' species prioritisation framework;
- M = Ranked as a medium priority under the Administering Authority's 'Back on Track' species prioritisation framework; and
- L = Ranked as a low priority under the Administering Authority's 'Back on Track' species prioritisation framework.

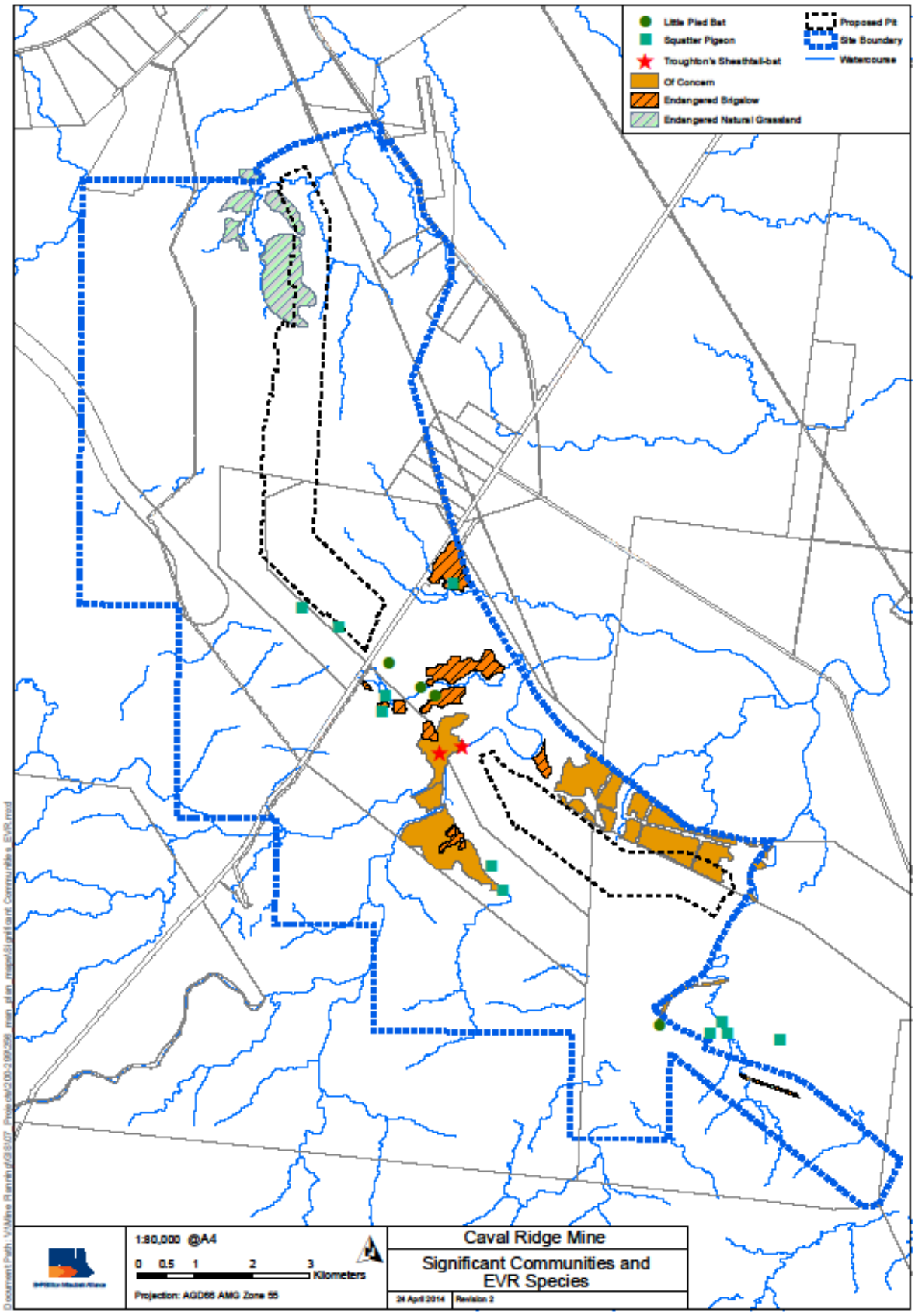


Figure 7: Location of Significant Vegetation Communities and EVR Species within and around CVM

Contaminated Land

30 A contaminated land preliminary site investigation was carried out for CVM ML1775 and ML70403 to determine if any previous or current land uses have resulted in possible contamination issues. This included a review of the Contaminated Land Register (CLR) and Environmental Management Register (EMR) (registers maintained by the Department).For a detailed description of CVM's past contaminated sites and potential sources of contamination refer to ***EIS Appendix G - Contaminated Land Preliminary Site Investigation***. Results of the investigation are also described in the ***CVM Plan of Operations***.

Protected Areas

31 Designated protection areas and areas of high conservation value are mapped for BMA via Mine2Map.

32 The only national park, state forest, reserve or conservation area within a 50 km radius of the mine site is the Peak Range Area (I.D No. 8886, Register of National Estate). The Peak Range National Park incorporates a number of conservation areas and was placed on the Register of National Estate on 21/10/1980 (Figure 4).

33 The CVM site is approximately 200 km upstream of any declared fish habitat areas of the Fitzroy River therefore it is highly unlikely that CVM will affect any declared fish habitat areas.

34 The nearest Ramsar Wetland is approximately 250 km east of CVM (Shoalwater and Corio Bays), therefore it is highly unlikely that CVM will impact on Ramsar Wetlands.

Cultural Heritage

35 A Cultural Heritage Management Plan (CHMP) is required for CVM, pursuant to Section 87(2) of the *Aboriginal Cultural Heritage Act 2003.* CMV has a Cultural Heritage Management Agreement (***Caval Ridge Mine Cultural Heritage Management Plan***) with the Traditional Owners. The CHMP defines, within the CHMP area, how CVM will:

a Avoid harm to Aboriginal Cultural Heritage; and

b To the extent that harm cannot be reasonable avoided, to minimise harm to Aboriginal Cultural Heritage; and

c To satisfy the Cultural Heritage Duty of Care.

5 Area of Influence

1 CVM's area of influence is determined in accordance with the ***BHP Billiton Environment GLD Environmental & Climate Change*** and is based on CVM's potential direct, indirect and cumulative impacts on the environment.

2 The following studies and assessments form the basis for determining the area of influence:

a EIS; and

b SEIS.

3 An area of influence has been determined by assessing the status of regional ecosystems along the CVM mining lease boundaries and the potential extension of influence around these total areas based on possibilities of fragmentation and cumulative impacts. The influence of CVM on land used as accommodation has also been included in the area of potential influence.

4 CVM's area of influence is depicted in Figure 8.

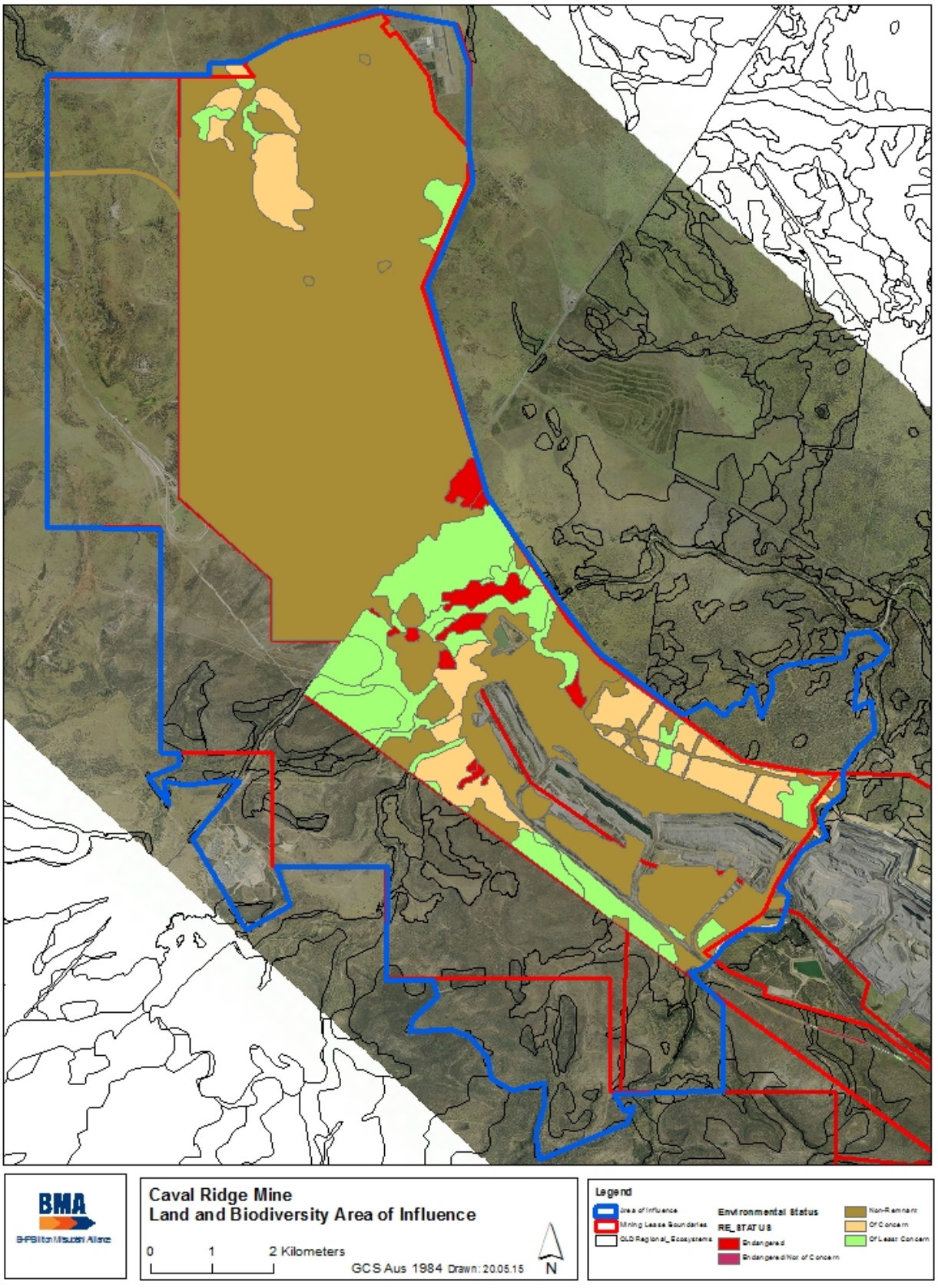


Figure 8: Land and Biodiversity Potential Area of Influence

6 Risks and Impacts to Land

1 Risk is managed in accordance with ***CVM STD Risk Management***.

2 The main activities and impacts contributing to land degradation are:

a **Biodiversity / Ecosystems:**

- **i** Clearing vegetation (including Endangered RE);
- **ii** Uncontrolled declared feral animals on BHP Billiton owned land;
- **iii** Weed spread and infestation;
- **iv** Disturbance of protected fauna habitat, flora and vulnerable species;
- **v** Disturbance of aquatic species and habitats;
- **vi** Creek diversions and erosion and sedimentation; and
- **vii** Failure to offset authorised cleared remnant regional ecosystems (RE).

b **Land:**

- **i** Failure to achieve future land use, land capability and land suitability objectives;
- **ii** Failure to achieve rehabilitation objectives (stable, sustainable landform);
- **iii** Failure to remove and correctly stockpile topsoil prior to mining activities;
- **iv** Disturbance of cultural heritage areas/ artefacts;
- **v** Land contamination from chemicals or hydrocarbons or improper waste disposal;
- **vi** Unacceptable impact on visual amenity; and
- **vii** Physically and chemically unstable mineral waste disposal stockpiles.

c **Mining Waste** and **Rehabilitation** (refer to ***CVM PLN Mining Waste Management*** and ***CVM PRO Rehabilitation Management***)**:**

- **i** Potential Acid Generating Material and heavy metal leachate;
- **ii** Salinity;
- **iii** Sodicity/dispersion;
- **iv** Erosion;
- **v** Slope stability;
- **vi** Poor plant growth medium / poor vegetation establishment;
- **vii** Use of incorrect soils in rehabilitation; and
- **viii** Poor landform construction/ regrading.

d Storage of mine affected water;

e Coal mining, transport and processing;

f General, hazardous material and regulated waste storage and disposal facilities;

g Abrasive blasting; and

h By-products of sewage treatment.

3 The ***CVM Plan of Operations*** details onsite activity planned to occur over the financial year and also details the existing and projected areas of disturbance and rehabilitation. This plan identifies the location of potential areas of contamination and impacts to land.

4 Disturbance data is reviewed each quarter for alignment with projected cumulative areas detailed in the current plan of operations.

7 Land Management Control Measures

1 The mitigation hierarchy is to be applied as described in the ***BMA Compensatory Action Procedure***, included in Figure 1.

2 Major controls have been implemented in order to address potential impacts to flora and fauna as a result of disturbance and also to control impacts of pests, mining waste and contaminated land. Rehabilitation will be carried out progressively to ensure an effective post-mine land use can be established.

Planning

3 The Mine Planning Department are responsible for planning future disturbance.

Approvals

4 Prior to commencement of any land disturbance and clearing, approval from the HSE Department is required to ensure that all land related criteria has been assessed. The land related criteria is assessed through the ***BMA Permit to Disturb Process***.

5 When a disturbance request is received, the HSE Department must ensure that:

- **a** Nature and extent of proposed disturbance conforms with the current ***Plan of Operations*** projections;
- **b** Cultural clearance is held for the areas to be disturbed and any significant artefacts which have been identified are managed according to the ***Cultural Heritage Management Plan***;
- **c** No restrictions related to land tenure exist;
- **d** Possible impacts to natural waterways have been considered (refer to ***CVM PRO Erosion & Sediment Control***);
- **e** Topsoil stripping and stockpiling requirements are appropriate; and
- **f** Any restrictions in relation to critical habitat for listed threatened species or listed threatened ecological communities are considered in relation to the date of grant (16/7/2000) of Surface Area with regard to triggering of referral process as per *Environment Protection and Biodiversity Conservation Act 1999* (refer to ***CVM PLN Threatened Flora, Fauna and Ecological Communities Management***).

6 The HSE Department must comply with the legal and policy requirements and will issue a Permit to Disturb when all requirements have been met.

Pest and Weed Controls

7 The following documents relevant to pest management shall be adhered to at CVM:

- **a** ***CVM PRO Animal Control***; and
- **b** ***CVM PRO Weed Management***.

8 CVM will conduct periodic weed management and feral animal baiting and trapping programs to identify and eradicate pest species.

9 Weed management practices include:

- **a** Vehicle movement restrictions and hygiene protocols, including movement of vehicles on topsoil stockpiles and in undisturbed habitats;
- **b** Use of a vehicle wash bay to ensure the removal of all potentially contaminated soil containing seeds;

c No weed species are to be used in landscaping;

d Ensure all removed weeds, weed-affected materials and rubbish are appropriately disposed of offsite; and

e Treatment areas and infestations will be tracked using GIS to ensure effective management is being achieved.

10 It is the responsibility of all employees to report weed infestation areas and siting of feral animals to the HSE Department.

Mining Waste Management Controls

11 The following Plan relevant to mining waste (spoil, coarse rejects and fine rejects) management shall be adhered to at CVM:

a ***CVM PLN Mining Waste Management***.

12 The majority of excavated overburden and interburden material will be returned to the mining pits following extraction of coal resources. An out-of-pit spoil pile will be constructed along the western edge of the Horse and Heyford Pits.

13 Four disposal methods for rejects are used in combination to achieve sustainable mine operation, these include:

a Tip head dumping (co-disposal);

b Paddock dumping;

c Dumping in dragline spoil valleys; and

d Storage / overflow cells.

14 As per the ***CVM EA*** condition *F12*, a mining waste and rejects characterisation program will be implemented to progressively characterise materials and inform spoil disposal planning. Refer to ***CVM PLN Mining Waste Management*** for testing frequencies and analysis.

15 Key reject and spoil disposal constraints include:

a Reject disposal areas shall be designed and constructed to ensure that any runoff or seepage from the reject disposal areas are contained within the mine water management system (MWMS) (refer to ***CVM PLN Water Management*** for additional information about the MWMS);

b Mixed plant reject (MPR) will not be placed within 10m of the final landform (rehabilitated) surface or within 10m of a final dump slope face;

c No overlapping of MPR disposed over tip heads. Hence, there will be separation between MPR loads deposited along the dump face; and no MPR will be dumped over existing loads of MPR already tipped over the dump face;

d No MPR (or fine reject) material will be used to form any part of tiphead safety bunds, haul roads or ramps; and

e All dumps will be designed and constructed to be free-draining.

16 If coarse material is separated the use and disposal of the coarse rejects may include alternative uses. Alternative uses for coarse rejects, which are only applicable when runoff drains into the pits, includes ramp or haul road sheeting and bunding (no use of rejects for bunding in high risk areas).

Contaminated Land Controls

17 Land with potential for contamination is identified by association with Notifiable Activities updated annually in the ***Plan of Operations***. Notifiable activities include abrasive blasting, chemical storage, mine wastes and petroleum product or soil storage.

18 Contaminated land is also managed through the implementation of the ***CVM PLN Waste Management*** with records maintained of locations of potentially contaminating activities.

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

- **a** Hydrocarbons and chemicals will be stored in accordance with Australian Standard AS1940.
- **b** All transfers of fuels and chemicals will be controlled and managed to prevent spillage outside bunded areas.
- **c** Any significant leakage/spillage will be immediately contained, cleaned-up and reported, as per ***CVM PRO Spill Response***.
- **d** Any rainfall collected in the bunded areas will be allowed to evaporate or be drained to a Mine Water Management System dam.
- **e** 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.
- **f** Waste water from wash down areas will be directed through oil and grease separators.
- **g** Separated hydrocarbon material will be collected and periodically removed offsite by licensed waste collection and transport contractors to a licensed recycling/disposal facility.

Rehabilitation Controls

1 Rehabilitation methods and controls utilised at CVM are outlined in the ***CVM PRO Rehabilitation Management***. Generic rehabilitation management controls are also covered in the following documents:

- **a** ***CVM PRO Land and Biodiversity Monitoring***;
- **b** ***CVM PRO Topsoil Management***;
- **c** ***CVM PLN Mining Waste Management***; and
- **d** ***BMA Permit to Disturb Process***.

2 Disturbed areas no longer required for operational purposes must be rehabilitated to a land use consistent with the pre-disturbance land use or alternative land use which takes into account regulatory requirements and stakeholder expectations.

3 EHP's four *General Rehabilitation Goals* require areas disturbed by mining to be rehabilitated to a safe to humans and wildlife; non-polluting; stable; and able to sustain an agreed post-mining land use.

4 Progressive rehabilitation shall be undertaken throughout the mine life, and will include the following main features:

- **a** Progressively constructing dumps to final landform design;
- **b** Immediately re-spreading suitable topsoil across available reshaped areas or stockpiling until suitable areas are available;
- **c** Contour ripping immediately after topsoil application, seeding, and applying fertilizer (if applicable);
- **d** Re-spreading cleared vegetation and vegetation mulch on rehabilitated land; and
- **e** Managing direct rainfall and runoff from the rehabilitated landform in sediment dams and in rehabilitated final voids.

5 Key rehabilitation management controls include:

- **a** Rehabilitation will be planned and implemented through the mining planning process, and include deliverables for the Life of Asset, 5 Year Plan and 2 Year Budget planning horizons;

b The criteria for achieving self-sustaining final landforms shall be developed by Mine Planning in accordance with the ***BMA Sustainable Landform Guideline***;

c Where possible, competent rock shall be selectively retrieved and dumped as a cover/ rock mulch over erosive Tertiary spoil;

d Rehabilitation requirements for disturbed areas (such as exploration) will be included in the Permit to Disturb conditions;

e When selecting vegetation species and establishment methodology, quick establishment of groundcover to prevent erosion should be balanced with long-term stability and compatibility with final land-use selection for that area.

Post Mining Land Use

6 The performance requirement for disturbed areas is a post-mining land use that consists of stable, self-sustaining vegetation communities with native tree, shrub and adapted grass species. It is proposed that the post-mining landscape will be a mosaic of bushland and pasture land.

7 It is anticipated that portions of the disturbed lands at CVM will be rehabilitated to attain capability classes VI and VII which have potential for grazing with adequate management of the erosion risk. The majority of disturbed lands, however, will be rehabilitated to attain capability class VIII which is not suitable for grazing. This category would apply to residual voids and other steep areas of the final landform.

8 Monitoring Requirements

1 Monitoring of representative areas of rehabilitation will assist the evaluation of methods, designs and appropriateness of proposed post-mining land use.

2 Site monitoring requirements are detailed in the ***CVM Land and Biodiversity Monitoring Procedure*** **and** ***CVM PLN Mining Waste Management***, which include monitoring specifications and frequencies.

3 The following monitoring of land and biodiversity is undertaken:

a Topsoil sampling;

b Vegetation clearing (mapped in GIS), through the ***Permit to Disturb Process***;

c Pest monitoring - weed identification, mapping, treatment controls and feral animal management;

d Rehabilitation monitoring, including land use, vegetation, fauna, landform stability and surface water; and

e Mining waste characterisation program, sampling as per ***CVM EA*** requirements.

4 The review should provide direction and evidence for auditors in the verification of Performance Category for annual ***Plan of Operations*** and ensure that:

a Any significant changes to the long term mine plan are incorporated;

b Mine site disturbance is updated on mine plans and conforms with the Plan of Operations;

c All environmental monitoring programs are being conducted to the required standards of the EA and data is readily available;

d Suitably qualified persons conduct reviews of all monitoring data to determine data trends, coverage is adequate and methods are appropriate;

e Spoil and topsoil chemistry characterisation is current; and

f Topsoil records (stockpiles and spread over rehabilitation) are current.

Disturbance

5 The area of disturbance is surveyed annually and reconciled with records, which are maintained and updated following survey.

6 Planned disturbances are managed in accordance with the ***BMA Permit to Disturb Process***.

7 Monitoring operational spatial information, including disturbance and rehabilitation areas associated with progress of the mine plan, is the accountability of the Mine Planning Department.

8 Areas of disturbance and rehabilitation are reconciled against an aerial image of the mine on a quarterly basis with attributes recorded in the mine's GIS database.

9 This data is used to develop a map of disturbance and rehabilitation which is submitted to the Administering Authority as part of CVM's Annual ***Plan of Operations***.

10 On a quarterly basis disturbance information is reported to Group via the HSE Reporting Function.

9 Roles and Responsibilities

11 Key roles and responsibilities with relevance to land and biodiversity management at CVM are outlined in Table 4.

Table 4: Roles and Responsibilities of relevance to Land and Biodiversity Management at CVM

Role	Responsibility
General Manager	• Ensure fulfilment of all applicable laws, regulations and requirements in relation to land and biodiversity management and reporting.
Managers / Risk Owners	• Provide the necessary resources such that land and biodiversity environmental impact targets can be achieved. • Implement any actions of this plan for which they are responsible.
Superintendent HSE	• Identify and advise Operations of potential initiatives relating to land and biodiversity management and meeting regulatory commitments. • Assist in identifying environmental impacts to land and biodiversity and potential controls associated with the Operations. • Execution of scheduled governance and compliance monitoring activities.
Manager Mine Planning	• Monitor and provide Operational spatial data for disturbance category reporting and Plans of Operations. • Provide short term executable mine plans in accordance with landform guidelines and mineral waste characterisation data from RPD.
Mining Personnel and Contractors	• Comply with land and biodiversity management requirements associated with their role and activities in accordance with procedures.

10 Awareness and Training

1 Effective land use and biodiversity management requires training commensurate with the roles and responsibilities of personnel.

2 Training will be undertaken in accordance with the ***BMA T&D Tracks Generic Training Scheme***.

3 Environmental awareness is included in the compulsory Caval Ridge Site Induction which includes the following topics:

a Environmental Awareness (Your Responsibility);

b Land and Biodiversity Management; and

c Permit to Disturb.

11 Reporting Procedures

1 Reporting falls into 2 categories:

a Performance reporting – reporting performance against defined business drivers, targets, compliance requirements or improvement goals.

b Technical reporting - analysis of datasets that details the current status or trends in a particular environmental area. Usually these reports detail a baseline, changes against a previously analysed baseline or identify improvement opportunities in performance of a particular environmental aspect.

2 Reporting on performance against the applicable monitoring programs should be in accordance with the ***Coal HSEC Reporting Standard*** and regulatory conditions.

3 When monitoring results do not conform to the identified requirements the HSE Department shall advise and consult with management responsible for the non-conforming plant or process;

4 The HSE Department must assess the requirement to report an environmental event as per ***CVM STD Event Management***.

Significant Event Reporting

5 In the event of emergencies, exceptions or incidents, all reasonable actions must be taken to minimise environmental harm and notification must be given to the Administering Authority, either verbally or written, as soon as practicably possible.

6 It is the responsibility of the HSE Department to report all relevant incidents to the Administering Authority in writing in accordance with timeframes stipulated in conditions of the site Environmental Authority. Duplicate copies of reporting documentation shall be maintained and filed in Hummingbird.

7 Refer to relevant ***CVM STD Event Management***.

Complaint Management

8 Complaints should be managed in accordance with the ***BMA PRO Community Complaints Grievance Procedure***.

12 References

Reference	Title
GLD	BHP Billiton GLD Environment & Climate Change
KM# 13175324	CVM STD Risk Management
KM# 7625027	BMA PRO Community Complaints Grievance Procedure (BMA PRO-0005)
KM# 10046069	CVM PRO Feral Animal Control
KM# 9749195	BMA Land and Biodiversity Management Standard
KM# 10174974	CVM PRO Land & Biodiversity Monitoring
KM# 7880893	BMA Environment Permit to Disturb Work Instruction (BMA Permit to Disturb Process)
KM# 9053894	CVM Cultural Heritage Management Plan
KM# 9996732	CVM PRO Erosion & Sediment Control
KM# 11536130	CVM PLN Threatened Flora, Fauna and Ecological Communities Management
KM# 10046164	CVM PRO Spill Response
KM# 10046118	CVM PRO Weed Management
KM# 14622968	CVM Environmental Authority EPML00562013 (EA)
KM# 14795773	CVM Plan of Operations FY17
KM# 11476922	CVM PLN Mining Waste Management
KM# 10046030	CVM PRO Rehabilitation Management
KM# 9888824	CVM Topsoil Strip Investigation 2013
KM# 11523933	CVM EIS Section - 4 Land Resources
KM# 11523853	CVM EIS Appendix G - Contaminated Land Preliminary Site Investigation
KM# 10320164	CVM EIS Appendix K – Ecological Assessment (URS 2009)
KM# 10320180	CVM EIS Appendix F - Soil Survey and Land Resource Assessment Report (GSS Environmental 2009).
KM# 10014707	Caval Ridge Site Risk Register
KM# 13569548	BMA HSE Compensatory Action Procedure
KM# 8175821	BMA T&D Tracks Generic Training Scheme
KM# 8345197	Coal HSEC Reporting Standard
KM# 13326973	CVM STD Event Management
KM# 8749333	BMA Guideline for the Design of Sustainable Mine Landforms
	EHP Guideline - Rehabilitation requirements for mining resource activities (http://www.ehp.qld.gov.au/assets/documents/regulation/rs-gl-rehabilitation-requirements-mining.pdf)

13 Glossary

Term/Acronym	Definition
Administering Authority	The governmental department responsible for the conservation and management of the natural environment for the benefit of all Queenslanders.
AMD	Acid Mine Drainage.
ANC	Acid Neutralizing Capacity.
Baseline	An evaluation of environmental conditions that exist prior to commencement of controlled activities so that there is a means of determining the potential and actual impacts of controlled activities.

Term/Acronym	Definition
Brigalow EEC	Term used to collectively refer to all vegetation that meets the definition of the Brigalow (*Acacia harpophylla* dominant and co-dominant) endangered ecological community under the EPBC Act. This definition encompasses a number of Queensland Regional Ecosystems.
CHPP	Coal Handling and Processing Plant.
DEHP	Queensland Government Department of Environment and Heritage Protection (formerly DERM Department of Environment and Resource Management).
Dispersion	Process where soil breaks down into its constituting particles when in contact with water. Dispersive soils are considered to be highly erodible.
Disturbance	Any activity that could cause an area of land to have vegetation removed, cultural heritage damaged, be dug-up, built-on or significantly altered such that topsoil would be removed, buried, contaminated, compacted or made inaccessible.
EA	Environmental Authority, as issued by the Administering Authority .
EEC	Endangered Ecological Community, as defined under the EPBC Act.
EIS	Environmental Impact Statement.
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
LBMP	Land and Biodiversity Management Plan.
Mining Waste	Refers to overburden and interburden materials including tailings and reject materials (course rejects, de-watered fine rejects and any other waste rock material).
ML	Mining Lease.
MPR	Mixed plant rejects (MPR) consists of coarse rejects and dewatered fine rejects
Mtpa	Million tonnes per annum.
NC Act	Queensland *Nature Conservation Act 1992.*
RE	Regional Ecosystem. REs are vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil.
Rehabilitation	The process of transforming disturbed land to a safe, stable and sustainable state. Includes massive earthworks associated with regrading spoil areas and all of the subsequent treatments such as capping, drainage, topsoiling ripping, seeding and fertilizing; and also covers work on areas of lesser disturbance such as hardstands, access tracks, and infrastructure areas, etc. which are being rehabilitated.
Rejects	Waste product from the CHPP process.
ROM	Run of Mine
Salinity	Soils with high levels of soluble salts.
SEIS	Supplementary Environmental Impact Statement.
SEWPAC	Commonwealth Department of Sustainability, Environment, Water, Population and Communities. Formerly known as the Department of the Environment, Water, Heritage and the Arts (DEWHA).
Shall	The word ‘shall’ is to be understood as mandatory.
Should	The word ‘should’ is to be understood as non-mandatory, advising or recommended.
Sodicity	Soils which contain an ESP greater than 6% are considered sodic. It affects soil stability, plant growth and land use.
Spoil	Refers to overburden and interburden materials.
Subsoil	Located below the topsoil, but provides a moisture store and a limited range of nutrients for plant growth. Soil quality becomes less favourable with depth for example clays typically become massive and gleyed associated with impeded drainage as well as more saline and sodic. Subsoil is usually not friable and is difficult to till and form a seed bed. Depths of subsoil can vary considerably depending on terrain but often transcend to weathered parent material where soils have developed in situ. Colour changes can often indicate an interface between topsoil and subsoil – e.g. sandy loams on clay subsoil also with frequent marked colour contrast between horizons; but may be vague or invisible on some the clay topsoils. Subsoil must not be mixed with topsoil as it can cause marked deterioration of topsoil quality. However, in some instances subsoil can be used as a topsoil substitute. But physical and chemical characterisation is necessary to confirm its viability.

Term/Acronym	Definition
Topsoil	The surface layer of soil suitable for plant establishment and growth. Topsoil thickness varies considerably and may range from 100 mm to 500 mm, depending on soil type, topographical location and formation history as well as land use impacts. Topsoil contains viable seed, and is generally higher in organic matter, microbial activity and nutrient content. It is a vital resource and every effort will be made to ensure salvage and management of this resource.
VM Act	Queensland *Vegetation Management Act 1999.*

14 Version Management

Version	Details
7A	Document called for review. Update to reference documents.
7	Review to align with updated BMA Land and Biodiversity Management Plan Template
6	Simplification of Management Plan. Removal of sub-sections.
5B	Updated Environmental Authority Permit number
5A	Document references table updated
5	Review – Workflow
4A	Draft incorporating CVM comments
1	Initial draft for comment

BHP Billiton Mitsubishi Alliance

CVM-PLN-0019

KM#11536130 / 12 January 2016

Caval Ridge Mine

Threatened Flora, Fauna and Ecological Communities Management Plan

Table of Contents

List of Figures

List of Tables

Abbreviations

ABBREVIATION	DESCRIPTION
BMA	BM Alliance Coal Operations Pty Ltd
Brigalow EEC	Term used to collectively refer to all vegetation that meets the definition of the Brigalow (Acacia harpophylla dominant and co-dominant) endangered ecological community under the EPBC Act. This definition encompasses a number of Queensland Regional Ecosystems.
CHPP	Coal Handling and Preparation Plant
Caval Ridge Mine	Caval Ridge Mine includes Caval Ridge Mine and the associated accommodation village and services corridor
DEHP	Queensland Department of Environment and Heritage Protection
EA	Environmental Authority, as issued by DEHP
EEC	Endangered Ecological Community, as defined under the EPBC Act
EIS	Environmental Impact Statement
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
MIA	Mining Industrial Area
ML	Mining Lease
Mt/a	Million tonnes per annum
NC Act	Queensland *Nature Conservation Act 1992*
RE	Regional Ecosystem. REs are vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil.
SDPWO Act	Queensland *State Development and Public Works Organisational Act 1997*
SEWPAC	Commonwealth Department of Sustainability, Environment, Water, Population and Communities. Now known as the Department of the Environment.
The Plan	Threatened Flora, Fauna and Ecological Communities Management Plan
VM Act	Queensland *Vegetation Management Act 1999*

1.0 Introduction

BM Alliance Coal Operations Pty Ltd (BMA) Caval Ridge Mine (CVM) is an open cut coal mine situated south-west of Moranbah in the Bowen Basin and approximately 160 km south-west of Mackay, Queensland. The northern most boundary of the mine will be approximately 6 km from Moranbah, while the mine industrial area (MIA) and coal handling and preparation plant (CHPP) will be about 16 km from Moranbah.

The Caval Ridge Mine is approximately 17 km long and 4 km wide (excluding the rail spur and overland conveyor). The mine is located in the northern section of the existing Mining Lease (ML) 1775, with Harrow Creek acting as the southernmost boundary.

Caval Ridge Mine includes a coal mine and coal handling and processing infrastructure to produce 11 Million tonnes per annum (Mtpa) of hard coking coal for the export market over a life of approximately 30 years. The Caval Ridge deposit is north of the Peak Downs coal mine (managed by BMA) and is intersected by the Peak Downs Highway. The location of the mine is shown in Figure 1.

Mining activities will include clearing vegetation, topsoil stripping, removing overburden to in pit and out-of-pit spoil dumps, coal mining and progressive rehabilitation.

Mining and cattle grazing are the predominant land uses within the Bowen Basin region. The northern section of Caval Ridge Mine has been partially cleared for grazing, while the southern section was previously mined. The landscape quality of the Caval Ridge Mine has been significantly altered by agricultural land uses over many years and more recently by open cut mining.

BMA also operate Buffel Park accommodation village, which accommodates up to 1200people (see Figure 2). The Buffel Park accommodation village is located approximately 20km south of the township of Moranbah, adjacent to Peak Downs Highway. It is situated on approximately 85ha of BMA owned agricultural land. The village will include accommodation buildings and associated shared facilities. The accommodation village will be serviced by an onsite water treatment plant, a sewage treatment plant and a 66/11kV sub-station.

A services corridor associated with the accommodation village is located on BMA properties, both on and off mine lease, adjacent to Peak Down Highway. It spans from the accommodation village and heads in a north-eastern direction towards the intersection of Peak Downs Highway and Winchester Road (see Figure 5).

For the purpose of the Threatened Flora, Fauna and Ecological Communities Management Plan (the Plan) - – Caval Ridge Mine includes Caval Ridge Mine, accommodation village and the associated services corridor.

Caval Ridge Mine has been subject to assessment and approval process under Commonwealth and Queensland legislation.

Commonwealth approval for Caval Ridge Mine, under section 130 (1) and 133 of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) was granted on 18 March 2011 by the Department of Sustainability, Environment, Water, Population and Communities (SEWPAC) (now the Department of the Environment). The relevant approval conditions are detailed in Section 2.1.1

State approval for Caval Ridge Mine, under section 35 of the *State Development and Public Works Organisational Act 1997* (SDPWO Act) was granted by the Queensland Coordinator General in August 2010. The subsequent approval of a change request for the accommodation villages was approved by the Queensland Coordinator General in February 2011. Relevant conditions of approval are detailed in Section 2.1.2

The Plan has been prepared by BMA to meet the requirements of relevant conditions under both the Commonwealth and Queensland government approvals.

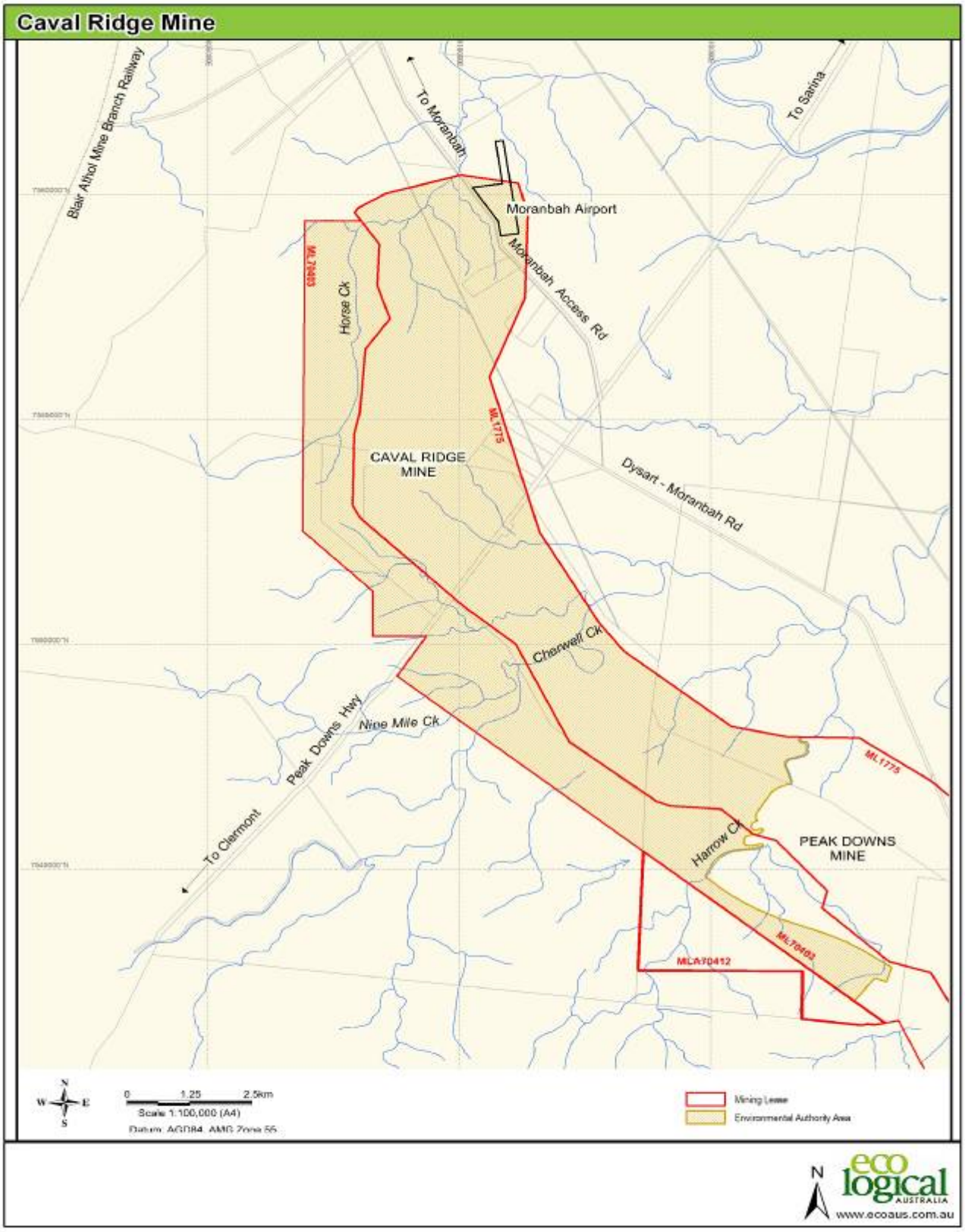


Figure 1: Location of the Caval Ridge Mine

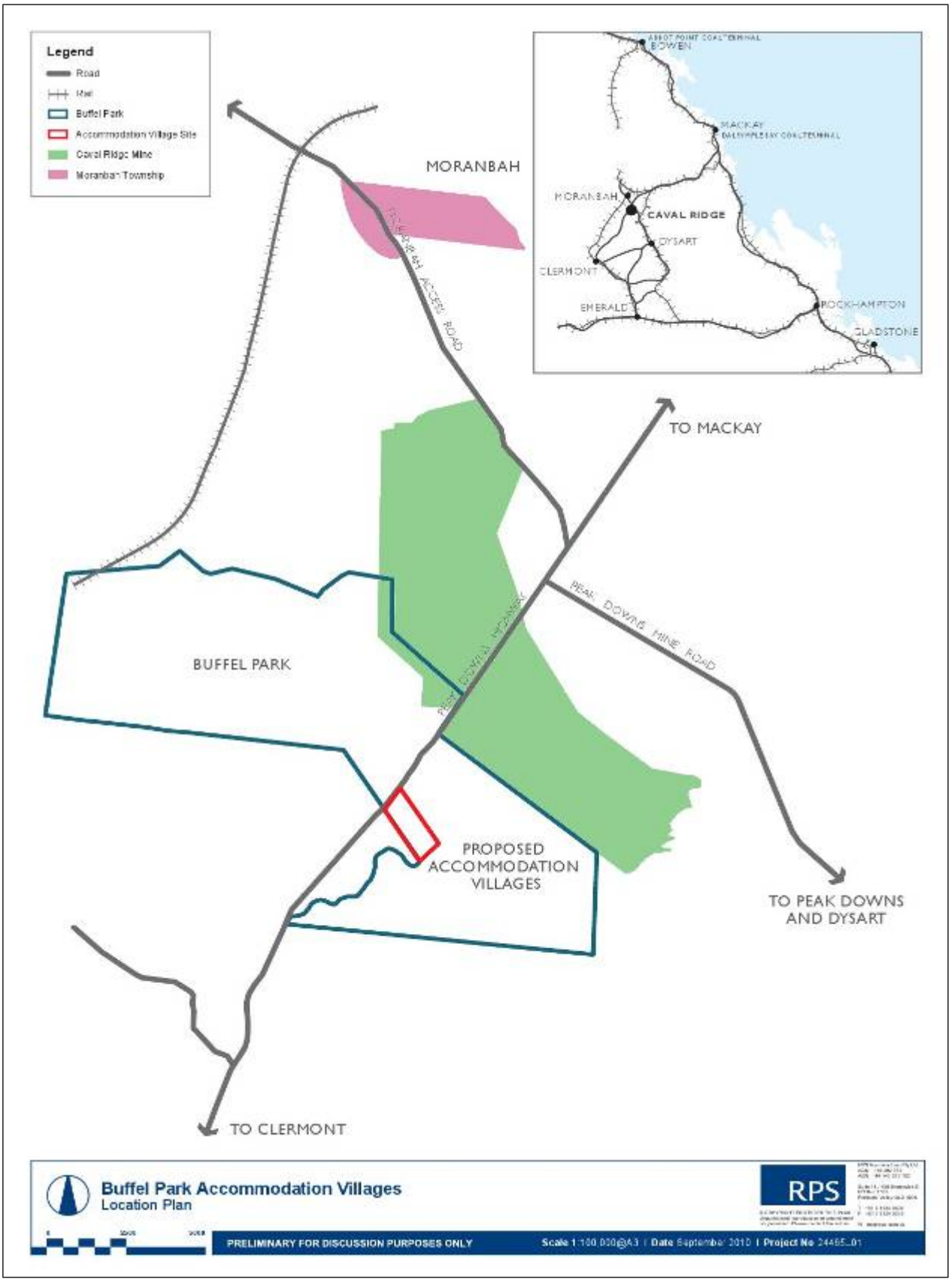


Figure 2: Location of the Buffel Park Accommodation Villages

2.0 Background

This section details the legislative requirements that have shaped this Plan and also provides a brief description of the existing environment at the Caval Ridge Mine, associated accommodation village and service corridor.

Prior to the commencement of mining activities, Caval Ridge Mine site was mainly cleared or disturbed land and cattle grazing was the predominate land-use. Subsequently the area had suffered significant weed infestation, although some patches of remnant vegetation still persisted. Caval Ridge Mine had been degraded by exotic pasture species which had resulted in the suppression and exclusion of native species.

The accommodation village was constructed on land highly modified through historical land-use, which had included extensive vegetation clearing. As a result the area was described as open woodland to shrubland, with minor weed infestation and grazing disturbances.

The services corridor had been modified through historical land-use and was predominately grazing land and open woodland.

2.1 Legislative requirements

Caval Ridge Mine was subject to an assessment and approval process under Commonwealth and Queensland legislation. Approvals were granted under both jurisdictions, and are detailed below.

2.1.1 Commonwealth Government approval conditions

The management principles outlined in this Plan have been designed to meet the requirements of the Commonwealth Government's approval conditions for Caval Ridge Mine. Commonwealth approval for Caval Ridge Mine, under the EPBC Act, was granted by SEWPAC in March 2011. Table 1 details the EPBC Act approval conditions relevant to this Plan.

Table 1: SEWPAC approval conditions relevant to this Plan

Conditions of Approval – Caval Ridge Coal Mine (EPBC 2008/4417)	
Condition 4	Before commencement of operations (excluding early works), the person taking the action must submit to the Minister for approval a "Threatened Flora and Fauna Species and Ecological Communities Management Plan". The Plan must contain, but is not limited to, the following: a. Management actions relating to EPBC listed species and ecological communities; and b. Mitigation actions relating to EPBC listed species and ecological communities. The approved Threatened Flora and Fauna and Ecological Communities Management Plan must be implemented. Any changes to the Threatened Flora and Fauna and Ecological Communities Management Plan must be approved by the Minister and approved variations to the Plan must be implemented. This Plan may be made publically available on the internet by the Department.

2.1.2 Queensland Government approval conditions

This Plan has also been designed to meet the requirements of the Queensland Government's approval conditions for Caval Ridge Mine. State approval for Caval Ridge Mine, under the SDPWO Act was granted by the Queensland Coordinator General in August 2010. The subsequent approval of the associated accommodation village was approved by the Queensland Coordinator General in February 2011. The Coordinator General's conditions relating to the Plan are detailed below in Table 2.

Table 2: Coordinator General's Conditions

Conditions of the Coordinator General – Caval Ridge Coal Mine	
Condition	**CG Report August 2010**
3(b)	The proponent must prepare to the satisfaction of DERM and DEWHA a 'Threatened Flora and Fauna Species and Ecological Management Plan' that: i. ensures the impacts to these species and communities are minimised ii. contributes to the survival of these species in the wild, and iii. achieves conservation benefits for these species and communities where practicable.
3(c)	As a minimum, the plan in (b) should include: i. affected species listed as endangered, vulnerable or rare under the *Nature Conservation Act 1994* ii. affected species listed by DERM on its 'Back on Track' systems that are identified as in decline and have a good potential for recovery iii. management measures addressing the threatened species listed in the 'controlling provisions' for the CRM under the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act). iv. the proponent's commitments to implement management measures to further mitigate the impacts of mining activities on ecological values v. the additional and on-going management activities to mitigate impacts to native vegetation communities outlined in chapter 8 of the CRM EIS and section 5.4 of the 'EPBC Matters Report' in Appendix C2 of the CRM EIS vi. how the proponent will satisfy the requirements of section 332 of the *Nature Conservation (Wildlife Management) Regulation 2006* relating to tampering with animal breeding places vii. a commitment to provide information on flora and fauna management actions for significant species for inclusion in DERMs 'Recovery Actions Database' when that framework is finalised and becomes operational.
3(d)	The plan in (b) should be provided to DERM and DEWHA for review at least 28 days prior to commencement of any construction activity, for the CRM project other than early road works.
Condition	**CG Change Report 1**
Ecology 1	The proponent must submit a threatened flora and fauna species and ecological communities management plan for approval by the Department of Environment and Resource Management prior to the commencement of any works that: a) ensures the impacts to these species and communities are minimised b) contributes to the survival of these species in the wild c) achieves conservation benefits for these species and communities where practicable.
Ecology 2	As a minimum, the plan in Ecology Condition 1 should include: a) a list of species listed as endangered, vulnerable or rare under the *Nature Conservation Act 1994* that may be impacted b) a KMZ map that identifies GPS positions significant species as listed under the *Nature Conservation Act 1994* in the clearing footprint and its surrounds c) affected species listed by the Department of Environment and Resource Management on its 'Back on Track' systems that are identified as in decline and have a good potential for recovery d) the additional and ongoing management activities to mitigate impacts to native vegetation communities e) how the proponent will satisfy Section *332* of the *Nature Conservation (Wildlife Management) Regulation 2006* relating to tampering with animal breeding places f) management of affected fauna during construction and operation phases g) a commitment to provide information on the flora and fauna management actions for significant species for inclusion in the Department of Environment and Resource Management's 'Recovery Actions Database' when that framework is finalised and becomes operation h) a commitment to submit a clearing permit for approval by the Department of Environment and Resource Management should an endangered, vulnerable or near threatened plant listed under the *Nature Conservation Act 1994* be identified in the clearing footprint.

2.1.3 Environmental Policy

Caval Ridge Mine is committed to the protection and management of the environment and operational activities will be performed in a manner that prevents pollution, promotes sustainability and minimises environmental impacts to native flora, fauna and ecological communities. Caval Ridge Mine has adopted a zero harm policy and will be undertaken in accordance with BHP Billiton's Charter Values.

This commitment is achieved by:

- continual improvement of environmental performance;
- timely and effective responses to non-conformance issues;
- ongoing environmental awareness training for all Caval Ridge Mine employees; and
- regular monitoring, auditing and reviewing of compliance with this Plan, applicable legislation, regulations and environmental authorities.

3.0 Purpose of this Plan

This Plan has been prepared to describe the management actions that will be implemented to mitigate impacts on significant flora, fauna and ecological communities.

The aim of the plan is to ensure that impacts to significant species and/or communities are minimised. In particular, the plan aims to:

- contribute to the survival of the species or community in the wild;
- achieve conservation benefits and maintain the ecological value of a species or community;
- protect and conserve threatened species and communities and the regional biodiversity value;
- describe the responsibilities and actions required during operations to maintain compliance with environmental requirements, commitments, and to address unanticipated discoveries;
- develop management practices for flora and fauna protection and conservation; and
- provide a framework for inspections and monitoring to evaluate compliance with flora and fauna protection requirements.

This Plan relates to the operational activities of Caval Ridge Mine, Buffel Park Accommodation Village and supporting infrastructure and services (eg. roads, powerlines, water and electricity).

4.0 Roles and Responsibilities

The Caval Ridge Mine General Manager is responsible for the implementation of the Plan (Table 3).

Table 3: Roles and Responsibilities

Title	Company	Roles and Responsibilities
General Manager	BMA	Responsible for providing adequate resources for the implementation of the Threatened Flora, Fauna and Ecological Communities Management Plan.
Environmental Representatives	BMA	Responsible for coordinating the day to day implementation of the Threatened Flora, Fauna and Ecological Communities Management Plan in consultation with the relevant Government Departments. Shall ensure that personnel involved in the implementation and monitoring of the values and activities in the Threatened Flora, Fauna and Ecological Communities Management Plan are suitably qualified to perform the task(s).
Ecology specialists(Botanists, Zoologists and Ecologists)	A suitably qualified and experienced person	Responsible for providing expertise in relation to the management and conservation of flora, fauna (including their habitat) and ecological communities.

5.0 Existing environment and impacts

The information provided below is based on the information presented in the EIS, the Supplementary EIS and associated ecological reports for the Caval Ridge Mine, the associated accommodation villages and service corridor.

5.1 Ecological Communities and Regional Ecosystems

A total of 20 Regional Ecosystems (RE's) have been identified as potentially occurring within Caval Ridge Mine . Of these, 14 have been or will be disturbed as a result of Caval Ridge mining activities. These RE's are outlined below in Table 4.

Of the 14 RE's that have been or will be disturbed by Caval Ridge Mine, five are encompassed by endangered ecological communities (EEC) under the EPBC Act. The EECs relevant to Caval Ridge Mine are as follows:

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

The Brigalow (*Acacia harpophylla* dominant and co-dominant) EEC occurs on the north-western slopes and plains and Darling River plains in NSW, and is characteristic of the southern Brigalow Belt Bioregion in Queensland. Queensland's southern Brigalow Belt stretches from Rockhampton in Queensland to the border of NSW. The region encompasses much of the country that receives 500 to 750 millimetres (mm) of rainfall per year.

In Queensland, the Brigalow EEC that has been listed as endangered under the EPBC Act and is relevant to Caval Ridge Mine is defined by reference to four REs, 11.4.3, 11.4.9, 11.9.5 and 11.4.8, all of which are listed as Endangered under the Queensland *Vegetation Management Act 1999* (VM Act). The Brigalow EEC is known to occur at various locations across Caval Ridge Mine (see Figures 3 and 4).

Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin

The Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin (Natural Grasslands EEC) occurs within the Queensland Brigalow Belt which stretches from Rockhampton in Queensland to the border of NSW. The region encompasses much of the country that receives 500 to 750 mm of rainfall per year.

In Queensland, the RE relevant to Caval Ridge Mine that contains the Natural Grasslands EEC that has been listed as Endangered under the EPBC Act is RE: 11.8.11, which is listed as Of Concern under the VM Act. The Natural Grasslands EEC is known to occur at various locations across Caval Ridge Mine (see Figure 3).

Table 4: Impacts to Significant Vegetation Communities Recorded at Caval Ridge Mine.

RE Code	Vegetation Description (Short)	Vegetation Management Act Status	EPBC Status	Area to be impacted (ha)
11.7.1	*Eucalyptus thozetiana* Woodland on slopes of rocky residual ranges with Cainozoic lateritic duricruct	Least concern		13.1
11.5.3	*Eucalyptus populnea* and/or *E. melanophloia* and/or *Corymbia clarksoniana* on Cainozoic sand plains/remnant surfaces	Least concern		110.2
11.10.3	*Acacia catenulate* or *A. Shirleyi* open forest on coarse-grained sedimentary rock. Crests and scarps.	Least concern		7.9
11.4.3	Open-forest dominated by *Acacia harpophylla* and/or *Casuarina cristata*	Endangered	Endangered	4.6
11.10.4	*Eucalyptus crebra, Corymbia aureola, C. Clarksoniana and/or Acacia shireyi* woodland. Small areas that occur in conjunction with *E. Decorticans woodland.*	Least concern		31.3
11.5.9	*Eucalyptus crebra* and other *Eucalyptus spp.* and *Corymbia spp*. woodland on Cainozoic sand plains/remnant surfaces	Least concern		225.9
11.8.5	*Eucalyptus orgadophila* open woodland on Cainozoic igneous rocks	Least concern		27.3
11.8.11	*Dichanthium sericeeum* grassland on Cainozoic igneous rocks	Of concern	Endangered	124.6
11.4.9	*Acacia harpophylla* shrubby open forest to woodland with *Terminalia oblongata* on Cainozoic clay plains	Endangered	Endangered	17.8
11.3.2	*Eucalyptus populnea* woodland on alluvial plains	Of concern		248.6
11.3.25	*Eucalyptus tereticornis* or *E. camaldulensis* woodland in Cainozoic clay plains	Least concern		31.5
11.9.5	Acacia harpophylla and/or Casuarina cristata open forest to woodland on fine grained sedimentary rock.	Endangered	Endangered	3.9
11.4.8	*Eucalyptus cambageana* woodland to open forest with *Acacia harpophylla* or *A. argyrodendron* on Cainozoic clay plains	Endangered	Endangered	8.2
11.4.2	*Eucalyptus spp.* and/or *Corymbia.spp* grassy or shrubby woodland on Cainozoic clay plains	Of concern		4.5

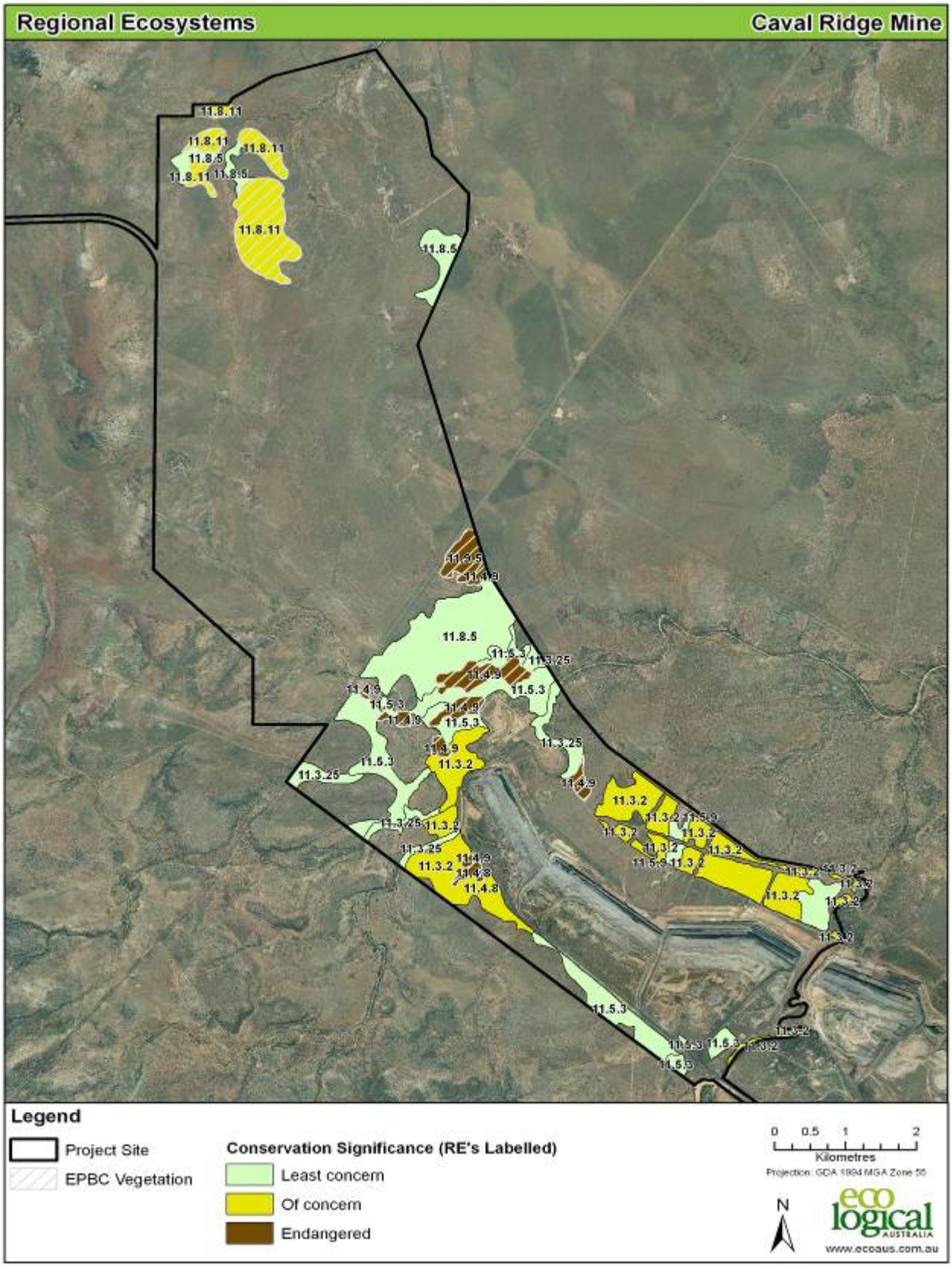


Figure 3: RE's and EEC at the Caval Ridge Mine

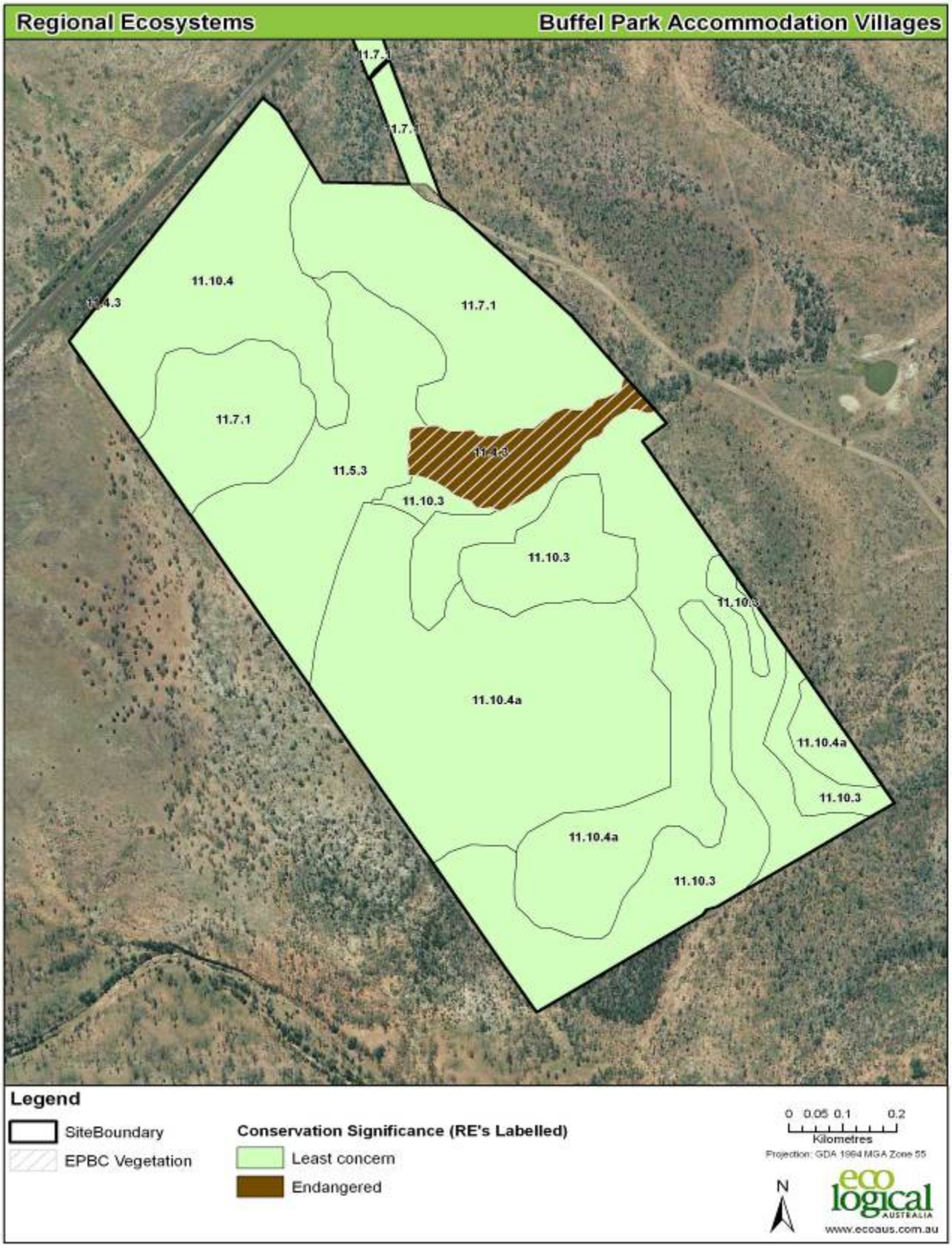


Figure 4: RE's and EEC's within the Buffel Park Accommodation Village

Figure 5: RE's and EEC's within the Services Corridor

5.2 Threatened Flora

No significant flora species listed under the EPBC or NC Acts were recorded within Caval Ridge Mine. However, two species listed under the EPBC and NC Acts were identified as having potential to occur. These species are:

- King Bluegrass (*Dichanthium queenslandicum*) – Vulnerable EPBC Act, Vulnerable NC Act.
- Finger Panic Grass (*Digitaria porrecta*) – Endangered EPBC Act, Rare NC Act.

Although neither species has ever been recorded on site, there is a reasonable probability of occurrence on site in RE 11.8.5 and 11.8.11.

King Bluegrass (*Dichanthium queenslandicum*)

King Blue-grass is listed as Vulnerable under both the EPBC and NC Act. It grows in heavy black soil, open downs or blue grass open downs with scattered Bloodwood on black cracking clay. Although this species was not recorded within Caval Ridge Mine, suitable habitat is known to occur.

Finger Panic Grass (*Digitaria porrecta*)

Finger Panic Grass is listed as Endangered under the EPBC Act and Rare under the NC Act. It occurs in grasslands on extensive basaltic plains and in undulating woodland and open forests. Although this species was not recorded within Caval Ridge Mine, suitable habitat is known to occur.

Given that no flora species listed under the NC Act were recorded within Caval Ridge Mine, it can be concluded that no flora species listed by the Department of Environment and Heritage Protection (DEHP) on its 'Back on Track' systems as a priority species will be affected by operational activities.

5.3 Threatened Fauna

A number of significant fauna species have been identified as having potential to occur or being known to occur at Caval Ridge Mine, including, one species listed as Endangered under both the EPBC and NC Acts, seven species listed as Vulnerable under both the EPBC and NC Acts, 3 species listed as Rare under the NC Act, and one species listed as Endangered under the NC Act (see Table 5).

The significant fauna species relevant to Caval Ridge Mine that are listed under the NC Act also have a priority ranking under the DEHP 'Back on Track' species prioritisation framework (the Framework). The Framework is an initiative that prioritises Queensland's native species (marine, terrestrial and aquatic species of flora and fauna) to guide conservation, management and recovery.

The Framework is designed to prioritise all species, regardless of their current classification under the NC Act or the EPBC Act. The aim is to better reflect the level of management required to conserve Queensland's native wildlife. Species are prioritised using multiple criteria, to allow the identification of species that are in trouble, and those which have the greatest chance of recovery.

The process identifies common threats and actions that affect a range of species, this encourages a multi-species or landscape approach to conservation as well as opportunities for cross regional projects. Species are ranked in order of priority as 'Critical', 'High', 'Medium' or 'Low'. The priority rankings of the species relevant to Caval Ridge Mine are shown in Table 5. Of these species, one species has been ranked as a High priority, eight as Medium priority and 3 as Low priority.

Impacts to a threatened fauna species as a result of Caval Ridge mining activities are not considered likely and it is not expected that those species listed under the Framework as in decline but with a good potential for recovery will be impacted.

Through the implementation of management and mitigation measures (see Section 6) and through the provision of an offset, Caval Ridge Mine will provide conservation benefits for threatened fauna species and therefore increase the chance of recovery for those species listed under the Framework.

Table 5: Significant Fauna Species Relevant to Caval Ridge Mine

Species	NC Act Status	EPBC Act Status	Location	Likelihood of Occurrence
Squatter Pigeon (*Geophaps scripta)*	Vulnerable (M)	Vulnerable	C / A	Known
Australian Painted Snipe (*Rostratula australis*)	Vulnerable (M)	Vulnerable	C / A	Potential
Little Pied Bat (*Chalinolobus picatus)*	Rare (M)		C	Known
Ornamental Snake (*Denisonia maculata*)	Vulnerable (M)	Vulnerable	C	Known
Brigalow scaly-foot (*Paradelma orientalis*)	Vulnerable (M)	Vulnerable	C / A	Potential
Allan's lerista (*Erista allanae*)	Endangered (H)	Endangered	A	Potential
Yakka skink (*Egernia rugosa*)	Vulnerable (M)	Vulnerable	C / A	Potential
Cotton Pygmy-Goose (*Nettapus coromandelianus albipennis*)	Rare (L)		C / A	Potential
Black-necked Stork (*Ephippiorhynchus asiaticus*)	Rare (L)		A	Potential
Troughton's Sheathtail-bat (*Taphozous troughtoni*)	Endangered (L)		C	Known
Greater Long-eared Bat (South-eastern) (*Nyctophilus timoriensis*)	Vulnerable (M)	Vulnerable	C / A	Potential
Dunmall's Snake (*Furina dunmalli*)	Vulnerable (M)	Vulnerable	A	Potential

C= Caval Ridge Coal Mine Site. A = Accommodation Villages
H = Ranked as a high priority under the DEHP 'Back on Track' species prioritisation framework.
M = Ranked as a medium priority under the DEHP 'Back on Track' species prioritisation framework.
L = Ranked as a low priority under the DEHP 'Back on Track' species prioritisation framework.

Although twelve species have been identified as having potential to occur, only four species were recorded within the vicinity of the Caval Ridge Mine Site. No significant species were recorded within the vicinity of the proposed accommodation villages or services corridor.

The four species recorded within the vicinity of the Caval Ridge Mine Site are as follows:

Squatter Pigeon *(Geophaps scripta)*

The Squatter Pigeon is listed as Vulnerable under both the EPBC and NC Acts. The range of the squatter pigeon extends from Cape York Peninsula south through Central Queensland to northern inland NSW. Over 100 records of this species have been made in the Brigalow Belt South Bioregion (DERM 2011).

During the 2008 surveys, squatter pigeons were observed on a number of occasions at the Caval Ridge Mine site, usually as single individuals and never in groups of more than three individuals, though two pairs were recorded in very close proximity (see Figure 6). Most observations were at the same location and may have been of the same individual. All individuals were observed in areas of active grazing and substantial habitat degradation, and their occurrence may reflect the nearby presence of water rather than food resources, or be simply a result of increased visibility improving the likelihood of detection.

Earlier surveys of the study area and adjacent Peak Downs Mine recorded squatter pigeons in groups of up to seven individuals (Ecoserve and LAMR 2005). Habitat details are not available for most of these records, though the report states that the species is likely to occur anywhere within the area that has grassland. The squatter pigeon, despite substantial declines and even local extinctions in the southernmost parts of its range, remains common locally, even in areas heavily degraded by cattle. The

species has been known to recover from declines driven by drought and then increase in abundance on active grazing properties (Woinarski and Catterall 2004).

Little Pied Bat (*Chalinolobus picatus*)

The Little Pied Bat is listed as Rare under the NC Act. The species is typically found in dry habitats including open forests, woodland, and mulga woodlands. There are numerous anabat survey records from the Brigalow remnant adjacent to the boundary of the Peak Downs Mine with Saraji Mine (Ecoserve and LAMR 2005). Surveys in 2008, also recorded (using anabat surveys) the species from three locations within Caval Ridge Mine (see Figure 6), all in or near woodland with Brigalow. Whilst the species is not expected to regularly use Caval Ridge Mine area, surveys have confirmed that the species may occur within a variety of habitats types that are known to occur within Caval Ridge Mine. Current threats to this species include habitat clearance, fragmentation and loss of potentially important roosting locations such as mine shafts or caves.

Ornamental Snake (*Denisonia maculata*)

The ornamental snake is listed as Vulnerable under both the EPBC and NC Acts. It is found in the Dawson and Fitzroy River drainages of central coastal Queensland (Ehmann 1992).

The ornamental snake occurs in low-lying areas with deep-cracking clay soils that are subject to seasonal flooding, and in adjacent areas of clay and sandy loams. The species is found in woodlands and shrublands, such as Brigalow, and in riverine habitats, and lives in soil cracks and under fallen timber.

Two ornamental snakes were recorded on the adjacent Peak Downs Mine during a nocturnal search. The location included known habitat characteristics for this species of inundated gilgais and Brigalow on deep-cracking clays. Additional targeted searches failed to locate any more individuals (Ecoserve and LAMR 2005) within Caval Ridge Mine area. However, an area of Brigalow possibly suitable for this species based on substrate and proximity to a creekline was identified during the winter 2008 survey. This area is outside of the area of proposed disturbance and, as only part of the patch has substrate suitable for Ornamental Snake, may be insufficient in size to maintain a population.

Troughton's Sheathtail-bat (*Taphozous troughtoni*)

The Troughton's Sheathtail-bat is listed as Endangered under the NC Act. It is known from three locations near Mount Isa and was considered to be restricted to this area. More recently, however, the species has been found to occur throughout much of south-eastern and central Queensland. The Troughton's Sheathtail-bat roosts in caves and abandoned mines and has been recorded form hills with open woodland and Spinifex.

The only records of the species occurring within Caval Ridge Mine are previous anabat records for Cherwell Creek (see Figure 6). Cherwell Creek runs through the Caval Ridge Mine. Although the species has previously been recorded, it is not expected that it would regularly use Caval Ridge Mine.

Although the following species were not recorded, they have been identified as having potential to occur within Caval Ridge Mine:

Australian Painted Snipe (*Rostratula australis*)

The Australian painted snipe is listed as Vulnerable under both the EPBC and NC Acts. It is patchily distributed throughout Australia, with most records being in the south-east of the country. Records are unpredictable, the species being absent from areas in some years and common in others.

The species occurs in terrestrial shallow wetlands, both ephemeral and permanent, usually freshwater but occasionally brackish. They also use inundated grasslands, saltmarsh, dams, rice crops, sewage farms and bore drains.

Although there are no actual database records for or nearby, the erratic nature of its movements and its willingness to use artificial waterbodies means that the species may occur on the study area at times. Any such occurrences could be years apart and could easily be overlooked due to the secretive nature of the species.

One North Dam to the south of the Caval Ridge Mine is one location that may provide suitable resources, though this will be dependent on water levels being such that the water's edge is near fringing vegetation. Caval Ridge Mine and immediate surrounds are not, however, likely to provide breeding resources and any occurrence is likely to be sporadic at best.

Brigalow scaly-foot (*Paradelma orientalis*)

The Brigalow scaly-foot is listed as Vulnerable under both the EPBC and NC Acts. The majority of records for the species are from the Brigalow Belt North bioregion.

The Brigalow scaly-foot was once thought to be confined to remnant Brigalow or sparse tussock grass vegetation on grey cracking soils (Shea 1987). More recent studies however, have found the species in additional habitats including broad-leaved hickory (*Acacia falciformis*) woodland, gidgee (*A. cambagei*) woodland, poplar box open woodland, sandstone rises in dry sclerophyll forests, spotted gum (Corymbia citriodora) and narrow-leaved ironbark dominated forest and mixed open woodland with buck spinifex (*Triodia mitchelli*) (Schulz and Eyre 1997; Kutt et al. 2003).

Ecoserve and LAMR (2005) report that Brigalow and Eucalypt communities within the south-eastern area of the adjacent Peak Downs Mine are most likely to provide suitable resources for Brigalow scaly-foot. The 2008 surveys indicate that there is only limited habitat north of Cherwell Creek, all of which is south of the Peak Downs Highway. South of Cherwell Creek is a patch of Brigalow on a variety of substrates and, although some of the patch is infested with buffel grass, it retains areas of leaf litter and coarse woody debris and appears suitable for Brigalow scaly-foot. This area is just outside of the area of proposed disturbance. No Brigalow scaly-foot have been recorded within Caval Ridge Mine.

Allan's lerista (*Erista allanae*)

Allan's lerista is listed as Endangered under both the EPBC and NC Acts. The species is found in the root systems of grass tussocks on black soils.

It is known to occur in open grasslands, scattered gums and occasional bottle trees on black and red soil. Although the species has not been recorded within Caval Ridge Mine, a small amount of suitable habitat occurs within the site for the accommodation villages. As such, there is a possibility that the species may occur. However, this is considered unlikely.

Yakka skink (*Egernia rugosa*)

The yakka skink is listed as Vulnerable under both the EPBC and NC Act. It is endemic to Queensland, occurring from Cape York Peninsula to the St. George area in the Southern Brigalow Belt (Drury 2001; Wilson 2005).

Yakka skinks live in colonies, occupying communal burrows, often under dead timber or deep rock crevices. They are found in a variety of drier forests, woodlands and shrublands (usually on well drained, coarse gritty soils) including poplar box on alluvial soils, low ridges, cypress on sands, belah, mulga and *Eucalyptus intertexta* (Ehmann 1992; Cogger 2000; Drury 2001; Wilson 2005). They can also occur in highly degraded sites and where there are log piles and rabbit warrens.

The species was targeted in earlier surveys south of Cherwell Creek (Ecoserve and LAMR 2005) but was not located nor was it reported as likely to occur. During the winter 2008 habitat assessment small areas of potentially suitable habitat were identified just outside of the area of proposed disturbance. The very small areas of apparently suitable habitat mean that its occurrence is questionable but cannot be discounted.

Cotton Pygmy-Goose (*Nettapus coromandelianus albipennis*)

The Cotton Pygmy-Goose is listed as Rare under the NC Act. The species is almost entirely aquatic and prefers freshwater wetlands with abundant floating and submerged aquatic vegetation. The species is known to nest in the hollows of dead trees next to deep swamps. There are previous survey records for this species from a few locations within the vicinity of Caval Ridge Mine. However, the presence of this species in these areas is subject to the presence of aquatic vegetation which can vary seasonally. The species is sensitive to drainage of wetlands and the invasion of weed species. Although it has not been recorded from within Caval Ridge Mine, if conditions are suitable it may utilise some of the dams within Caval Ridge Mine.

Black-necked Stork (*Ephippiorhynchus asiaticus*)

The Black-necked Stork is listed as Rare under the NC Act. It occurs in terrestrial wetlands, estuaries, littoral habitats and, occasionally, grasslands. The species is widespread throughout northern and eastern Australia and occurs through much of Queensland. The Black-necked Stork has the potential to occur occasionally within areas of Caval Ridge Mine, including the shallow margins of wetlands and may utilise small dams scattered throughout the grazing land north of Cherwell Creek. These waterbodies only provide a very limited habitat resource for the species. The major threats to this species include collision with powerlines, loss of nesting trees and wetland habitat.

Greater Long-eared Bat (South-eastern) (*Nyctophilus timoriensis*)

The greater long-eared bat is listed as Vulnerable under both the EPBC and NC Acts. It occurs across southern Australia, including Tasmania, but avoids coastal regions on the south-eastern mainland (NPWS 2003).

The greater long-eared bat occurs in dry forest and woodland, mallee, Brigalow/Belah and other arid and semi-arid habitats. The species is most common in box/ironbark/cypress pine woodland on sandy soils (Turbill et al. 2008). It roosts in tree hollows or under bark (NPWS 2003).

The genus Nyctophilus is readily identifiable by Anabat call analysis, though there are major difficulties in further resolution to species level. However, there are no Anabat records for any species of Nyctophilus for Caval Ridge Mine. It is therefore unlikely that the greater long-eared bat is present on Caval Ridge Mine. However, sporadic use of the study area by any individuals possibly present in the local area cannot be discounted.

Dunmall's Snake (*Furina dunmalli*)

The Dunmall's Snake is listed as Vulnerable under both the EPBC and NC Acts. The species is known to occur in Brigalow forest and woodland with fallen timber and ground litter present. Although the species has not been recorded within Caval Ridge Mine, a small amount of suitable habitat occurs within the site for the accommodation village. As such, there is a possibility that the species may occur. However, this is considered unlikely given the highly disturbed nature of the site.

As a requirement of Section 332 of the *Nature Conservation (Wildlife Management) Regulation 2006,* a person must not, without a reasonable excuse, tamper with an animal breeding place that is being used by a protected animal. Caval Ridge Mine is not known to contain suitable breeding habitat for any protected animals. As such, it is not likely that a breeding place of a protected species within Caval Ridge Mine will be tampered with. To ensure

that breeding places immediately outside or adjacent to Caval Ridge Mine are not impacted, a range of mitigation measures such as dust suppression, and fencing will be implemented.

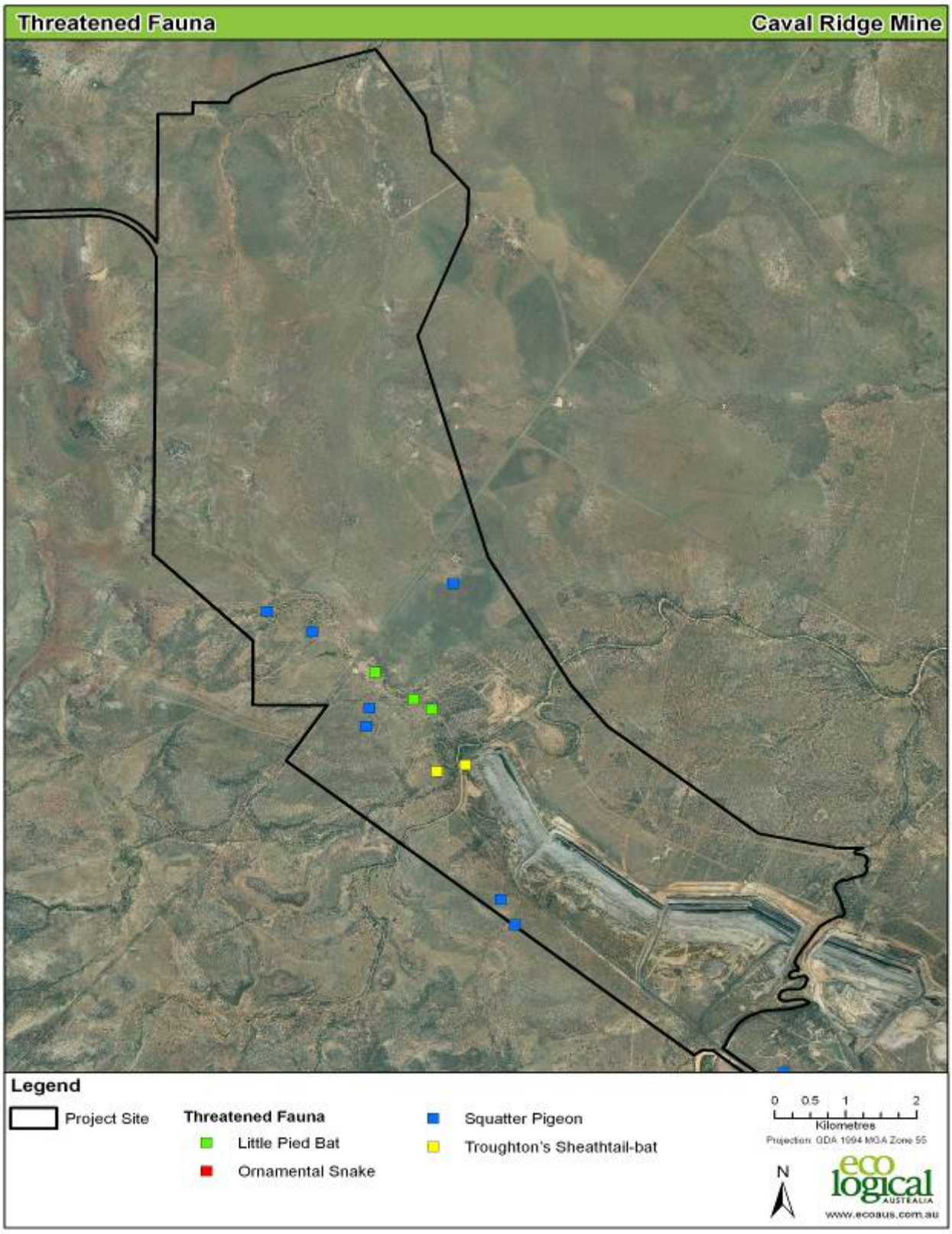


Figure 6: Significant Fauna within the Caval Ridge Mine Site

6.0 Management Actions and Mitigation Measures

The following management actions and mitigation measures have been designed to ensure that potential impacts to native flora, fauna and ecological communities associated with the operation of Caval Ridge Mine are minimised. They aim to contribute to the survival of these species and ecological communities in the wild and provide an overall conservation benefit.

Management actions and mitigation measures have been developed with the DEHP - hierarchy of rehabilitation objectives in mind. This hierarchy, developed specifically for mining projects is listed below in order of decreasing capacity to prevent or minimise environmental harm:

- avoid disturbance that will require rehabilitation;
- reinstate a natural ecosystem as similar as possible to the original ecosystem;
- develop an alternative outcome with a higher economic value than the previous land use;
- reinstate previous land use;
- develop lower value land use;
- leave the site in an unusable condition or with a potential to generate future pollution or adversely affect environmental values; and
- leave the site in an unusable condition or with a potential to generate future pollution or adversely affect environmental values.

As mention above in Section 5, a number of RE's listed under the VM Act and EEC's listed under the EPBC Act have been or will potentially be disturbed as a result of the construction and operation of Caval Ridge Mine. As such, a range of mitigation measures have been developed. These measures will be implemented to ensure that impacts are kept to a minimum and that the Caval Ridge Mine operations do not adversely affect the survival of these communities.

Although a range of mitigation measures and management actions will be implemented as part of operational activities, given the level of unavoidable impacts to some ecological communities, BMA have committed to providing an environmental offset to compensate for the loss of these communities. Detailed information regarding the offset is contained within the Caval Ridge Offset Management Plan. The offset will provide habitat for a number of threatened flora and fauna species and contain a number of RE's and ECC.

In addition to the impacts to ecological communities, a number of threatened flora and fauna species have been recorded within Caval Ridge Mine or as having potential to occur. Although direct impacts to threatened flora or fauna species are not considered likely, given the potential for a number of species to occur within Caval Ridge Mine, a range of mitigation measures and management actions aimed at minimising impacts to threatened species have also been developed.

Mitigation measures will be implemented to ensure that potential impacts are kept to a minimum and that the operational activities do not adversely affect the survival of a threatened species or community. They have also been designed to provide a conservation benefit where possible, through the enhancement of habitat and through the provision of an offset. The offset for Caval Ridge Mine captures areas of vegetation that take into account habitat for significant fauna, flora and ecological communities.

Given the range of management actions and mitigation measures outlined below, it is not expected that the Caval Ridge Mine will have an adverse effect on the ecological value of a threatened species or community.

6.1 Operational Activities

During operational activities at Caval Ridge Mine, BMA will implement the following general mitigation and management measures to reduce impacts on RE's, EEC's and threatened flora and fauna to levels that will not cause permanent harm to significant species or community:

Land and Biodiversity Management Plan (LBMP)

The CVM LBMP has been developed to identify the potential environmental risks from land use and ensure an acceptable level of impact to biodiversity. It covers managing impacts to RE's, EEC's and threatened flora and fauna, including a range of measures aimed at reducing on-going impacts to threatened species and communities that are associated with operational activities.

Vegetation Clearing

Vegetation clearing shall be undertaken in accordance with the CVM Environmental Authority EPML00562013 (EA) and the BMA Permit to Disturb Procedure.

Prior to Clearing Activities

All unnecessary clearing shall be avoided and significant areas of remnant vegetation shall be retained where possible. Prior to the commencement of any disturbance:

- An application for a Permit to Disturb form shall be completed and submitted to the Advisor Environment in accordance with the BMA Permit to Disturb Procedure;
- A Permit to Disturb shall be obtained;
- Location of protected species shall be mapped; and
- Appropriate buffer zones shall be implemented and maintained to conserve and protect riparian vegetation.

Disturbance activities will be limited to reasonable daylight hours and night work will be minimised where practical. This will reduce the potential for impacts to the roosting and breeding patterns of threatened species that may be using the surrounding area.

- The Advisor Environment will field inspect the area and/or use available information, including GIS mapping, to assess the likely impacts to fauna. This assessment will consider the vegetation's RE status, presence of hollow bearing trees or mature trees, and proximity to water.
- No Endangered Regional Ecosystems (ERE) and Of Concern Regional Ecosystems (OCRE) shall be cleared at night time, when practical.

Areas of new disturbance must be captured by quarterly disturbance tracking procedures and reported in the Plan of Operations**.**

During Clearing

- Clearing of vegetation shall not occur outside of the marked boundaries and will be confined to the smallest practicable area required to safely perform the task.
- Clearing shall be planned and carried out in a manner that causes minimum disturbance to natural drainage patterns.
- Vegetation removal will be carried out using appropriate earthmoving equipment.
- Disturbance of the topsoil will be kept to a minimum.
- Debris from vegetation clearing must not be pushed into gullies, watercourses, other drainage lines or waterlogged areas, cleared vegetation should either be stockpiled for burning, rehabilitation or used as sediment control as appropriate.
- Where practical, salvage and stockpile suitable logs and stumps for use as habitat creation in rehabilitation areas as per the CVM Rehabilitation Management Procedure.

For areas of ERE and OCRE, fauna management requirements are listed below.

Fauna

Protection of Fauna when Clearing Habitat

Where possible, clearing of habitat containing populations of fauna of conservation significance should be avoided. When clearing is being conducted, an Environmental Representative will be made available to rescue, relocate or manage impacted fauna detected during disturbance activity.

Hollow Bearing Trees

Should personnel encounter what may be a hollow bearing tree (HBT) during vegetation clearing, they are to report the occurrence to their supervisor and not disturb the tree until it has been assessed by the Advisor Environment who will determine the process required to manage the HBT.

Recording Animal Sightings

All personnel are required to report sightings of all feral and rare or uncommon native animals to the Advisor Environment.

Endangered & Of Concern Regional Ecosystems

Pre-Clearing

Areas mapped as ERE and OCRE approved for vegetation clearing must have an Environmental Representative undertake a pre-clearance fauna survey to identify wildlife that may potentially inhabit the area.

- Identify and flag all HBTs and potential breeding sites within the clearing area and where possible search hollows for resident fauna.
- Involve a search of likely ground habitats such as rocky areas, fallen logs and woody debris, gullies and waterways and banks (including any artificial habitat sites such as discarded mine or farm equipment, water tanks etc).
- If fauna is present and can be relocated, this shall be undertaken by the Environmental Representative.

During Clearing

The Environmental Representative will be present during clearing of ERE and OCRE to manage fauna impacted by clearing. Works should not commence/continue until the Environmental Representative has given notification that no fauna lies directly in the path of clearing machinery.

All HBTs that require removal will be inspected for resident fauna immediately prior to clearing by an Environmental Representative.

- all reasonable attempts will be made to clear these trees as late in the day as possible to avoid disturbing/dislocating nocturnal fauna in the middle parts of the day and thus exposing them to a greater period of daylight without shelter; and
- the method for clearing HBT that are confirmed habitat trees will involve “tapping” the trees and clearing non-habitat vegetation around this tree. HBT will then be gently felled.

All HBT will be inspected immediately after felling to ensure that no fauna are present in the hollows that were missed by the original pre-clearance survey.

Reporting & Recoding

Event Reporting - Fauna Injury or Death

In the event of injury or death of any significant fauna species (refer to Table 5)*Table 5*, incidents will be recorded and reported to DEHP within 24 hours of the incident occurring. The details for reporting incidents to DEHP are as follows:

- the coordinates of where the incident occurred;
- the checking methods will be outlined i.e. confirmation the pre-clearance surveys were undertaken in accordance with the methodology outlined above;
- confirmation that the Environmental Representative was suitably qualified; and
- suggested mitigation measure to ensure that a similar incident does not occur in the future.

All injuries or death of native fauna during clearing works must be reported and recorded by the Environmental Representative. These records will be kept and made available to DEHP upon request.

Dust Suppression

Dust suppression will be mitigated through the implementation of the Caval Ridge Mine Air Emissions Management Plan. Caval Ridge Mine will utilise a range of dust suppression techniques to reduce dust impacts on areas containing significant ecological communities and/or threatened species habitat.

Dust suppression measures implemented during operational activities will include:

- availability of water trucks to provide dust suppression on haul and light vehicle roads;
- water sprays on stacker/reclaimer units;
- maintaining high moisture content of product coal and reject material as they leave the CHPP; and
- train loadout to incorporate veneering.

Erosion and Sediment Controls

Erosion and sediment control measures will be implemented during operational activities. They will be designed to ensure that impacts associated with erosion and sedimentation to the remaining RE's, EEC's and threatened species are minimised. Detailed erosion and sediment controls will be outlined in the CVM Erosion and Sediment Control Procedure.

Weed Management

Weed management will be on-going and is detailed in the CVM Weed Management Procedure (WMP). Ongoing monitoring and weed surveys will determine if weed species are spreading into riparian buffer areas and rehabilitated areas, and effective response to weed infestation will be implemented as required.

Weed management will include:

- installation of a vehicle wash bay to ensure the removal of all potentially contaminated soil containing seeds;
- avoiding dispersal of weed species from both internal and external sources by implementing control measures, such as ensuring potentially contaminated vehicles are cleaned (i.e. free of contaminants) prior to entering the site;
- ensure all removed weeds; weed-affected materials and rubbish are appropriately disposed of off-site; and
- undertake monitoring of weed growth in disturbed areas on a quarterly basis.

BMA will ensure that environmental weed species will not be used in landscaping.

The WMP provides strategies for the treatment and control of the more problematic weed species. Five flora species listed as declared pests under the provisions of the *Land Protection (Pest and Stock Route Management) Act 2002 (Qld)* (LP Act) were recorded on Caval Ridge Mine during baseline assessments:

- Mother-of-Millions (*Bryophyllum delagoense*) – Class 2;
- Harrisia Cactus (*Eriocereus martini*) – Class 2;
- Lantana (*Lantana camara*) – Class 3;
- Velvet Tree-pear (*Opuntia tomentosa*) – Class 2; and
- Parthenium Weed (*Parthenium hysterophorus*) – Class 2.

Other declared weed species likely to be found in areas of close proximity to Caval Ridge Mine include:

- Rubbervine (*Cryptostegia grandiflora*);
- Giant Rats Tail Grass (*Sporobolus pyramidalis* and *Sporobolus natalensis*); and
- Bellyache Bush (*Jatropha gossypifolia*).

The following management strategies will be implemented:

- management methods for declared weeds within Caval Ridge Mine in accordance with local management practices;

- identification of priority species, target areas and timing of control strategies;
- monitoring of treated areas to assess the success of the eradication of declared pest plants;
- monitoring Caval Ridge Mine to identify any new infestations, including any new occurrences of declared weeds;
- site-wide communication of information on identifying declared pest plants and environmental pest plant issues; and
- details around vehicle access to and movement within areas of remnant vegetation, including vehicle hygiene protocols such as the use of vehicle wash-down facilities for vehicles entering and leaving declared pest plant zones.

The WMP will be reviewed annually. Treatment areas and infestations will be tracked using Geographic Information System (GIS) to ensure effective management is being achieved.

Habitat Rehabilitation and Enhancement

There are a number of opportunities to improve habitat connectivity and quality on Caval Ridge Mine. Available disturbed areas will be strategically rehabilitated to minimise the net loss of vegetative cover, such that:

- areas of vegetation that are considered significant (i.e. habitat for threatened flora, flora and areas of endangered EEC's) that are retained on Caval Ridge Mine are identified in GIS. Disturbance to these habitat areas is managed by the BMA Permit to Disturb Procedure, which involves using GIS to identify and map the habitat areas, and where practical restricting disturbance. . These areas are inspected for weed infestations and as per the WMP are subject to weed controls, such as spraying and weed removal programs.; and
- freshwater sediment basins using during construction will remain on site to provide aquatic habitat for frogs and migratory waterbirds.

Rehabilitation of available threatened species habitat and ecological communities will be undertaken using native species to minimise the net loss of habitat. The CVM Rehabilitation Management Procedure has been developed to guide rehabilitation activities. In particular, the procedure includes:

- rehabilitation planning deliverables and time periods;
- rehabilitation concept designs, including desired fauna habitat and food species;
- rehabilitation and final landform strategies and methods;
- habitat enhancement, such as the introduction of coarse woody debris.
- native tree and shrub species list;

Rehabilitation or restoration/enhancement of comparable habitat in the local area, including the exclusion of livestock, will be employed as measures to mitigate impacts from disturbance resulting from operational activities.

Fire Management

A CVM Fire Management Plan and Bush Management Plan – Buffel Park Accommodation Villages has been developed for Caval Ridge Mine and Buffel Park, respectively. The Bush Management Plan includes the following:

- assessment of vegetation communities, including DEHP RE mapping and State Planning Policy 1/103 Guideline;
- assessment of accommodation village site slope, aspect and surrounding land use;
- bushfire hazard assessment; and
- fire management actions, including maintaining fire breaks, maintaining low fuel loads, ensuring access to water supply and development of emergency evacuation plan.

Fauna Mortality on Roads

On-going measures to avoid fauna mortality on internal roads will be implemented. These will include the provision of fauna crossing signs to warn drivers and speed reduction measures, where practical. Focus will be on roads that traverse areas of significant fauna habitat, including creeks and any areas associated with Brigalow Ecological Communities.

Feral Animal Control

The procedure for federal animal management is detailed in the CVM Feral Animal Control Procedure. Control measures include on-going eradication program for foxes, feral pigs, cats, dogs and rabbits as per the requirements of the *Land Protection (Pest and Stock Route Management) Regulation 2002*.

To reduce the pressure on native fauna, especially rare and threatened fauna species such as the Ornamental Snake and Squatter Pigeon, the following strategies will be implemented for the management / control of pest animals:

- conduct an initial survey to identify the pest animals in Caval Ridge Mine. The survey may include analysis of previous survey results and records; and
- feral animal controls procedures include:
  - types of pest animals to be targeted;
  - methods for the eradication and/or control of declared pest animals (i.e. trapping or baiting) in accordance with local management practices and / or DNRW Pest Fact Sheets;
  - timing of control strategies (i.e. implementation and completion); and
  - monitoring and field auditing of pest animal occurrence, particularly declared pest animals, to assess the progress and success of the control measures.

BMA are committed to providing the relevant information on flora and fauna management actions for significant species for inclusion in the DEHP 'Recovery Action Database' when that framework is finalised and becomes operational. This data will be provided in a suitable format agreed by DEHP.

7.0 References

Caval Ridge Mine Project Environmental Impact Statement, 2009.

Caval Ridge Mine Supplementary Environmental Impact Statement, 2009.

Cogger, HG (2000). Reptiles and Amphibians of Australia. Reed New Holland, Sydney.

DERM (2011). 'Back on Track species prioritisation framework'. Queensland Department of Environment and Water Resources.

DERM (2011). 'WildNet database.' Queensland Department of Environment and Water Resources, Southern Region, Brisbane.

Drury, W (2001). 'Reptiles under threat in Queensland's Southern Brigalow Belt.' World Wide Fund for Nature, Brisbane.

Ecological Assessment, Buffel Park Accommodation Villages, Final Report, RPS September 2010.
Ecoserve and LAMR (2005). '2005 summer season flora and fauna surveys for Peak Downs Mine.' Unpublished report for BMA Peak Downs Mine.

Ehmann, H (1992). Encyclopedia of Australian Animals: Reptiles. Angus and Robertson, Sydney.

Kutt, AS, Hannah, DS and Thurgate, NY (2003). 'Distribution, habitat and conservation status of Paradelma orientalis Gunther 1876 (Lacertilia: Pygopodidae).' Australian Zoologist, 32: 61-264.

NPWS (2003). Threatened Species of the New England Tablelands and north west slopes of New South Wales. NSW Parks and Wildlife Service, Coffs Harbour.

Schulz, M and Eyre, TJ (1997). 'New distribution and habitat data for the Pygopodid, Paradelma orientalis (Gunther 1876).' Memoirs of the Queensland Museum, 42: 12.

Wilson, S (2005). A Field Guide to Reptiles of Queensland. Reed New Holland, Sydney.

Woinarski, JCZ and Catterall, CP (2004). 'Historical changes in the bird fauna at Coomooboolaroo, northeastern Australia, from the early years of pastoral settlement (1873) to 1999.' Biological Conservation, 116: 379-401.

8.0 Version Management

Version	Details
1.0	Plan submitted to Environmental Assessment Brach of the department in May 2011. Plan approved on 3 June 2014
1.0 Addendum	Plan addendum for the operational phase of the project submitted to the department in September 2014.
1.B Addendum	Plan addendum addressing the department's requirements submitted in November 2014.
2.0	Plan version 2.0 for the operational phase of the project submitted to the department in December 2015.
2A	Track changes removed

BHP

Coal HSE
CVM Water Management Plan

30 September 2019

Contents

Introduction

Purpose

The primary purpose of this Water Management Plan (WMP) is to identify the potential risks to the environment from operations at Caval Ridge Mine (CVM) and the controls necessary to mitigate any impacts. The WMP aims to minimise the release of contaminants to the receiving environment and ensure water resource use does not adversely impact the local and regional environment.

This plan meets obligations of the ***CVM EPML00562013 Environmental Authority*** and ***BHP Our Requirements: Environment and Climate Change***.

Scope

This WMP describes CVM's planning, operational and reporting requirements for minimising impacts within the defined area of influence for water resources.

This WMP covers anyone involved in planning or executing exploration, operational or closure activities at CVM.

The plan forms part of the CVM Environmental Management System (EMS).

This WMP shall be implemented in conjunction with the ***CVM Mine Affected Water Release Procedure.***

Risk Management

Risks associated with CVM have been assessed in accordance with the ***BLD.007 Coal Risk Management Process***. Any activities identified that trigger Material Risk thresholds must be managed in accordance with ***Our Requirements: Risk Management***.

Overview of Operations

CVM is a multi-seam open cut coal mine with coal handling and processing infrastructure to process up to 11 million run of mine (ROM) tonnes per annum (Mtpa) of hard coking coal for the export market over a life of approximately 30 years.

It is located southwest of Moranbah and approximately 160 km southwest of Mackay, Queensland. The northernmost boundary of the mine is approximately 6 km from Moranbah, while the mine industrial area (MIA) and coal handling and preparation plant (CHPP) is around 16 km from Moranbah.

The Operation uses a combination of draglines and a truck-shovel fleet. Activities include clearing vegetation, topsoil stripping, removing overburden to in-pit and out-of-pit spoil dumps, coal mining and progressive rehabilitation.

Figure 1 shows the site layout of CVM pits and infrastructure.

Figure 1: Caval Ridge Mine – Site Layout

Legal & Other Requirements

Details of CVM's legal obligations in regards to water management are specified in ***Environment Essentials***.

Relevant legislation includes:

- *Environmental Protection Act 1994 and Regulation 2008 (Qld);*
- *Water Act 2000 (Qld);*
- *Environmental Protection (Water) Policy 2009;*
- *Planning Act 2016 (Qld);* and
- *Environmental Protection and Biodiversity Conservation Act 1999 (Commonwealth).*

Legal and other requirements include:

- Environmental Authority (Mining Activities) – Permit Number EPML00562013;
- CVM Environmental Impact Statement;
- Water license 608364, 606715, 104779 and 49428L
- ***BHP Our Requirements: Environment and Climate Change;*** and
- ***BHP Our Requirements: Health, Safety, Environment and Community Reporting***.

Environmental Authority

The main regulatory tool at CVM used by the Regulator to implement the *Environmental Protection Act 1994* (EP Act) is the Environmental Authority (EA). The EA sets the acceptable level of impact to water resources and may change over time in consultation with the regulator and other stakeholders.

This WMP has been prepared to comply with Caval Ridge's ***Environmental Authority EPML00562013*** (EA) condition C27 which stipulates that a Water Management Plan must:

- Be developed by a suitably qualified person and implemented.

Associated Water

Under section 334ZP of the *Mineral Resources Act 1989*, the holder of a mineral lease (ML) or mineral development licence (MDL) is required to measure or (if the take is the result of evaporation) to estimate the volume of associated water taken, and to report the volume of associated water taken to the chief executive. The requirements for measuring and reporting the volume of associated water taken are set out in the *Mineral Resources Regulation 2013* (the Regulation).

For MLs or MDLs that did not have an Environmental Authority prior to 6th December 2016, an Associated Water License may be required.

Baseline Environment

Pre-Mining Land Use

The 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 site are predominantly large rural holdings used for grazing cattle on freehold and leasehold land. Land uses within the 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), Moranbah Airport and a small quarry. The town of Moranbah is located 6.2 km north of the most northern point of the site. Moranbah is a purpose-built mining town in the northern part of the Isaac Regional Council Area.

Climate

CVM is located in the warm subtropics. The area exhibits moderate rainfall and high evaporation rates. Rainfall is highly variable between and within the seasons; and droughts are common. Most rainfall (approximately 70%) occurs as intense storms and cyclonic depression rain in summer (December to March). High intensity rainfall events are common hence surface runoff can be substantial.

Temporary water surpluses can occur although evaporation rates are much higher than rainfall. The highest evaporation rates occur from October to February with monthly evaporation averaging above 6.3 mm/day during these months. The general trend in Moranbah is for evaporation rates to exceed rainfall rates throughout the year except for the months of January and February, where rainfall exceeds evaporation (Australia Government Bureau of Meteorology, 2013).

As the majority of precipitation occurs between November and February, it is expected that water stocks will be at, or near capacity during March and reach their lowest levels during September/October.

As the receiving watercourse is an ephemeral tributary of the Isaac River, it is anticipated that when a controlled release does occur from 12N (12 North), it will be during the wet season. Dry season releases may occur in events of higher than average winter rains, or climatic variability.

Month	Temperature (°C)		Relative Humidity (%)		Evaporation (mm)	Wind Speed (km/hr)		Rainfall (mm)		
	Min	Max	9am	3pm	Daily	9am	3pm	Median	Highest Daily	Highest Monthly
January	21.9	33.8	69	43	8	7.5	8.8	89.2	120.4	315
February	21.8	33.1	74	48	7.4	7.7	9.6	91.6	150.8	347.4
March	20.0	32.1	70	41	6.8	8.1	9.4	37.2	164.8	268
April	17.6	29.5	72	43	5.7	7.6	8.7	24.9	143.8	271
May	14.2	26.5	73	43	4.3	6.2	6.9	22.7	58	196.6
June	11.2	23.7	73	44	3.5	5.5	6.6	10.4	43.4	170.3
July	9.9	23.7	69	39	3.7	5.3	7	6	60	103.6
August	11.1	25.5	66	35	4.9	6.6	7.7	11.3	150.8	247.3
September	14.1	29.2	60	30	6.6	7.7	8.3	4.2	27.6	60.7
October	17.6	32.3	58	31	8	8.4	8.4	15.8	73.8	146.6
November	19.4	33.1	60	34	8.5	8.4	8.9	55	86	220.3
December	21.1	34	64	38	8.5	8.4	8.8	82.6	116	350

Table 1: Moranbah Climate Statistics

Geology

The Moranbah area is located within the Bowen Basin of Central Queensland. The Bowen Basin is approximately 600 km long, up to 250 km wide and contains significant resources of Permian black coals. Of these black coals, the later Permian coals of the Moranbah Coal Measures are favoured, as they provide uniformly high grade coking coals.

The mine site is situated over a section of the Moranbah Coal Measures, which range in thickness from 250 m to 300 m, and variably consist of sandstone, shale, mudstone and coal. The aggregate thickness of coal in the Moranbah Coal Measures ranges from 12 m to 24 m, and may consist of up to eight seams.

The topography of the mine site is generally flat to undulating. Elevation across the mine site ranges from 220 mAHD to 274 mAHD, and surface slopes are typically <1% grading to east northeast towards the Isaac River which is the most prominent regional drainage feature.

The mine site consists of the following geomorphological land zones of Cainozoic age:

- Alluvial plains and piedmont fans adjoining the Cherwell and Heyford Pits;
- Clay deposits under gently undulating plains within the Cherwell Pit area;
- Sand deposits on extensive flat or gently undulating plains adjoining the Heyford Pit;
- Igneous rocks, flood basalts forming extensive plains and occasional low scarps to the north of the Cherwell Pit; and
- Duricrusts formed on a variety of rock types.

Surface Water and Infrastructure

Hydrological studies of the environment surrounding CVM have been undertaken and include:

- Receiving Environment Monitoring Program (REMP) (EA Requirement);
- Aquatic Ecosystem Health Project (AEHP); and
- Isaac River Cumulative Study.

Significant Watercourses

CVM is located within the Isaac River catchment, a major drainage area of the Fitzroy Catchment (within the Bowen Basin). The ephemeral Isaac River flows south for approximately 230 km to join the McKenzie River, which flows onwards for approximately 150 km to the Fitzroy, a major river which enters the sea east of Rockhampton.

All surface water sources in and around the CVM are tributaries of the Isaac River. The significant watercourses are:

a) Cherwell Creek;
b) Horse Creek;
c) Nine Mile Creek;
d) Harrow Creek; and
e) Caval Creek.

Cherwell Creek is the principal receiving watercourse for the CVM operational water release.

The Operation covers approximately 103 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.

Flood modelling has indicated that all significant watercourses passing through CVM are able to contain a Q100 precipitation event, with the exception of the tributary junctions into Cherwell Creek whereby excess flows will enter associated floodplains.

The characteristics of each significant watercourse are described in detail in the receiving environment monitoring program (REMP). The various catchment drainage at CVM is shown in **Figure 2**.

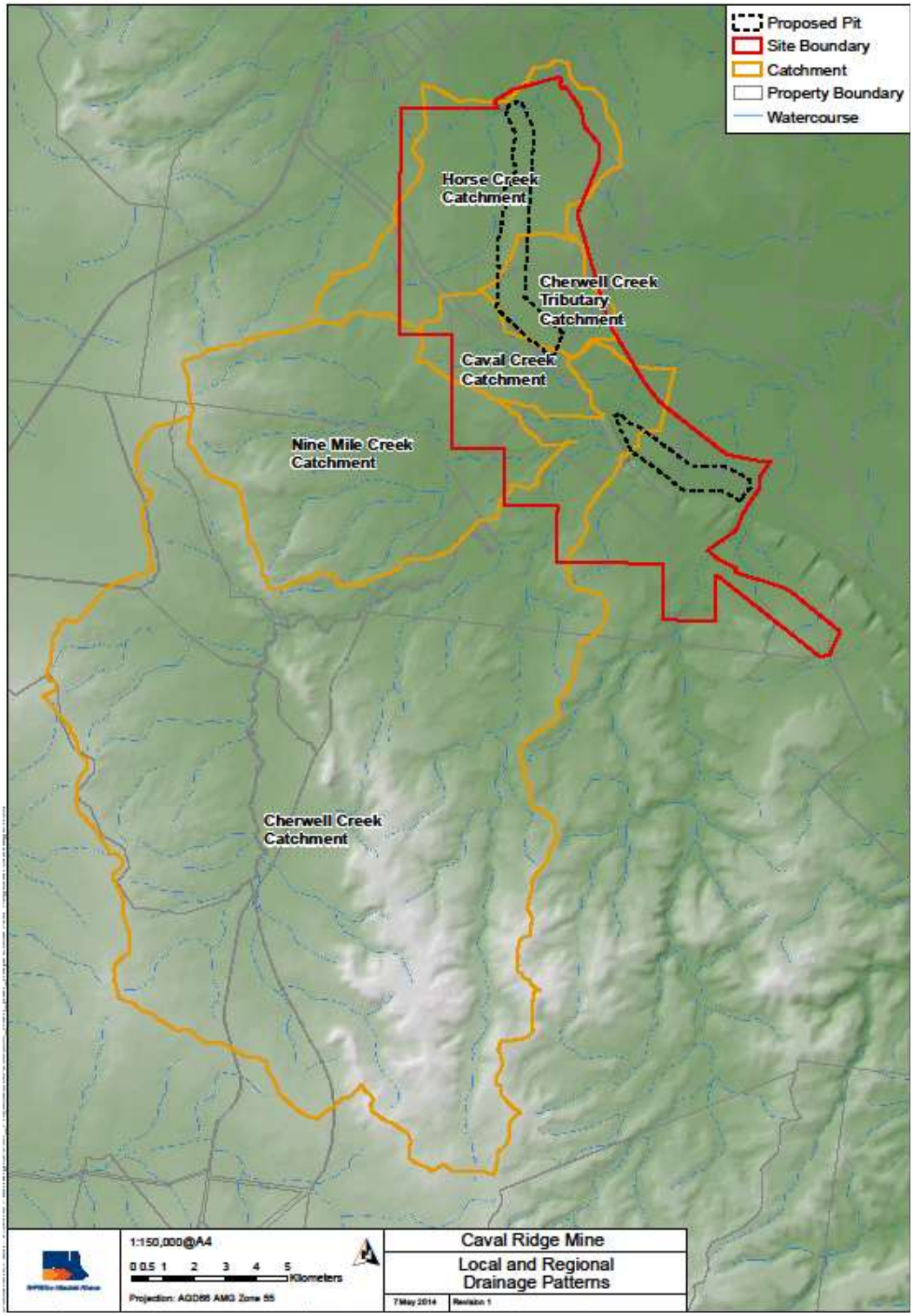


Figure 2: Local and Regional Drainage Catchments

Surface Water Quality

Relevant water quality objectives for the operation were identified from the Queensland Water Quality Guideline 2009 (QWQG) and Isaac River Sub-basin guidelines to support and protect different environmental values for waters in the upper Fitzroy River Catchment. The physicochemical indicators were obtained from the Central Coast Region upland stream values. Salinity guidelines were obtained from Appendix G of the QWQG.

The existing water quality of the watercourses and downstream receiving environment of the CVM was assessed to characterise the baseline water quality conditions, as part of the CVM Environmental Impact Statement (EIS). Details of the assessment of water quality are provided in the REMP.

The WQOs for local receiving waters will be further defined as part of the REMP and in the interim; the Isaac River, QWQG and ANZECC Water Quality guidelines are used as reference values.

Environmental Values – Aquatic Ecosystems

Within CVM there are five watercourses and various minor tributaries that are subject to protection under the EPP Water. Specific Environmental Values (EVs) for Cherwell Creek, Nine Mile Creek, Harrow Creek, Caval Creek and Horse Creek are not defined within the EPP Water and EPP Water Amendment and there are no detailed local plans relating to EVs for the catchment.

The watercourses within the CVM are ephemeral in nature and this provides seasonal habitat for aquatic fauna and flora. The five watercourses are assessed as 'slightly to moderately disturbed aquatic habitat' and their ratings can be seen in **Table 2**

Environmental Value		Near Field (Cherwell, Nine-Mile, Caval and Horse Creeks within 15km of lease)	Far Field (Isaac and Mackenzie Rivers)
Aquatic Ecosystems	**HVE (High Environmental Value)**		
	SMD (Slightly-to-Moderately Disturbed)	✓	✓
	HD (Highly Disturbed)		
Primary Industries	Irrigation		✓ (Fodder, etc.)
	Farm Use		✓
	Stock Watering	✓ (beef cattle, limited to post rainfall)	✓
	Aquaculture		
Recreation and Aesthetics	Primary Recreation		✓ (Swimming/fishing)

	Secondary Recreation		✓
	Visual Appreciation		
Human Consumption	Consuming Wild Stocked Fish		✓ (Recreational)
Drinking Water	Suitable raw water		
Industrial Use	Mining		
Cultural and Spiritual Values	Indigenous		
	Symbolic		
	Lifestyle		

Table 2: Environmental Values

Environmental Values – Human Use

The surrounding land is currently dominated by agricultural grazing and other mining operations. The primary industry values for Cherwell, Harrow, Caval, Nine Mile and Horse Creeks are for stock watering, farm use and industrial use. Potential other environmental values such as recreational use and industrial water supply are considered unlikely to be of significance due to unreliable and infrequent flows in the ephemeral streams.

Groundwater

Groundwater occurs in the unconsolidated and consolidated rock in the vicinity of CVM. The physico-chemical results from groundwater sampling at CVM 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.

The existing concentrations of some dissolved metals in the groundwater are above the water quality guidelines for freshwater ecosystems (ANZECC 2000; QWQG 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). Local groundwater use is primarily for livestock watering purposes owing to the variable salinity levels and generally low yields.

The main factors influencing natural groundwater levels are groundwater recharge, evapo-transpiration 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. However, land-use and land-cover changes may have significantly altered the natural water-balance and groundwater levels.

Groundwater ingress into the open pit mines will cause groundwater drawdown around the pits, which in turn may cause regional groundwater levels to lower. The radius of influence of the drawdown of groundwater level is expected to be approximately 1,800 m (EIS, 2009).

No groundwater users have been identified within 2 km from the site, thus it is anticipated that the mine activities will not have an impact on the local groundwater users.

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 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 exists 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 (PDM) to the south of Cherwell Creek. The depth and confined nature of the Permian aquifers would likely result in a subdued response to recharge.

Bores currently used for monitoring are listed in **Table 3.** Groundwater monitoring is undertaken as described in 'monitoring and control verification.' **Figure 3** shows a map of the groundwater monitoring sites.

Sample Points	Geology
PZ01	Coal seam
PZ04	Coal Seam
PZ07D	Coal Measures
PZ07S	Alluvium
PZ08D	Coal seam
PZ08S	Alluvium
PZ09	Coal seam
PZ11D	Alluvium
PZ11S	Alluvium
PZ12S	Sandstone
PZ12D	Siltstone

Table 3: CVM Groundwater Monitoring Bores

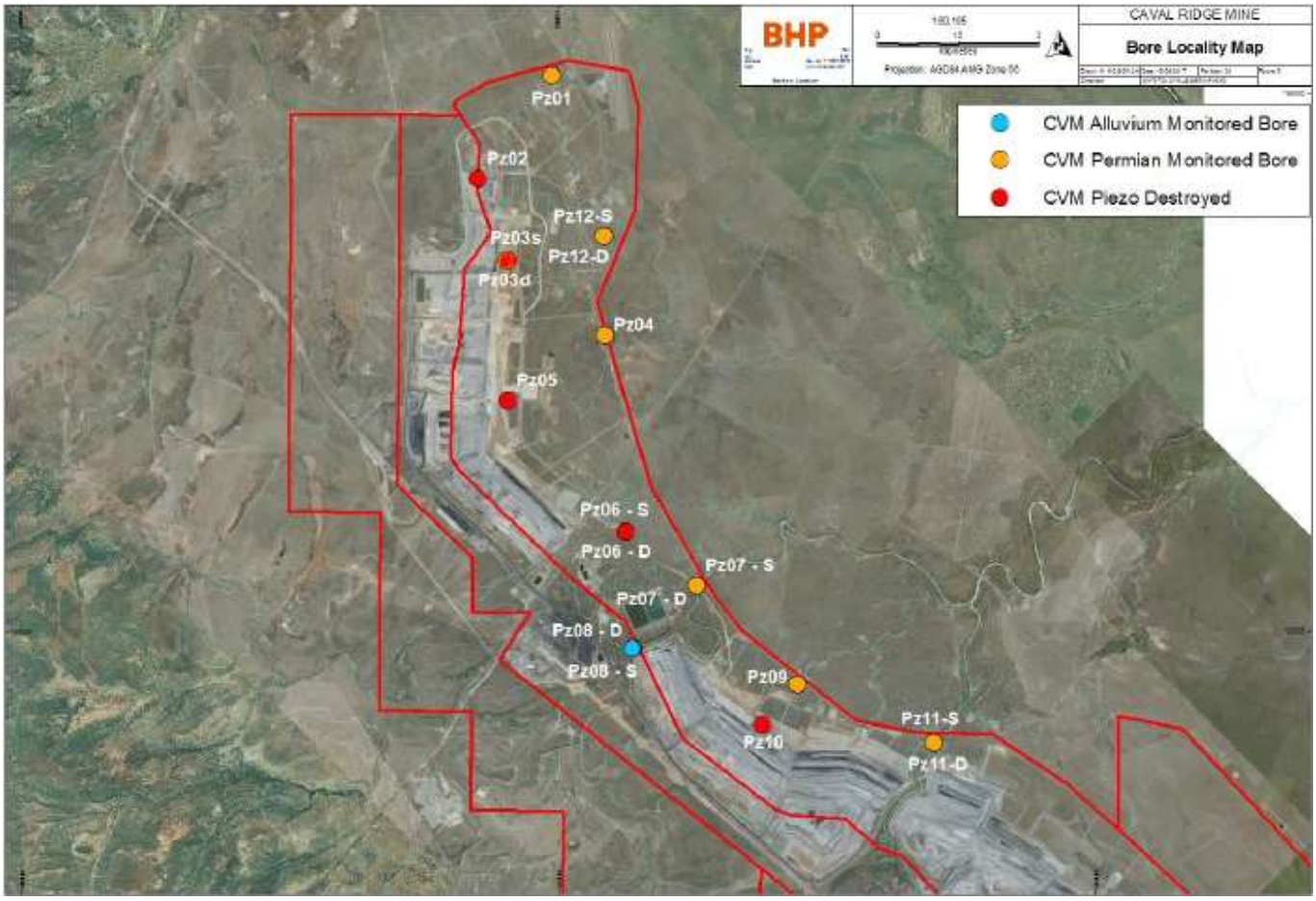


Figure 3: Groundwater Monitoring Bore Locations

Area of Influence

CVM's area of influence was determined in accordance with the ***BHP Our Requirements: Environment and Climate Change*** and is based on CVM's potential direct, indirect, and cumulative impacts on the environment.

Key Features and the area of influence for BMA and BMC's operations are mapped in the ***Mine2Map QLD Area of Influence Viewer***. The process for defining and mapping the area of influence is detailed in ***the Coal HSE Environment and Climate Change Plan***.

Risks & Environmental Impacts

A water risk assessment has been completed and documented in the ***CVM Risk Register*** in accordance with the ***Standard Coal Risk Management / CVM Risk Management Standard.***

The potential risks of water quality impacts; from site operations include, but are not limited to:

- Impacts resulting from the accumulation of salts and metals in waterways and their sediments including as the discharged water evaporates;

- Impacts through drawdown and contamination on local and regional aquifers and the associated environments;
- Impacts associated with cumulative effects of other industries discharging into the same waterways.

Sources of Contamination

Operating open cut and underground coal mines have a range of well recognised contaminant sources which have significant potential to adversely impact downstream water quality. These mine sites require management either at source of contamination or at drainage collection points to prevent impact downstream. The major potential source of contamination is related to land disturbance in which deeper sediments are exposed to surface runoff. Such land disturbance and sources of contamination at CVM site are associated with the characteristics of the coal deposit discussed in **Table 4.**

In 2013, an assessment was undertaken of the geochemical characteristics of the overburden, interburden, roof and floor of the coal seam for CVM (Baker, 2013). 83 samples were analysed, which were sourced from 7 geotechnical cores drilled in 2012. This investigation revealed the following:

- Acid mine drainage is a very low risk to the site overall,
- Most of the samples taken were moderately to highly sodic, and
- The majority of samples tested were alkaline.

Potential Contamination Sources

A summary of the potential sources of contamination, the type of contamination and mechanism of contamination is presented in **Table 4.**

Contaminant Source	Potential Contaminants	Mechanisms of Contamination
Runoff from disturbed land	Suspended Solids (Turbidity), Dissolved Solids (sodium, chloride, sulphate), +/- pH, metals	Erosion, overland flow, capillary rise of salts, sodic spoils (elevating pH), acid generating rejects (lowering pH)
Runoff from rehabilitated land (contaminant loading expected to be significantly lower than disturbed areas)	Suspended Solids (Turbidity), Dissolved Solids, +/- pH, Dissolved Solids (sodium, chloride, sulphate), +/- pH, metals	Erosion, overland flow, capillary rise of salts, sodic spoils (elevating pH),
Release of recycled waters from tailings dams, sewage treatment plants, industrial areas, etc.	Suspended Solids (Turbidity), Dissolved Solids (sodium, chloride, sulphate), +/- pH, hydrocarbons, pathogenic micro-organisms, metals	Releases from dams (seepage, catastrophic failure, by wash), pipes, drains, spills, acid generating rejects (lowering pH) ineffective sewage treatment, release from sewage ponds
Release of waters from pits and storages	Suspended Solids (Turbidity), Dissolved Solids (sodium, chloride, sulphate), +/- pH, metals	Releases from dams (seepage, catastrophic failure, by wash), pipes, drains, etc
Release of waters from sediment dams	Suspended Solids (Turbidity), Dissolved Solids (sodium, chloride, sulphate), +/- pH, metals	By wash, capacity reduced due to sedimentation
Spilt or leaking flammable and combustible liquids and chemicals	Hazardous or toxic products, +/- pH, metals.	Contamination of land and surface runoff causing impact to regional water systems.

Table 4: Summary of Potential Sources of Contamination

Water Quality Impacts

The quality of mine water storages and receiving waters are monitored regularly as required by the mine's EA EPML00562013. Further details of the monitoring requirements are detailed in the 'monitoring and control verification' section and in ***CVM PRO Water Monitoring Procedure*.**

Target Environmental Outcomes

The Coal Target Environment Outcomes (TEOs) are based on assessed environmental risks and impacts, and legislative requirements.

The Coal TEOs were approved by the Coal Asset Presidents in 2017, refer ***to Coal Authorisations - Target Environmental Outcomes – Approved***. The Water TEOs are supported by specific and measurable criteria and reporting metrics which are annually reviewed.

The Coal TEOs for water are listed in **Table 5.**

Aspect	Target Environmental Outcome (TEO)
Water Resources	No unacceptable environmental impact to surface water and groundwater.
	No unacceptable change to the function of key water-dependent ecosystems.

Table 5: Target Environmental Outcome for Water

Continuous Improvement

The HSE Department shall ensure that the WMP is subjected to annual review. The findings from these reviews shall be used to continually improve the management of impacts to water quality.

Water Management System & Controls

Mine affected water as per EPML00562013 means the following types of water:

I. pit water, tailings dam water, processing plant water;

II. water contaminated by a mining activity which would have been an environmentally relevant activity under Schedule 2 of the Environmental Protection Regulation 2008 if it had not formed part of the mining activity;

III. rainfall runoff which has been in contact with any areas disturbed by mining activities which have not yet been rehabilitated, excluding rainfall runoff discharging through release points associated with erosion and sediment control structures that have been installed in accordance with the standards and requirements of an Erosion and Sediment Control Plan to manage such runoff, provided that this water has not mixed with pit water, tailings dam water, processing plant water or workshop water;

IV. groundwater which has been in contact with any areas disturbed by mining activities which have not yet been rehabilitated;

V. groundwater from the mine's dewatering activities;

VI. a mix of mine affected water (under any of paragraphs i to v) and other water.

does not include surface water runoff which, to the extent that it has been in contact with areas disturbed by mining areas that have not been completely rehabilitated, has only been in contact with:

I. land that has been rehabilitated to a stable landform and either capped or revegetated in accordance with the acceptance criteria set out in the environmental authority but only still awaiting maintenance and monitoring of the rehabilitation over a specified period of time to demonstrate rehabilitation success; or

II. land that has partially been rehabilitated and monitoring demonstrates the relevant part of the landform with which the water has been in contact does not cause environmental harm to waters or groundwater, for example:

1. areas that are been capped and have monitoring data demonstrating hazardous material adequately contained with the site
2. evidence provided through monitoring that the relevant surface water would have met the water quality parameters for mine affected water release limits in this environmental authority if those parameters had been applicable to the surface water runoff, or

III. both.

The objectives of the Mine Water Management System (MWMS) include:

- To divert water away from areas affected by mining activities;
- Contain water from areas disturbed by mining activities;
- Prevent the release of water that is of non-compliant quality;
- Sustainably divert and discharge water suitable for release; and
- Reuse all captured water where possible for dust suppression and process requirements.

Water Balance Model

The water balance model is managed by Water Planning (P&T Resource Engineering) at the asset level and by the Mine Planning Department at the site level.

CVM has developed a water balance model to assist with management of its stored water inventories, releases and investigations into improved water management. The ***GoldSim*** model has been specifically designed for water management investigations covering the entire mine site including breakdown of all catchments.

GoldSim is a dynamic model which simulates the operation of the site's water management system and is based on a daily time step process in which a complete account of water stored and transferred can be achieved. The model accounts for the following:

- Climatic variability;
- Catchment runoff and collection;
- Pit dewatering;
- Water reuse in support of mine operations and the CHPP;
- Pumped and gravity transfers;
- Haul Road and hard stand watering for dust suppression;
- Evaporative losses, ground water seepage; and
- Spills – controlled and passive from mine storages to creeks at Caval Ridge.

The ***GoldSim*** model has been formulated to enable CVM to test the capability of its water management system and identify improvement initiatives. The model is confined by a series of operational guidelines which can be altered to test the capability of the system under a range of scenarios.

Operational Water Requirements

The major water demand for the site arises from coal processing and dust suppression. The mine water system has been configured to maximise the re-use of water on site with the aim to reduce the amount of raw water consumed by the operation.

A summary of operational water requirements is presented in **Table 6.**

Water Use	Volume Required	Water Quality Requirements	Source
CHPP	7.0 ML/d	MAW	12 North – MWC Raw Water Dam
Dust Suppression	10.3 ML/d	MAW	12 North – MWC Raw Water Dam

Table 6: Summary of Operational Water Requirements

Water Storages

CVM's water storages are summarised in **Table 7** and shown in **Figures 4** and **5**.

Storage Name	Size (ML)	Function	Regulated structure (Y/N)	Overflow Destination
Clean Water System				
Sediment Dam N1	140	- Captures runoff from Horse Pit spoil stockpiles and haul road. - Pumps to 12N Dam CWC.	N	**Caval Creek**
Sediment Dam N2	225	- Captures runoff from Horse Pit spoil stockpiles and haul roads. - Pumps to Sediment Dam N1.	N	**Horse Creek**
Sediment dam N3A	24	- Captures runoff from Horse Pit spoil stockpiles and haul road - Pumps to CWC	N	**Horse Creek**
Sediment dam N3B	14	- Captures runoff from Horse Pit spoil stockpiles and haul road - Pumps to N3A	N	**Horse creek**
Sediment Dam N3C	18	- Captures runoff from Horse Pit spoil stockpiles and haul road - Pumps to N3B	N	**Horse Creek**
Sediment Dam S1	75	- Captures runoff from Heyford Pit spoil stockpiles and haul Road. - Pumps to 12N Dam CWC.	N	**Cherwell Creek**
Sediment Dam S2	111	- Captures runoff from Heyford Pit spoil stockpiles and haul road. - Pumps to Sediment Dam S1.	N	**Harrow Creek**
Sediment Dam S3	86			
MIA Sediment Dam 1	40	- Captures runoff from the administration and workshop hardstand (industrial) areas. Dam 2 pumps to Dam 1 and Dam 1 pumps to Dam 12N CWC.	N	**9 Nile Creek**
MIA Sediment Dam 2	17			
Raw Water Dam	30	- Accepts pipeline water from Eungella-Bingegang (SunWater) Pipeline	N	**Caval Creek**
Mine Water Dam 12N - CWC	1,000	- Accepts water from all sediment dams. - Pumps water to Process Water Tank - Supplies CHPP and haul road dust suppression demands. - **No pit water.**	Y	**Controlled releases & Emergency overflow to Cherwell Creek**
Total Clean Water System	**1,780**			

Mine Water Dam 12N - MWC	1,100	- Accepts excess pit water from Horse Pit via Mine Water Dams N1 and N2. - Accepts excess water from Heyford Pit - Receives ROM, CHPP, Reject & Coal Stockpile areas & haul road run-off via Mine Water Dams MIA Dam 1, MIA Dam 2, MIA Dam 4 and MIA Dam 5. - Pumps water to Process Water Tank - Supplies CHPP and haul road dust suppression demands.	Y	**Controlled releases to Cherwell Creek**
Mine Water Dam N1	20	- No external runoff. - Accepts water from Horse Pit (south). - Pumps to 12N Dam MWC.	N	**Cherwell Creek**
Mine Water Dam N2	20	- No external runoff. - Accepts water from Horse Pit (north). - Pumps to 12N Dam MWC.	N	**Cherwell Creek**
Mine Water Dam MIA 1	76	- Captures runoff from Mine Industrial Area – Workshop, Admin offices. - Receives treated STP effluent water from MIA STP & Buffel Park STP. - Pumps to 12N Dam MWC. Authorised to overflow when operated as per design. - **No pit water.**	N	**9 Nine Mile Creek**
Mine Water Dam MIA 2	80	- Captures runoff from ROM, coal stockpiles & fill point overflow. - Receiving water from MIA Dam 4. - Pumps to 12N Dam MWC. Authorised to overflow when operated as per design. - **No pit water.**	N	**9 Nine Mile Creek**
Mine Water Dam MIA 4	26	- Captures runoff from CHPP, ROM and Reject areas. - Can contain contents of tailings thickener. - Pumps to 12N Dam MWC. Authorised to overflow when operated as per design. - Pumps to MIA Dam 2 via drain (wheel pump). - **No pit water.**	N	**Caval Creek**
Mine Water Dam MIA 5	57	- Captures runoff from TLO, product stockpile & haul road. - Pumps to 12N Dam MWC. Authorised to overflow when operated as per design. - **No pit water.**	N	**Caval Creek**
Total Mine Affected Water System	**1,379**			
TOTAL SYSTEM	**3,159**			

Table 7: Water Storage Summary

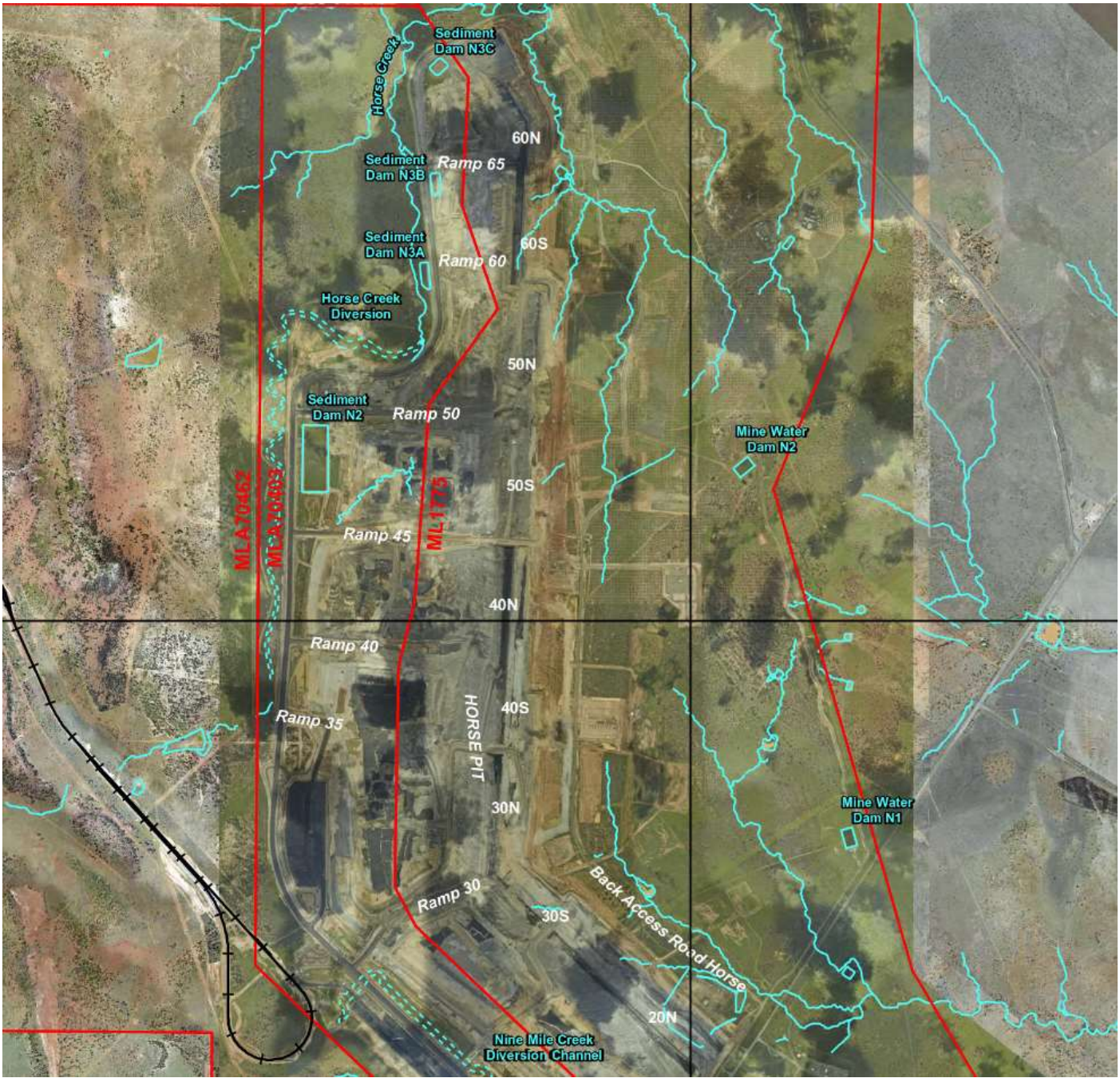


Figure 4: Locations of water storages at Caval Ridge (North)

Figure 5: Locations of water storages at Caval Ridge (South)

Water Transfers & Pumping

CVM has constructed an extensive pipe and pump network designed to meet the mines needs of:

- Transferring water to required operational infrastructure (i.e. CHHP);
- Processing or treatment;
- Transferring mine affected water to 12N Dam to release off site when EA release criteria is met;
- Dewatering of sumps and pits to allow for the continuation of mining;
- Dust suppression; and
- Mine expansion/construction activities.

Figure 6 is a schematic of water transfers / pumping between dams which also summarises the transfer pump rates.

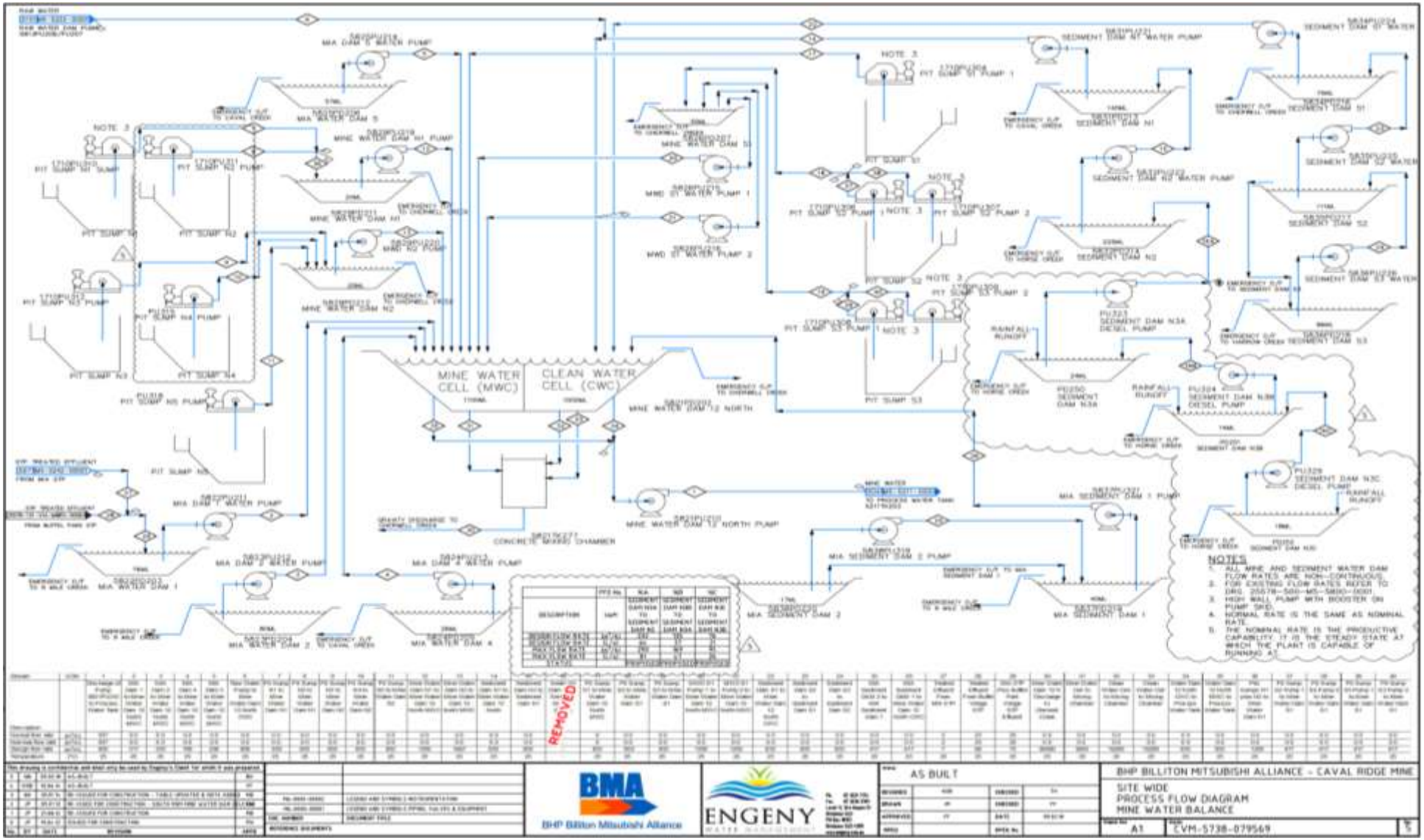


Figure 6: Water Balance Schematic

Water Transfer Agreement

A ***Transfer of Water between Sites Agreement*** exists between Norwich Park Mine (NPM), Caval Ridge Mine (CVM), Peak Downs Mine (PDM), and Saraji Mine (SRM).

In the Agreement, the mine sites have committed to complying with the relevant EA conditions. Commitments include:

- The volume, pH and electrical conductivity of water is monitored and recorded;
- Water is used in a way as to prevent environmental harm and health incidences; and
- Awareness of the General Environmental Duty is communicated.

Monthly water reports are sent out via email by the Water Planning team outlining TARP levels and water volumes which can be used to monitor the need for the transfer of water to CVM.

Water Supply Infrastructure

The water supply infrastructure for CVM encompasses the following components:

- Raw water supply;
- Potable water supply;
- Mine water supply; and
- Sewage effluent.
- Water transfer agreement with PDM

Raw Water Consumption

Raw water is sourced via a branch off the Eungella-Bingegang (SunWater) Pipeline. This water is sourced at the Eungella Reservoir and is used to fill the raw water dam as well as for potable water. CVM has an internal allocation to draw a maximum of 5,260 ML per annum of raw water as part of a larger BMA licence. The GoldSim Water Balance Model predicts an average of 3,200 ML of raw water will be required each year. Pipeline water consumption is recorded by Infrastructure and Asset Maintenance Team.

Raw water consumption is minimised by maximising the reuse of on-site mine affected water in the mining process and by employing techniques to minimise losses due to seepage and evaporation.

Potable Water

Raw water for potable purposes is sourced via the Eungella-Bingegang pipeline and treated on-site at the Caval Ridge Potable Water Treatment Plant to appropriate standards (see ***CVM Potable and Raw Water Management Plan***). As the quality of the on-site surface water is not suitable for potable water only treated pipeline raw water is used.

Potable water is required to have no consistent elevation in water quality parameters above the Australian Drinking Water Guidelines (2004) health related indicators.

Mine Water Supply

Mine water supply is considered to be any water that is mine affected and can be utilised onsite, including:

- *Dust Suppression:* approximately 10.3ML/day of MAW is used in dust suppression activities around site. Water is sourced from MAW dams.
- *Fire Water:* Water is stored on site for firefighting purposes. Currently raw water/mine water is pumped into on-site water storages. This water is then mechanically filtered and stored in tanks ready for use.
- *CHPP:* The estimated demand for CHPP process water is 286 m_3/h, with an estimated maximum demand of 463 m_3/h. This water is sourced from the Process and Fire Water Tank.

Saline Drainage & Acid Rock Drainage Management

The water management system provides a range of measures for capturing mine-affected saline waters and delivering to 12N Dam MWC for secure containment and reuse in supporting mine operations such as coal processing and dust suppression. A number of storage dams that have been constructed have the pump capability to redirect to other storage areas. This is to prevent an unauthorised release, or for release when stream flow conditions and stored water quality meet the existing Environmental Authority conditions.

Management measures for these hostile materials include:

- Selective placement of newly excavated spoil to areas in prestrip dumps which will be encapsulated by benign spoil as the dump develops.
- Capping hostile in situ spoil with benign spoil before applying rehabilitation treatments, such as top-soiling, rock. Mulch and drainage works.
- Directing drainage to retention dams for reuse in mine activities.
- Ongoing rehabilitation monitoring programs aimed at detecting surface and near surface changes in pH and salinity. Ongoing water quality monitoring programs on storages and pits which store surface runoff and leachate from mine-affected areas and structures.

Water Releases

The water balance model results indicate that the risk of uncontrolled release from the water management system is low.

Criteria set in the EA EPML00562013 provides environmental triggers under which compliant release of mine affected water to Cherwell Creek can occur.

12N Dam is the only authorised mine water discharge point. Further details regarding release criteria, associated monitoring of the receiving environment and coordination or releases are documented in the EA, ***REMP Design***, ***CVM Mine Affected Water Release Procedure*** and ***CVM SWI 12N Dam Mine Water Release.***

Updating the rating curves after significant flow events will be performed after significant flow events to ensure data accuracy. This is scheduled in SAP

Creek / River Diversions

CVM has diverted creeks to allow for the continuation of mining and/or diverting water away from active mining areas.

The mine has diverted the following systems:

- Cherwell Creek
- Caval Creek
- Horse Creek

CVM has diverted sections to allow for the continuation of mining activities, the operation of associated mine infrastructure and to maintain existing fluvial processes. The diversions of these creeks will divert clean water (from outside of the mine site) around disturbed (mine affected) areas.

Creek Levees

Flood protection is provided via the haul road running adjacent to the proposed diversion of Horse Creek and along with a number of Q1000 AEP (Annual Exceedance Probability) flood protection levees that were 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 1:1000 AEP.

The details of pit protection levees are listed in the ***CVM Regulated Structures Register***, which include:

- Cherwell Creek levee, and
- Heyford Levee

Treated Sewage Effluent

Treated sewage effluent produced on-site must only be released in accordance with the relevant conditions of the EA. Where the treated effluent is to be used for the purposes of dust suppression, irrigation (surface or sub-surface), and/or discharge to receiving waters, sampling of treated effluent is conducted as per EA requirements. CVM engages Blomfield Environmental to sample treated effluent on a monthly basis to ensure compliance with the EA.

Sewage from the MIA and the CHPP is collected via a system of gravity and pumped rising sewerage mains and treated via a package sewage treatment plant (STP) within the MIA. The effluent is treated to a suitable quality to allow safe and efficient reuse on site. The STP process is to be designed to meet EA requirements.

Following treatment, the effluent is discharged to the Mine Water MIA Dam 1, combined with effluent from the Buffel Village STP (treatment standards for this STP are contained in the relevant Development Application). Effluent entering Mine Water MIA Dam 1 is used for dust suppression in mine operations.

Sludge is treated in a bioreactor, removed from site and disposed of by a licensed contractor. The sewage treatment process in place does not require a sludge lagoon.

Septic tanks are used to treat sewage from toilet facilities in the mining area. Sludge from septic tanks are removed by a licensed contractor.

Monitoring & Control Verification

Water quality monitoring provides a mechanism for assessing performance against the Coal Target Environmental Outcomes and statutory requirements. The objective of CVM's water monitoring program is to determine the effectiveness of the site's water management system.

Monitoring and verification of the effectiveness of implemented controls is conducted through:

- Periodic review of this WMP and environmental risk assessments;
- Internal audits, including HSE Assurance audits and site based compliance audits;
- Inspections of key sediment and erosion control infrastructure when 24hr rainfall totals exceed 30mm;
- Field Leadership activities; and
- Review of SAP events.

Monitoring Program

Water monitoring requirements for CVM are documented in the ***CVM Water Monitoring Procedure***. The monitoring program includes:

- Receiving waters - creek and river water quality and level;
- Release and water storages - water quality and level;
- Groundwater quality and levels;
- Water transferred to PDM;
- Contaminated water released to land (from the sewage treatment plant); and
- Weather (rainfall volume and intensity).

Further monitoring details are outlined in the ***REMP Design***, and ***CVM Mine Affected Water Release Procedure*** and scheduled in SAP.

CVM uses a combination of telemetry equipment, in-situ sampling and laboratory analysis to meet the requirements of the monitoring program.

Sampling

All determinations of water quality must be:

- Performed by a suitably qualified person or body possessing the appropriate experience and qualifications to perform the required measurements.
- Made in accordance with methods prescribed in the latest edition of the administering authority's Water Monitoring and Sampling Manual.

The CVM HSE Department shall ensure all equipment used for water quality monitoring is identified and documented. Field equipment must be prepared and calibrated in accordance with manufacturers' guidelines and the administering authority's Water Monitoring and Sampling Manual.

All laboratory analysis shall be conducted by a NATA accredited laboratory with an internal quality control and auditing process.

The CVM HSE Department shall ensure that all data collected as part of water monitoring program is loaded and stored in BHP's Environmental Data Management System (EDMS) – the central repository for all environmental data.

Monitoring data is regularly reviewed by the HSE Department to ensure continuity and compliance with the monitoring program objectives and requirements.

Inspections

Inspections are required to ensure requirements of the EA are met with regard to:

- Temporary interference with waterways;
- Erosion and sediment controls are in place and effective;
- Spillages of wastes, contaminants or other materials; and
- The MWMS and appropriate functioning of diversion channels and watercourse levees.

These inspections are documented and scheduled in SAP.

Additional inspections that are completed throughout the year and are scheduled in SAP include:

- Critical control verification for inrush scenarios
- Regulated dams and levees inspection

- Non-regulated dam inspection
- Pre wet season inspection
- Post wet season inspection
- Post rainfall inspection where 24hr rainfall totals exceed 30mm

Investigative Monitoring

The EA requires investigative monitoring to be undertaken due to an uncontrolled discharge of mine affected water, or a release event where the downstream water quality characteristics for the receiving environment exceed the upstream results.

The details of the investigations, monitoring data and the actions taken to prevent environmental harm must be documented. Refer to ***CVM Mine Affected Water Release Procedure***.

Emergency & Contingency Planning

Where a situation poses an immediate risk or threat that requires attention in relation to water management Emergencies and contingency planning are covered in the following key documents:

- ***CVM PRO Crisis Emergency Management - IMT;***
- ***CVM PRO Emergency Management Procedure;***
- ***CVM PRO Severe Weather Management;*** and
- ***CVM PRO Working In and Around Water.***

Training

Effective site water management requires providing training and awareness. Training will be undertaken in accordance with the ***T&D TRACKS Training System Guidelines*** (or equivalent).

Environmental awareness is included in the compulsory Caval Ridge Site Induction which includes the following topics:

- Environmental Awareness (Your Responsibility); and
- Water Management.

Reporting

Reporting associated with Group HSE requirements is facilitated by the HSE Reporting Function. Data required for reporting is maintained in the environmental database (EDMS) refer to ***Procedure HSE Data Collection and Recording***.

Reporting on performance against water monitoring program shall be in accordance with the ***Standard Coal HSEC Reporting*** and regulatory conditions.

When monitoring results do not conform to the identified requirements, the HSE Department shall advise and consult with the risk owner(s) responsible for the non-conforming plant or process and provide input into corrective or preventative actions.

Event Response & Reporting

In the event of emergencies, incidents or exceptions, all reasonable actions must be taken by Operations to minimise environmental harm, or the risk thereof. If required, the HSE Department must also notify the Administrating Authority as per EA conditions A7 – A10

Emergency response shall be in accordance with the ***CVM Emergency Management Procedure*** and spills shall be contained and cleaned up in accordance with ***QLD Coal Spill Response Procedure***.

Events shall be reported in accordance with the ***Standard Coal HSEC Reporting***.

Complaint Management

Complaints shall be managed in accordance with the ***Community Complaints Grievance Procedure*** (or equivalent) and EA requirements.

References

Reference	Title
BHP Portal	Our Requirements: Environment and Climate Change
BHP Portal	Our Requirements: Health, Safety, Environment and Community Reporting
BHP Portal – BLD	BLD.007 Coal Risk Management Process
KM# 15748256	Coal HSE Environment & Climate Change Plan
KM# 15703136	Coal Authorisations - Target Environmental Outcomes – Approved
BHP Portal – BLD	Standard Coal HSEC Reporting
BHP Portal – BLD.011	Procedure HSE Data Collection and Recording
KM# 10635165	CVM PRO Mine Affected Water Release Procedure
KM# 8487451	BMA T&D TRACKS Training System Guidelines
KM#14770881	CVM PRO Crisis Emergency Management Procedure - IMT
KM#7625027	BMA PRO Community Complaints Grievance Procedure
https://www.ehp.qld.gov.au/water/monitoring/sampling-manual/	Water Monitoring and Sampling Manual

Terms and Definitions

Term/Acronym	Definition
BoM	Australian Bureau of Meteorology

Discharge	Discharges via spillway or dam overflow.
Release	Active initiation of release via pipe or pump
Shall	The word 'shall' is to be understood as mandatory.
Should	The word 'should' is to be understood as non-mandatory, advising or recommended.
WMP	Water Management Plan

Version Management

Version	Details
0.0	Draft for comment
0.1	Reviewed comments incorporated
1.0	Initial Release
2.0	Updated to align with changes to GLD.009 and to EMS framework
2.A	Updated to align with changes to GLD.009 and BMA Water Management Standard
3.0 & 3.A	Updated to align with Our Requirements for Environment and Climate Change (July 2017)
3.B	Update to area of influence and target environmental outcome (TEOs) sections (January 2018)
4.0	2018 review. Updated to legislative requirements
4.B	2019 review. Alignment with site specific requirements

BHP

Weed and Feral Animal Management

QLD Coal HSE Procedure

Document Number BHP-PRO-0001

Status: Approved

Version: 2.0 Date: 21 May 2019

Business Owner: Manager HSE BP (BMA) Supt HSE BP (BMC)

Table of Contents

1. Introduction

1 This procedure provides Queensland (QLD) Coal employees and contractors with information in relation to weed and feral animal (pest) management including key pest species, risks and controls.

1.1. Objective

2 The objective of this procedure is to:

- **a** Prevent the introduction of new weeds onto QLD Coal Operations through the early detection of, and rapid response to new weeds;
- **b** Identify and control the spread of weeds and feral animal populations on our Operations;
- **c** Raise awareness and understanding of the risks associated with weeds and feral animals; and
- **d** Ensure compliance with regulatory and corporate requirements.

1.1.1. Legislative Requirements

3 Operations are required to manage activities in accordance with the ***Environmental Protection Act 1994*** as well as all relevant conditions relating to the management of pests as stipulated in the sites' corresponding ***Environmental Authority (EA)***.

4 The ***Stock Route Management Act 2002***, (some sections of which have been amended and captured in the ***Biosecurity Act 2014*** requires all landholders to control declared pests, specifically stating:

- **a** A landowner must take reasonable steps to keep land free of ***Class 1*** and ***Class 2 Pests*****;**
- **b** A person must not, without reasonable excuse, move or transport the vehicle without ensuring the vehicle is free of pest reproductive material;
- **c** A person must not feed a declared pest animal (other than for trapping purposes); and
- **d** A person must not keep or release a declared pest animal.

5 A key strategy relevant to weed management is the ***Australian National Weeds Strategy (2017 – 2027)*** which identifies 32 Weeds of National Significance (WONS) requiring management and control. The strategy also requires:

- **a** Landholders (private and public) and co-existing land users to control and manage weeds to mitigate, as necessary, the impacts on their own assets or as required by regulation; and
- **b** Landholders and land users to take reasonable steps to minimise the impacts of weeds on other landholders.

1.2. Application

6 This procedure is applicable to ***BHP Mitsubishi Alliance (BMA)*** and ***BHP Mitsui Coal (BMC)*** operations and applies to anyone involved in planning or executing exploration, operational or closure activities and anyone involved in collecting and reporting environment data.

7 The Procedure does not apply to offset areas, which shall be managed as per their approved offset area management plan.

8 This Procedure is to act as an overarching document for all QLD Coal sites, superseding any site-specific Weed / Pest / Feral Animal Management Procedures (or equivalent).

Note

This Procedure only apply to the management of declared pest plants and environmental weeds that have the potential to impact ecological values (native flora and fauna). It does not apply to the management of other weeds, such as grasses/ garden weeds growing near buildings or infrastructure.

2. Baseline Assessment

2.1. Weeds

1 Ten flora species listed as declared pests under the provisions of the ***Biosecurity Act 2014*** and/or declared a WONS have been recorded on or within close proximity to Operations:

- **a** Mother-of-Millions (*Bryophyllum delagoense*) – Class 2;
- **b** Harissa Cactus (*Eriocereus martini*) – Class 2;
- **c** Lantana (*Lantana camara*) – Class 3;
- **d** Prickly Pear (aka Velvet Tree-pear) (*Opuntia spp*) - Class 2 / WONS;
- **e** Parthenium weed (*Parthenium hysterophorus*) – Class 2 / WONS;
- **f** Hymenachyne (*Hymenachne amplesicaulis*) – WONS;
- **g** Prickly Acacia (*Vachellia nilotica*) – WONS;
- **h** Rubber Vine (*Cryptostegia grandiflora*) - Class 2 / WONS;
- **i** Giant Rats Tail Grass (*Sporobolus pyramidalis* and *Sporobolus natalensis*) - Class 2; and
- **j** Bellyache Bush (*Jatropha gossypifolia*) – Class 2 / WONS.

2 Two environmental weeds are also commonly found in areas surrounding QLD Coal mining leases:

- **a** Leucaena (Leucaena leucocephala); and
- **b** Castor Oil Bush (Ricinus communis)

2.2. Feral Animals

3 There are several species of declared pests (feral animals) that been recorded on Operational leases. The most common feral animals include:

- **a** Feral Cats (*Felis catus*);
- **b** Feral Pigs (*Sus scrofa*);
- **c** Feral Dogs (*Canis familiaris dingo, Canis familiaris*);
- **d** European Red Fox (*Vulpes vulpes*);
- **e** European Wild Rabbit (*Oryctolagus cuniculus);* and
- **f** Cane Toads (*Bufo marinus*).

3. Risks

1 The site's risk register shall document any key risks and control measures associated with weed and feral animal management.

3.1. Weed Risks

2 Risks associated with weed establishment and infestations include:

- **a** Potential to alter the natural diversity and balance of ecological communities;
- **b** Contribution to biodiversity decline through the displacement of native species via competition for habitat, nutrients and sunlight;
- **c** Vehicles have the potential to introduce and/or spread weed species and plant pathogens such as root-rot fungus in disturbed soil;
- **d** The presence of weeds may affect rehabilitation and limit the achievement of acceptable post-mining land use; and
- **e** Greater bushfire intensity through increased fuel loads.

3.2. Feral Animal Risks

3 Risks and impacts of feral animals include:

- **a** Feral Cats – have a serious impact through predation on native populations such as small mammals, birds, reptiles and fish. Predation by feral cats is listed as a key threatening process under the ***Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)***.
- **b** Feral Pigs – predation on small mammals, birds, reptiles and amphibians. They also destroy habitat and erode and degrade waterways. Predation, habitat degradation, competition and disease transmission by feral pigs was listed as a key threatening process under the EPBC Act in 2002.
- **c** Feral Dogs - predation on small remnant populations of native species.
- **d** Foxes - predation on small marsupial species and ground nesting birds.
- **e** Rabbits – cause impact to endangered and native vegetation and compete for available habitat with other small mammals.
- **f** Cane Toads - impact native species and in particular, invertebrate communities, through predation and competition. The biological effects, including lethal toxic ingestion, caused by Cane Toads was listed as a key threatening process the EPBC Act in 2005.

4. Management Controls

4.1. Weed Management Controls

4.1.1. Disturbance and Topsoil Management

1 Most weed species thrive on undisturbed ground where there is a lack of competition from native species. The ***Coal Permit Disturb (PTD)*** process is a key control that helps to reduce the risk of weed establishment, spread and invasion in disturbed areas. Any disturbance of land (or a change in land use) will trigger the requirement to obtain and operate under an approved PTD.

2 Movement of sand, gravel, rock, soil and organic matter must be controlled to ensure that it does not result in contamination by weed reproductive material, hence contaminating ‘clean’ material. Where possible, all reasonable efforts should be made to limit the application of topsoil containing weed seeds.

4.1.2. Restriction of Vehicle Movement

3 The risks associated with the spread of weeds from vehicle movements shall be assessed and, where considered appropriate, the following restrictions shall be implemented:

- **a** No vehicles are to drive over, or within close proximity to, topsoil stockpiles unless conducting authorised topsoil movement;
- **b** Vehicles are to remain on existing tracks and avoid driving over weed populations; and
- **c** Vehicle access to neighbouring properties will only be undertaken with the permission of property owners and in accordance with the ***Biosecurity Act 2014***.

4.1.3. Vehicle Hygiene Protocols

4 Weed hygiene measures shall be enforced onsite to prevent the spread of weeds and reduce the risk of further establishment.

- **a** All vehicles, machinery and equipment shall be cleaned at designated wash down bays / pads;
- **b** All vehicles, machinery and equipment accessing landowner properties should be inspected and declared 'weed free' prior to entering. An example checklist used to complete this inspection is provided in Appendix A.
- **c** All on-site vehicles, machinery and equipment should be inspected when:
  - **i** Entering undisturbed areas of protected vegetation (e.g. threatened ecological communities);
  - **ii** Entering vegetated areas within proximity to rehabilitated areas; and
  - **iii** Leaving areas with known established weed populations, when existing access tracks are not used.
- **d** All rehabilitation materials (e.g. seed, straw, hay) brought to site should be declared 'weed free' and recorded in the site's document management system.

4.2. Weed Treatment

5 Major weed species that are considered high risk across QLD Coal Operations are outlined in Appendix B. The presence of some of these species may not occur on a specific site, or a specific site may have other species requiring management.

6 For detailed information on weed treatment chemical controls and herbicide application, refer the ***Department of Agriculture and Fisheries (DAF)'s declared pest species fact sheets for registered chemical controls and herbicide application rates***. Any chemicals to be used on site for the purposes of weed control shall be reviewed based on the Safety Data Sheet (SDS) and chemical label to ensure they are appropriate for the target species. In conjunction with this, all safety and environmental requirements will be addressed based on the SDS. All chemicals used shall be approved in ChemAlert.

7 Any weed treatment that is in the vicinity of neighbouring landholders, especially organic farmers, shall be communicated to those landholders at least two weeks prior to the weed treatment.

Warning

Employees or contractors undertaking chemical weed treatment shall be appropriately licenced.

4.3. Feral Animal Control

8 A feral animal control program should be implemented when monitoring confirms:

- **a** There is a trend in population increase (i.e. increase in the number of sightings);
- **b** There is evidence that feral animals are impacting on threatened species (i.e. through competition for food or shelter); or
- **c** Neighbouring landholders raise valid concerns or a formal complaint in regards to feral animals.

4.3.1. Trapping

9 Feral cats and feral pigs can be controlled using traps. When implementing a trapping program, the following process shall be followed:

- **a** Traps shall be placed in areas least likely to interfere with non-targeted species i.e. native animals.
- **b** Traps shall be positioned so there is shade for animals. Pig traps must have water available for trapped animals.
- **c** Captured animals shall be handled and managed with techniques that involve the least amount of stress possible.
- **d** Traps shall be inspected early each morning (ideally before first light).
- **e** Animals shall to be euthanized using methods which satisfy requirements by the RSPCA and AQIS (for example euthanized by a veterinarian).
- **f** Feral animal trapping and euthanasia details shall be recorded and saved in the site's document management system.

Warning

A Job Safety Analysis (JSA) must be completed prior to commencing a feral animal trapping program.

4.3.2. Baiting

10 Feral dogs and feral pigs can be controlled using 1080 (sodium fluoroacetate) poisoned baits. Refer to Appendix C for baiting program processes.

4.4. Education and Awareness

11 It is important to promote education and awareness on the impacts and risks associated with weeds and feral animals. Pest management awareness training should be included in site-specific inductions. Where possible, activities that present a risk to land and biodiversity should assess the threat of weed establishment and spread, vehicle hygiene protocols, and feral animals.

5. Monitoring and Reporting

1 Pest management records and completed forms must be saved in the site's document management system and kept for a minimum of five years.

5.1. Weed Monitoring

2 Monitoring should be undertaken to verify the effectiveness of weed management controls and plan weed treatment requirements.

- **a** Weed surveys and monitoring shall be conducted based on site's level of risk (at least every second year is recommended).
- **b** Record the following information when undertaking weed monitoring:
  - **i** Name and class of weed;
  - **ii** GPS location;
  - **iii** Estimated extent and density of the weed;
  - **iv** Proximity to sensitive receptors; and
  - **v** Recommended control method.
- **c** A Weed Inspection and Treatment Form Template is provided in Appendix D.
- **d** Where possible, the location of weed infestations should be mapped spatially (e.g. in Mine2Map).

5.2. Feral Animal Monitoring

3 Monitoring should be undertaken to confirm the need to implement feral animal control programs. Furthermore, monitoring may be required post control implementation to verify the effectiveness of the control program.

4 The following should be considered when undertaking feral animal monitoring:

- **a** Location of recently sighted feral animals or signs of feral animals (e.g. diggings, footprints, faeces, plant damage);
- **b** Water or food sources (i.e. pigs are often found near dams; cats are often found near mobile crib huts); and
- **c** When the target species is most active (i.e. mornings/ evenings when the temperature is cooler).

6. Roles & Responsibilities

1 Department roles and responsibilities relevant to weed and feral animal management are outlines in Table 1.

Department	Responsibilities
HSE	• Understand the site's environmental legal requirements in regards to weed and feral animal management. • Include relevant weed and feral animal controls when approving Permit to Disturbs. • Implement a weed monitoring program based on risk.
Operations	• Understand and comply with the requirements of this Procedure.
Site to Determine	• Implement weed treatment to prevent the establishment and spread of weeds. • Implement feral animal controls (take reasonable steps) to keep land free of declared pests.

Table 1: Department roles and responsibilities.

7. Terms and Definitions

Term	Definition
1080	Sodium fluoroacetate – poison used to control pest animals.
Class 1 or Class 2 Pest	Pests that have the potential to cause an adverse economic, social or environmental impact to the state. Declared Pests must not be introduced into any BHP Coal Mining Lease.
Environmental Authority (EA)	Environmental approval, under the *Environmental Protection Act 1994*, that authorises an operation to undertake Environmentally Relevant Activities (ERAs), including mining.
Shall	The word 'shall' is to be understood as mandatory.
Should	The word 'should' is to be understood as non-mandatory but advisory or recommended.
WONS	Weed of National Significance

Table 2: Terms and Definitions

8. References

Controlled Document Number	Title	Hummingbird Number
	Coal Permit to Disturb Procedure	BMA KM# 15723118 BMC: Documentum - Cabinets/BMC Controlled Documents/BRISBANE/HSEC/Environment/Procedure
	Coal Permit to Disturb Form	BMA KM# 15713516 BMC: Documentum - Cabinets/BMC Controlled Documents/BRISBANE/HSEC/Environment/Form
	Environment Essentials	https://www.enviroessentials.com.au/
	Toxin 1080: A guide to safe and responsible use of sodium fluoroacetate in Queensland	https://www.daf.qld.gov.au/__data/assets/pdf_file/0010/1274185/IPA-Toxin-1080-Guide.pdf
	Weeds of National Significance (WONS)	http://www.environment.gov.au/biodiversity/invasive/weeds/weeds/lists/wons.html
	Biosecurity Act 2014	https://www.legislation.qld.gov.au/browse/inforce#/act/title/b

Table 3: List of reference documents

9. Version Management

Version	Details
1.A	Creation of document by Environment Analysis & Improvement (A&I) (17/08/2018)
1.B	Updated after Environment BP review workshop (24/10/2018)
1.C	Updated after stakeholder engagement sessions and HSE Manager/ Superintendent feedback (07/12/2018)
2.0	Approved procedure transferred into new template and minor updates (13/03/2019)

10. Appendix A – Vehicle Checklist for Weed Hygiene

	Task
☐	Remove loose floor mats and wash
☐	Brush and wash fixed floor mats, under pedals and under seats
☐	Wash under bonnet
☐	Wash around vents, radiator, headlamps and windscreen wipers
☐	Use wire hook / brush to remove plant material from crevices
☐	Wash in and around all openings in the chassis
☐	Wash under mudguards and inside wheel arches
☐	Wash mudguards/ mud flaps
☐	Wash around brake drums and discs
☐	Wash around all steering linkages and suspension parts
☐	Wash under bumper bars and bull bars, including rear bumper bar
☐	Wash around and under spare wheel
☐	Wash around and above muffler and exhaust system
☐	Wash out protector guard under fuel tanks (front and rear tanks)
☐	Wash under side steps and brush down rails/ guards
☐	Wash inside chassis rails or any open spaces
☐	Wash around differential, gearbox and engine
☐	Wash attached equipment (e.g. tool boxes, buckets, blades, tines and rippers)
☐	Clean any tools and equipment used in the field
☐	Brush down trouser legs (check inside any cuffs), ensuring all seeds and plant material is removed
☐	Clean boots to ensure they are free of plant material, soil or mud

11. Appendix B – Weed Profiles

Mother-of-Millions *(Bryophyllum delagoense)*	
	
Weed Profile	
Status	• Declared Pest Plant Class 2
Description	• Plants grow to >1m in height. • All species form tall flower spikes in winter with clusters of bell-shaped flowers. • Grey-brown, fleshy tubular leaves with up to seven projections at the top of each leaf. • Flowers are orange-red and occur in a cluster at the top of a single stem. • Seeds can germinate for several years.
Habitat	• Plants establish in leaf litter or other debris on shallow soils in shady woodlands. • Often grows on roadsides, along fence lines and around old rubbish dumps. • Adapted to dry conditions and can survive long periods of drought.
Lifecycle	• Flowers in winter and reproduces by seed and by tiny plantlets that are produced at the tops of its fleshy (succulent) leaves. • Dislodged leaves and broken leaf parts can also take root and give rise to new plants.
Toxicity	• These plants are toxic, in particular their flowers and can occasionally cause a significant number of stock deaths. • Poisoned stock show symptoms including dullness, diarrhoea and heart failure. Some may drool saliva or dribble urine. • If left untreated cattle can die within 5 days (depending on amount ingested). • Treatment needs to be carried out by a veterinarian or under their direction.
Treatment	• Mechanical: for small areas, hand-pulling plants and burning in a heap can be effective. • Chemical: May be controlled with herbicides at any time of the year but infestations are easiest to see in winter when the plants are in flower. Treating infestations during this time of year also has the benefit of preventing new seeds from developing.

Lantana *(Lantana camara)*



Weed Profile	
Status	• Declared Pest Plant Class 3
Description	• A heavily branched shrub that grows in compact clumps, dense thickets or as a climbing vine.

Harissa Cactus *(Eriocereus martini)*


Weed Profile	
Status	• Declared Pest Plant Class 2
Description	• The spiny fleshy stems are jointed and form tangled mats approximately 0.5m high. • Many branches often lie flat and take root where they touch the ground. • The large flowers are open at night, are pink and funnel-shaped with a tinge of white. These grow singly near the ends of the stems on a scaly but spineless slender grey-green tube 12 – 15cm long. • Round, red fruits 4-5cm across have scattered bumps with hairs and spines. Numerous black seeds are embedded in the white pulp of the fruit.
Habitat	• Mainly a pest in Brigalow and associated softwood country. Infestations are now appearing in box and ironbark stands as well as within pine forests. • The cactus is shade-tolerant and reaches its maximum development in the shade and shelter of scrub.
Lifecycle	• Harissa cactus bears a bright-red fruit containing 400 – 1000 small black seeds. Plants are easily established from seed and germinate after rain. • Seedlings quickly produce a swollen tuberous food storage root that develops as the plant grows. • Branches take root where they touch the ground and new plants will grow from broken branches and sections of underground tubers.
Treatment	• Mechanical: Dig out plants completely and burn. Ensure that all tubers that can grow are removed and destroyed. • Chemical: Foliar application of registered herbicides provide effective control but can be costly over large areas.

	• The stems are square in cross-section with small, recurved prickles. • Most leaves are 6cm long and are covered in fine hairs. • Flowers appear throughout most of the year in clustered, compact heads about 2.5cm in diameter. Flower colours vary from pale cream to yellow, white, pink, orange and red. • Lantana produces berry-like fruit that turn from glossy green to purplish-black when ripe.
Habitat	• Found throughout most coastal and subcoastal areas of eastern Australia. It grows in a wide variety of habitats from exposed dry hillsides to wet, heavily shaded gullies.
Lifecycle	• Flowering and germination occurs all year round but peaks after summer rains. Several thousand seeds can be produced per square metre - these can remain viable for several years. • Lantana can produce some viable pollen and have potential to cross-pollinate with ornamental forms creating new varieties that could naturalise in the environment.
Toxicity	• Many lantana varieties are poisonous to stock, in particular young animals. • Symptom severity depends on the quantity and type of lantana consumed and comes in the form of head swaying, loss of appetite, constipation etc. Jaundice (yellowing of skin and eyes) is also a side effect. • If animals show any of the early symptoms they should be moved to lantana-free areas, kept in the shade and monitored. Should symptoms worsen, treatment should be carried out by a veterinarian or under their direction.
Treatment	• Regular burning will reduce the capacity of plant to survive, however initial kill rates are variable. • Red flowered and pink-edged lantana are often considered the most difficult to control because their leaves are often smaller and tougher. • For single-stemmed lantana, basal bark spraying and cut-stump methods are effective. • On multi-stemmed varieties, best results will be seen from applying herbicide to each stem. • For plants <2m spraying of foliage to the point of run-off is recommended.

Prickly Pear *(Opuntia tomentose)* and other Opuntiods

Weed Profile	
Status	• Declared Pest Plant Class 2
Description	• Perennial, leafless succulent cactus, approx. 50 – 100cm tall. • Stems are spiny, flattened, and leafless, divided into segments. • Skin is thick, tough and drought-resistant. • Fruit is pear-shaped, bristly, varies from red to purple, orange, yellow and green. • Flowers are large, 6cm-wide, range from yellow, orange, red, pink, purple and white. • Some species develop underground bulbs that enable them to be fire resistant.
Habitat	• Prefers sub-humid to semi-arid areas in warm temperate and subtropical regions. • Habitat varies depending on species and can range from streams, banks, roadsides and woodlands.
Lifecycle	• Reproduces sexually and asexually. • Asexual reproduction (cloning) occurs when joints / segments or fruits on ground take root and produce shoots. • Pads can survive long periods of drought before weather conditions allow them to set roots. • Flowers late spring to summer.
Treatment	• Mechanical Control: machinery is not effective. • Fire is an effective method for dense prickly pear infestations. • Herbicide control is highly effective.

Parthenium Weed (*Parthenium hysterophorus*)

Weed Profile	
Status	• Weed of National Significance • Declared Pest Plant Class 2
Description	• Annual herb up to 1.5m tall developing many branches in its top half when mature. • Leaves are pale green, up to 2mm long, deeply lobed and covered with fine, soft hairs. • Flowers are small, creamy-white on stem tips 4 – 10mm in a 5-sided shape. • Flowers have 4-5 wedge-shaped black seeds, 2mm long with 2 thin, white scales.
Habitat	• Grows in most soil types. • Most dominant in alkaline, clay and loam soils. • Found along roadsides and railway lines, in pastures and disturbed areas.
Lifecycle	• Germinates in spring / early summer. • Produces flowers and seeds throughout its life. • In summer it can flower and set seed within 4 weeks of germination. • Dies late autumn.
Treatment	• Spray early before plants can set seed. Keep a close watch on areas for at least 2 years. • Treat small and/or isolated infestations immediately. • Herbicide control will involve a knockdown herbicide to kill plants that are present and a residual herbicide to control future germinations. • Repeated spraying may be required even within a single growing season to prevent further seed production.

Hymenachne *(Hymenachne amplexicaulis)*

Weed Profile	
Status	• Weed of National Significance
Description	• Robust, rhizomatous, perennial grass up to 2.5m tall. • Stems are erect and pithy. • Leaf blades are 10 – 45cm long, up to 3cm wide, flower heads are spike-like, cylindrical, 20 – 40cm long. • Capable of growing in permanent wetlands up to 1.2m in depth.
Habitat	• Prefers streambanks, shallow wetlands and irrigation ditches. • Floodwater can deposit hymenachne in dams, lagoons, wetlands, rivers and creeks. • Will not persist in water with moderate to high concentrations of salt for part or all of the year.
Lifecycle	• Grows from seed and broken stem fragments. • The main flowering period occurs from April through to June depending, with seeds setting from late autumn to early spring. However, plants have been observed flowering between March and September • A single flower stalk can produce more than 4000 seeds and there is the likelihood of a large soil seed bank. • Viability remains for up to 25% of the seeds after 8 years
Treatment	• Mechanical control: Mechanical / physical removal will not completely eradicate hymenachne because of the plants ability to reproduce vegetatively from very small pieces. • Herbicide control: No herbicides are currently registered for control of hymenachne, however there are two off-label minor use permits. • Spraying an entire heavy infestation can cause hymenachne to sink and result in biological hazards from the rotting vegetation. Large masses of decomposing hymenachne may use all the oxygen in the water leading to fish kills. This problem can be avoided by spraying strips of the weed.

Prickly Acacia *(Vachellia nilotica)*

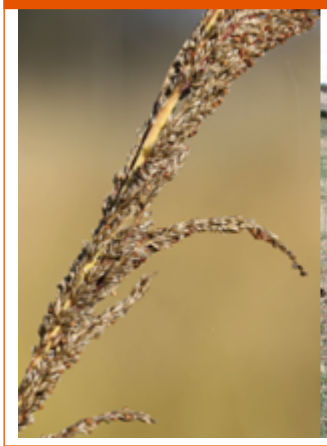
Weed Profile	
Status	• Weed of National Significance
Description	• Thorny shrub or small tree that typically grows 4 – 5m high. The umbrella shape and seed pods are characteristic features. • Young shrubs form dense thorny thickets while mature trees are usually single stemmed with spreading branches. • Leaves are finely divided and fern-like, with four to ten pairs of leaf branches and 10 – 20 pairs of small, narrow green leaves on each branch. Pairs of stout thorns usually grow at the base of the leaves. • Flowers are yellow, ball-shaped and about 1cm across. Pods are 10 – 15cm or longer and flat.
Habitat	• Widespread infestations of prickly acacia in areas of north-west and central-west QLD. • Several million hectares of the Mitchell grass plains are infested with prickly acacia. • Has the potential to grow in most areas of QLD and NSW. About one-third of QLD is well-adapted for prickly acacia growth.
Lifecycle	• Flowering generally occurs late February and continues through to June. • Pods ripen and fall from late October to January. • Seeds germinate after significant rainfall in late spring and summer. • Seedling growth can be rapid and trees flower and set seed within 2 – 3 years after germination under ideal conditions.
Treatment	• Chemical: Basal bark treatment, cut stump treatment, soil-applied treatments and foliar spray are all effective methods of chemical treatment.

Rubber Vine *(Cryptostegia grandiflora)*



Weed Profile	
Status	• Weed of National Significance • Declared Pest Plant Class 2
Description	• Climbing vine up to 30m tall in trees, untidy shrub up to 1 – 2m tall. • Leaves are dark green, glossy, 6 – 10cm long, 3 – 5cm wide in opposite pairs. • Leaves, stems and unripe pods exude a white, milky sap when broken or cut. • Flowers are large with 5 white to light purple, funnel-shaped petals. • Seed pods are distinctive, rigid and grow in pairs at the end of a short stalk. • Pods are 10 – 12cm long, 3 – 4cm wide, have white tufts of long, silky hair and contain up to 450 brown seeds.
Habitat	• Widely distributed throughout tropical and subtropical regions. • Prefers areas where annual rainfall is between 400 – 1400 mm and is well adapted to a monsoonal climate.
Lifecycle	• Flowers throughout the year if sufficient moisture is available. • *Non-flowering* period is usually between June and July. • Plant stem diameter must be approximately 20mm before flowering can occur. • Seed pod formation occurs from spring to late autumn with peak seed production corresponding to maximum flowering. • Eventually, pods dry out and split open approximately 200 days after formation. • Seeds are scattered by wind but also carried by water. • Approximately 95% of seed is viable although germination requires favourable temperature and soil moisture conditions.
Treatment	• Mechanical control: Slashing is possible for scattered or medium-density infestations. Dense formations require blade-ploughing to reduce the bulk of the infestation. Fire is also an effective means of control. • Chemical control: basal bark spray, cut stump treatment and soil application are effective means of control.

Bellyache Bush *(Jatropha gossypifolia)*



Weed Profile	
Status	• Declared Pest Plant Class 2
Description	• Upright grass 0.6 – 1.7m tall with long, narrow leaf blades • Seed head is up to 45cm long and 3cm wide • Seed heads change shape from 'rats tail' when young to elongated pyramid shape when mature • Difficult to distinguish from other pasture grasses and native *Sporobolus* grasses before maturity • **Tip:** Giant Rats Tail (GRT) can be identified through a 'twist test', simply break off a small clump of stems and leaves and twist with two hands and attempt to break in half. Compared with other grasses GRT is very difficult to break.
Habitat	• Suits a wide range of soils and conditions • Ecoclimatic modelling suggests giant rats' tail grass is suited to conditions present in 60% of QLD including areas receiving as little as 500mm average annual rainfall.
Lifecycle	• Flower and seed in the frost-free period of the year with the main seeding in late summer / autumn, • It can produce up to 85,000 seeds per square metre in a year with initial seed viability being approximately 90% • A significant proportion of seed remains viable for up to 10 years.
Treatment	• Physical control: hand chip, bag and remove tufts then burn. • Chemical control for small infestations: Spot spray with glyphosate and flupropanate • Chemical control for dense infestations: boom or jet spray with glyphosate. Burn prior to cultivating to reduce viable see bank. Where possible spot spray of hand-chop fence lines, headlands, drainage lines, shelter belts and any surviving or newly established weeds to prevent reseeding.

Leucaena *(Leucaena leucocephala)*

Weed Profile	
Status	• Weed of National Significance • Declared Pest Plant Class 2
Description	• A squat, thick-stemmed shrub 2.5 – 4m tall developing from a short, single-stemmed plant with 3 or 4 young leaves sprouting from the top. • Young leaves are sticky, purple and deeply divided into three rounded lobes. • Older leaves are bright green, about 10cm in diameter and may have up to 5 lobes with the edges covered in coarse, dark brown hairs. • Flowers are small, red with yellow centres and found in small clusters on the upper part of the plant. • Seed pods are smooth and oval, about the size of a cherry and 12mm across. They contain three to four seeds about 8mm long.
Habitat	• Commonly found along riverbanks and roadsides. • Naturalised in various areas of north QLD. • Smaller infestations throughout QLD and NSW.
Lifecycle	• Seeds germinate October – December. • Flowers throughout the year where moisture is adequate.
Treatment	• Physical control: as the plant is shallow rooted, grubbing by hand is effective. • Repeated slashing of infested areas will help reduce density. • Fire: high mortality rates using fire have been observed in the field. • Chemical control: herbicides are also an effective option.



Weed Profile	
Status	• Environmental Weed
Description	• A shrub growing up to approximately 6m high. • Leaves are approximately 25cm long and bipinnate with dull, greyish-green leaflets. • Flower heads are spherical and creamy yellow on short stalks about 5cm long. • Flattened pods up to 15cm long can occur in dense clusters with each pod containing around 30 flat, glossy-brown seeds that scatter when ripe.
Habitat	• Found on disturbed sites, in gardens and waste areas, along creek lines and roadsides. • Prefers tropical and subtropical climates.
Lifecycle	• Sets seed and flowers all year round.
Treatment	• Physical control: Hand-pull small individual plants. Remove roots to prevent regrowth. • Herbicide control: Herbicides are effective. • Controlled grazing before it grows out of stocks reach is effective. On larger specimens or infestations this option is not feasible.

Castor Oil Bush (*Ricinus communis*)

Weed Profile	
Status	• Environmental Weed
Description	• A tall, branching perennial shrub that grows to approximately 3m high. • It has stout, hollow branches that are a dull pale green or red. Older branches and trunks turn grey in colour. • Large leaves (10 – 60cm across) are widely spaced on the branches and grown on long, stout stalks attached off-centre to the bottom of the leaf. • Each leaf is divided into 7 – 9 pointed triangular segments with toothed edges and conspicuous veins. • Leaves are glossy, dark reddish-green when young and glossy green when mature.
Habitat	• Prefers warm and subtropical regions. • Abundant along gullies, watercourses, floodplains, roadsides and on disturbed land or wasteland. • May be common after heavy rains or floods.
Lifecycle	• Seeds germinate in spring. • Flowering occurs December – March. • Can grow up to 6m tall within 12 months.
Treatment	• Individual plants or small infestations may be removed by cultivation or hand-pulling. • Broad scale infestations may require spraying with herbicides to control the plant.

12. Appendix C - Baiting

Warning

A Job Safety Analysis (JSA) must be completed prior to commencing a feral animal baiting program.

12.1. Feral Dog Baiting

12.1.1. Baiting Program

1 Feral dogs are controlled utilising 1080 (sodium fluoroacetate) poisoned baits. The baits are fresh meat with the 1080 injected into the bait at a measured rate. Dog species have the lowest known tolerance to 1080 and as such only a small dose is required per bait. Dog control programs are carried out in conjunction with neighbouring landholders where possible to maximise results.

12.1.2. Location of Bait Lines

2 Dog baiting programs are run along a predetermined baiting line, with baits placed every 300 to 400 metres. Baiting lines are chosen in consultation with neighbouring landholders. Bait lines are run within the boundaries of the Operation, generally following the boundary fence. Other easements might be used as well, such as power lines and access tracks.

3 Within the document ***Toxin 1080: A guide to safe and responsible use of sodium fluoroacetate in Queensland***, a number of distance requirement and exclusion zones for the placement of 1080 baits are highlighted. In light of these points in should be noted that:

- **a** No baits are to be laid within five metres of a fenced boundary,
- **b** No baits are to be laid within twenty metres of permanent or flowing water bodies, and;
- **c** No baits are to be laid within fifty metres of the centre line of a declared road.

12.1.3. Bait Preparation

4 1080 poison may only be loaded by an authorised person. The authorised person injects the 1080 poison into the prepared fresh meats baits at the appropriate concentration. A record shall be kept documenting the number of baits loaded and the amount of 1080 used. A BHP representative must sign an indemnity form which also states the land that the baits may be used on.

12.1.4. Notification

5 Signs are to be erected at all entrances to the property where baiting is occurring and along the boundary fence to a public thoroughfare. Signs are provided by the authorised person. Notification of intent to bait will be given to the Operation's management team and the OCE's (or equivalent) will be notified of the baiting location and timeframe.

12.1.5. Bait Laying

6 Prepared baits are only to be handled by approved personnel utilising appropriate PPE. Baits are to be kept in the bags provided by the authorised person until placed in the identified baiting location. Baits are to be buried in shallow holes and covered with loose material or placed in mounded material as required. PPE is to be disposed (or decontaminated with water where appropriate) after the handling of each bait to minimise exposure to 1080.

12.1.6. Monitoring and Recording

7 Baits are placed along a predetermined line at 300-400 metre intervals. The actual location of each bait is to be recorded with GPS and identified with flagging tape to allow for easy recovery. Baits are to be regularly checked for the period of the baiting program, with all taken baits recorded.

12.1.7. Bait Recovery and Clean Up

8 At the cessation of the baiting program (7days after initial baiting), all remaining baits are to be buried in a deep pit (>1m). All reasonable efforts are to be taken to remove deceased animal carcasses and bury them in the pit. Collection of remaining baits is to be undertaken using appropriate PPE.

12.2. Feral Pig Baiting

12.2.1. Baiting Program

9 Feral pigs are controlled using 1080 grain baits. Fermented corn is used as the grain bait and is tumble mixed with a predetermined amount of 1080. The concentration of 1080 in grain baits is significantly higher than that used in dog baits, however there is less requirements to handle the baited material. An authorised person loads the baits into pre-soaked grain.

12.2.2. Location

10 Feral pig baiting is conducted wherever activity has been detected, either through visual identification or by tracks and furrowing activity. All pig baiting is conducted away from mining activity to avoid interaction with mine workers.

11 Within the document ***Toxin 1080: A guide to safe and responsible use of sodium fluoroacetate in Queensland***, a number of distance requirement and exclusion zones for the placement of 1080 baits are highlighted. In light of these points in should be noted that:

- **a** No baits are to be laid within five metres of a fenced boundary,
- **b** No baits are to be laid within twenty metres of permanent or flowing water bodies, and;
- **c** No baits are to be laid within fifty metres of the centre line of a declared road.

12.2.3. Trap Establishment

12 Feral pig baiting is conducted within purpose built traps. The traps are steel panels with wire mesh screening and have one way entry doors. The traps are transported to the baiting location and installed by experienced personnel. Two people will erect traps as a minimum. Traps are to be installed utilising appropriate PPE with adherence to the SOP Manual Handling (or equivalent).

12.2.4. Pre-Feeding

13 Traps are free fed for a period prior to baiting to allow feral pigs to locate and become accustomed to the trap. Traps are monitored with infrared cameras to assess the number of pigs visiting the trap. This allows for an appropriate amount of grain to be baited. Monitoring during free feeding also allows for the identification and control of non-targeted species prior to baiting.

12.2.5. Baiting Traps

14 The loaded grain is placed into feeding receptacles within the trap. The trap is set in order to keep 1080 affected animals in the trap to allow for appropriate disposal of carcasses. The baited trap is visited daily to remove any deceased animals. In the event that non deceased animals are discovered in the trap, further baited grain is supplied to effect mortality.

12.2.6. Carcass and Bait Disposal

15 The trap is to be checked each day with all deceased carcasses removed for burial in a deep pit (>1m). Handling of carcases is to be kept to a minimum, and be undertaken using appropriate PPE and manual handling techniques. Where possible and as required, mechanical means of carcass removal shall be employed (i.e. loaders or backhoes to remove carcasses to burial pit). Handling of intact carcases poses no threat of exposure to 1080, however other hygiene issues need to be considered.

16 If no further pig activity is occurring in the trap, the baited grain is to be collected and disposed of in a deep pit (>1m). All feed bins are to be washed out with a large volume of water to remove any 1080 residue. Bins should be left upside down whilst the 1080 degrades (14 days) before free feeding use.

12.2.7. Recording

17 The location of each trap for each baiting event is to record using GPS. The number of feral pigs destroyed is to be recorded. These details shall be kept along with the date of the program and the quantity of bait used.

12.3. Safety

12.3.1. 1080

18 1080 is the trade name given to sodium fluoroacetate. Sodium fluoroacetate is a naturally occurring compound found in some native flora species. Due to this, native fauna can have an increased tolerance to the poison in comparison to introduced species which makes it a useful targeted poison for the control of introduced pest animals.

19 1080 should only be handled by a competent person. The authorised person prepares the baits on behalf of the landholder. The landholder then places the baits in the desired locations. No 1080 poison is kept or stored onsite. Only prepared baits are used onsite.

12.3.2. Fresh Meat Baits

20 Fresh meat baits are prepared using pre-cut meat, with a measured dose of 1080 injected into the meat. The effective concentration of 1080 in fresh meat baits is 0.0034% 1080 by weight or 6mg 1080 per 125g of fresh meat. As the product is diluted below 0.1%, it is not classified as a hazardous substance or dangerous goods. The baits may only be handled using elbow length heavy PVC gloves which must be washed well between each use to avoid skin contact with 1080.

12.3.3. Grain Baits

21 Grain baits are made using fermented corn. The corn is tumble mixed with a predetermined dose of 1080 by the authorised person. Green food dye is added to deter grazing by birds. The effective concentration of 1080 in grain baits is 0.02% 1080 by weight or 72mg 1080 per 250g of fermented grain. As the product is diluted below 0.1%, it is not classified as a hazardous substance or dangerous goods. The baits may only be handled using appropriate PPE including elbow length heavy PVC gloves which must be washed well between uses to avoid skin contact with 1080.

12.3.4. SDS and First Aid

22 The Safety Data Sheet (SDS) for both fresh meat 1080 baits and 1080 grain baits is stored in ChemAlert. The SDS should be referred to for information regarding PPE, first aid and toxicology.

13. Appendix D - Weed Inspection and Treatment Form Template

PART 1 – WEED INSPECTION		
Record Number		
Date		
Locality		
Purpose of Visit (e.g. weed treatment / inspection / survey)		
GPS Coordinates of the outmost boundary of the weed infested / treated area *Projection UTM, Datum AGD 1984; AMG Zone 55*		
Total area of infestation (ha)		
Common name and class of weed species	**Weed Name**	
	Weed Class (e.g. 1, 2, 3)	
Cover / density of the weed species	**Cover (% per m2)**	
	Density (# per m2)	
Stage of development (juvenile, flowering / seeding, mature)		
Proximity of weed infested area to nearest track, road, waterway or drain (m)		
PART 2 – ADDITIONAL INFORMATION		
Proximity to protected areas / vegetation		
Condition of protected areas / vegetation		
Is this in compliance with weed control measures stipulated in the Permit to Disturb?		
	SAP #	
Have personnel completed a Vehicle Hygiene Checklist completed upon demobilisation?		
Visible signs of new weed infestations within proximity to sprayed area?		
If applicable, do topsoil stockpiles show any signs of weed establishment?		